UNIVERSITY OF CALIFORNIA, RIVERSIDE

UNDERGRADUATE RESEARCH JOURNAL

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Cover Art - 'A Reemerging Light'

One year ago, all normal functions in the world came to a startling halt, undergraduate research being no exception. The students walking within an empty UCR campus serve as a reminder of the pandemic and the individuals who were able to navigate research during these difficult times. As the world recovers and returns to a "new normal," so too does UCR, persevering against the challenges of COVID-19 under the welcome light of a new day.

~Co-Editors, Shaiva Patel & Ethan Tanchoco

Photo taken by Stan Lim, UCR Communications, 2020

TABLE OF CONTENTS

FROM THE CHANCELLOR

The word *resilient* is having a moment. Over the last year, as we rode waves of obstacles and changes, much has been written about the human spirit and our ability to continue forward in the face of adversity. Resilient certainly describes the students and mentors who forged a path forward in undergraduate research during an immensely challenging year.

Impressive is another relevant description. To complete research projects, then collaborate remotely to finish and submit articles for this year's *UC Riverside Undergraduate Research Journal*, required an impressive level of creative thinking and dedication. This reveals an underlying passion and commitment to scholarship and development of new knowledge. As you will find, the work itself is also impressive.

At UCR, we strive to prepare our students for what's now and what's next so they may be future fluent, ready to tackle the world's evolving challenges. The research articles published in this journal provide a glimpse of the opportunity our students embody.

To all of the students who contributed to this year's journal, congratulations on your outstanding work. I am incredibly grateful to the faculty mentors and staff members whose dedication, guidance, and perseverance made these projects possible. All of your efforts inspire pride in our university and strengthen our hope for the future.

Sincerely,

Kim A. Wilcox
Chancellor

The COVID-19 pandemic changed all of our lives, halted most research, and delayed valuable learning experiences for undergraduates. However, the pandemic did not prevent student,faculty,and staff creativity and ingenuity in finding new and innovative methods of continuing to contribute to their fields of study. Undergraduate researchers and their faculty mentors demonstrated flexibility in adjusting their research and creative methods to accommodate social distance guidelines. Their contributions may have followed a different process, but they continued. The student researchers whom are presenting their work in the following pages demonstrate resiliency in tackling the local challenges that face California's Inland Empire as well as the dynamic and emerging challenges facing humanity.

Participating in original research and creative activities always takes courage: the courage to challenge assumptions, admit a lack of knowledge, and persist through the inevitable setbacks and obstacles of expanding our shared understanding of the world. This year's scholars conducted their research during a time of national turmoil and unrest, and so they are doubly courageous. They had the tenacity to build connections – social, intellectual, and empathetic – when so much of the country was struggling. We must applaud them all and find both comfort and our own courage in knowing that these researchers represent the best and brightest of our shared future.

The Fifteenth Edition of the *University of California, Riverside Undergraduate Research Journal* features some of the best faculty-mentored undergraduate research and scholarship, adding to the university's 67-year legacy. Thank you to our students, faculty, and staff who made the publication of the Undergraduate Research Journal possible. A special thanks to the Student Editorial Board for leading the peer-review process, the Faculty Advisory Board for its consultation and advice, and the staff of Student Engagement for their roles in bringing this journal to fruition.

I hope you are enriched and encouraged by the discoveries revealed in this year's Undergraduate Research Journal.

Wishing you all the best,

Jennifer Brown, Ph.D.
Vice Provost and Dean of Undergraduate Education
Professor in the School of Public Policy

UNDERGRADUATE RESEARCH JOURNAL EDITORIAL BOARD

It is with great pleasure that we present UC Riverside's 15th edition of the Undergraduate Research Journal. We have had the honor of collaborating with brilliant minds across campus in bringing this publication to fruition during such an unprecedented year. It is the collective efforts of everyone involved that ensures the integrity and standards of the Journal reflect the excellence that UCR represents. Congratulations to the authors for your commitment — your ability to adapt to a remote environment, one that is not conducive to traditional undergraduate research, is commendable and serves as a testament to UCR's academic and creative culture built upon the pursuit of knowledge. Your achievements found in this 15th edition will forever be a part of the Journal's legacy. Congratulations also to the Student Editorial Board and Faculty Advisory Board – your diligence and dedication to the publication process have ensured the quality and success of the Journal. We are remarkably grateful to have been part of the outstanding team that made this edition possible.

Sincerely,
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FROM THE
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Since UCR's *Undergraduate Research Journal* started 15 years ago, it has published over 160 scholarly articles across many fields. These papers represent the commitment of our undergraduate students to performing independent research as part of their undergraduate experience. Because undergraduate research can often form part of a larger work with many contributors, the importance of the student's contribution can sometimes be lost. With the *Undergraduate Research Journal*, students can publish their work as first authors before the end of the academic year through a peer-review and publication process. The paper becomes a part of a student's professional experience, contributing to their record of scholarly achievement. The *Journal's* submission and review process is run by undergraduates who form the Student Editorial Board, working with members of the Faculty Advisory Board. We owe a debt of gratitude to the students for their professionalism and dedication for the review and preparation of the articles in this issue. We are also grateful for the participation of the members of the Faculty Advisory Board in guiding the reviewers. I would like to thank Gladis Herrera-Berkowitz for her work in supporting and guiding the process every year, Lisa Des Jardins for providing Graphic Design assistance this year, as well as Undergraduate Education for their funding support. If you are interested in publishing your undergraduate research at UCR, consider submitting to our next issue!

Prof. Morris F. Maduro
Chair of the Undergraduate Research Journal
Faculty Advisory Board
Professor of Biology

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Psychological Experiences with Gambling

Alvin Josh Zafra, *Department of Psychology*
Kate Sweeny, Ph.D., *Department of Psychology*

ABSTRACT

According to the 2021 Worldwide Gambling Statistics website, more than a quarter of the population gambles, which means literally billions of people gamble at least once a year (Casino.org, 2021). However, despite the vast number of people gambling per year, there is a lack of research on how emotion regulation affects their perceptions and experiences of gambling. Thus, the aim of this study was to better understand the role of emotion regulation deficits in gambling. A survey was conducted to assess the relationship between frequency and type of gambling behavior and emotion regulation difficulties. The participants were gathered from the UCR Psychology Subject Pool (N = 195; after attention checks, N = 162). These participants were directed to a survey that assessed personal experiences and beliefs about gambling and their emotion regulation strategies and difficulties. Results from correlational analyses indicated that people who tend to use cognitive reappraisal (thinking differently to change their emotions), but not expressive suppression (hiding their emotions), gambled in a more controlled way. Suppression tendencies did not predict any gambling experience or belief. In addition, people who generally had greater difficulty regulating their emotions reported gambling less frequently and gambling in a more enjoyable and focused but also stressful way. The findings suggest that cognitive reappraisal may provide a benefit for individuals who gamble in moderation. Furthermore, those who struggle with regulating their emotions may experience gambling in different ways compared to those who struggle less with emotion regulation.

KEYWORDS: Gambling, Difficulties in Emotion Regulation, Frequency, Recency, Behaviors

Alvin Josh Zafra

Alvin Josh Zafra is a fourth year Psychology major with an Education minor. Under the guidance of Dr. Kate Sweeny, he currently studies gambling behaviors and its impact on emotion regulation. Alvin Josh is Dr. Kate Sweeny's lab manager, and a Crisis Counselor for the Riverside County 2-1-1 HELPline. He is also a research assistant for Dr. Annie Ditta's TEACH Lab and works as a Behavior Technician for Maxim Healthcare Services. He plans to pursue a Ph.D. in School Psychology and study mental health interventions in the K-12 population.

FACULTY MENTOR

Kate Sweeny, Department of Psychology. Kate Sweeny is a Professor of Psychology and a Teresa & Byron Pollitt Endowed Term Chair at the University of California, Riverside. She received her PhD in social psychology at the University of Florida, where she initially developed her line of research on waiting and worry. She has now published more than 100 papers on the psychology of uncertainty and related topics, and her work has been covered by the New York Times, the Washington Post, and NPR.

Psychological Experiences with Gambling

INTRODUCTION

According to the 2021 Worldwide Gambling Statistics website, more than a quarter of the population gambles, which means literally billions of people gamble at least once a year (Casino.org, 2021). However, despite the vast number of people gambling per year, there is a lack of research on how emotion regulation affects their perceptions and experiences of gambling. Therefore, the aim of this survey-based correlational study was to better understand the role of emotion regulation tendencies and deficits in gambling.

Although gambling is a common behavior, it can have numerous negative consequences such as financial troubles, lack of self-care, and relationship problems (Yang et al., 2015). Unfortunately, these negative consequences are often overlooked by individuals due to their overwhelming focus on winning, no matter the cost (Yang et al., 2015). One reason some people engage in problematic gambling behavior is that they may have deficits in emotion regulation abilities (Rogier & Velotti, 2018; Williams et al., 2011). For instance, gambling behavior is associated with poor self-control, and gamblers tend to use detrimental coping strategies such as escaping and avoiding reality (Williams et al., 2011). Gambling can even cause individuals to develop depression and anxiety, which may be exacerbated by poor emotion regulation skills (Barrault et al., 2019).

We focused on the two most widely researched emotion regulation strategies in our study (e.g., John & Gross, 2004): cognitive reappraisal and expressive suppression. Cognitive reappraisal entails thinking differently about a situation in an effort to minimize negative emotions or intensify positive emotions (Miu & Crisan, 2011). Expressive suppression involves hiding facial expressions or other signals of one's emotional state from others (Miu & Crisan, 2011). Reappraisal tends to be associated with positive life outcomes, whereas suppression tends to be associated with negative life outcomes (e.g., John & Gross, 2004). In our study, we investigate how these emotion regulation tendencies might

be associated with gambling. We also explore the role of difficulties in regulating emotions (e.g., a lack of clarity or awareness regarding one's emotions; Gratz & Roemer, 2004) in gambling behavior and experiences.

The present investigation examined individuals' experiences with and perceptions of gambling to better understanding the role of emotion regulation strategies in gambling. We focus our investigation on young adults, given that emerging independence at this stage of life presents new opportunities to engage in gambling. Our research was driven by the following question: Are emotion regulation tendencies (i.e., cognitive reappraisal and expressive suppression) and difficulties in emotion regulation associated with gambling frequency or experiences during gambling?

Grounded in the research literature on emotion regulation (e.g., Williams et al., 2011, Rogier & Velotti, 2018) and considering the roles of cognitive reappraisal, expressive suppression, and difficulties in emotion regulation in gambling activities (e.g., Miu & Crisan, 2011), we hypothesized that individuals higher in cognitive reappraisal tendencies (thus allowing them to reappraise losses and persist in gambling), expressive suppression tendencies (thus allowing them to hide and minimize their emotions about gambling losses), and difficulties regulating their emotions (thus creating a volatile emotional experience while gambling) would report more gambling behavior and riskier perceptions of gambling (i.e., perceptions that might lead to poor decision making, such as feeling out of control or highly stressed). This research has the potential to reveal risk factors for gambling problems, which could inform interventions to reduce negative consequences associated with gambling (as we discuss in later sections).

METHOD

Participants

The sample consisted of 195 participants (after removing participants who failed attention checks, $N = 162$) recruit-

ed from the Psychology Subject Pool at the University of California, Riverside. All materials and de identified data are available on the Open Science Framework (https://osf.io/4d3rh/). This study was reviewed and approved by the authors' Institutional Review Board.

MEASURES

Gambling Frequency

Frequency of gambling was measured with a single item ("How often do you gamble?"; 1 = *Never*, 5 = *Very Often*; M = 1.44, SD = 0.82). Although the mean on this measure is quite low, nearly a third of our participants indicated gambling more often than "never." Given that one goal of our investigation was to compare gamblers to non-gamblers, we were satisfied with this distribution of gambling behavior.

Gambling Recency

Recency of gambling was measured with a single item ("When was the last time you gambled (# of weeks ago)?"; 1 = *Less than a week ago*, 6 = *Never*; M = 3.50, SD = 1.57).

Gambling Frequency Within the Last Year

Frequency of gambling within the last year was measured with a single item ("How often have you gambled in the past 12 months?"; 1 = *Every day or nearly every day*, 7 = *Never*; M = 6.32, SD = 1.14).

Gambling Experiences

Personal experiences and perceptions of gambling were measured with a 20-item questionnaire designed for use in this study (e.g., "I feel energized when I watch other people gamble," "I feel that I am aware of my emotions while deciding whether to gamble"; 1 = *Strongly Agree*, 7 = *Strongly Disagree*; M = 4.35, SD = 0.78). Because these items were new to this study, we first sought to create subscales within our novel gambling experience items via exploratory factor analysis (a statistical technique that reveals how scale items group together, based on participants' responses). This analysis sug-

gested that four factors (groups of items) were appropriate. After inspecting the items that loaded most strongly onto each factor, we labeled the factors as follows: gambling enjoyment (7 items; e.g., "When I am winning, I engage more in gambling behaviors," "I gamble to have a good time with friends and/or family; M = 3.48, SD = 1.49, Cronbach's α = .78), gambling focus (4 items, e.g., "I tend to lose track of time when gambling," "Gambling is an activity best done alone"; M = 2.52, SD = 1.09, Cronbach's α = .74), controlled gambling (5 items, e.g., "When I am losing while gambling, I can change my negative experience into a positive experience," "I keep calm and collected when gambling"; M = 4.66, SD = .88, Cronbach's α = .60), and stressful gambling (4 items, e.g., "I feel that I am aware of my emotions while deciding whether to gamble," "I prefer to watch other people gamble rather than engaging in gambling myself"; M = 4.85, SD = 1.07, Cronbach's α = .48).

Emotion Regulation Questionnaire

Emotion regulation tendencies were measured with the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), a 10-item scale designed to measure emotion regulation tendencies in two ways: (1) cognitive reappraisal (e.g., "When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about," "When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about"; 1 = *Strongly Agree*, 7 = *Strongly Disagree*; M = 4.99, SD = 1.00, α = .81), and (2) expressive suppression (e.g., "I control my emotions by not expressing them," "I keep my emotions to myself"; 1 = *Strongly Agree*, 7 = *Strongly Disagree*; M = 4.26, SD = 1.09, α = .74) . The measure does not indicate a particular period of time or context to consider, focusing instead on participants' perceptions of their emotion regulation in general.

Difficulties in Emotion Regulation

Difficulties in emotion regulation were measured with the Difficulties in Emotion Regulation Scale (DERS-18; Victor

& Klonsky, 2016), an 18-item questionnaire that measures various difficulties in regulating emotions (e.g., "I pay attention to how I feel," "I have difficulty making sense out of my feelings"; 1 = *Almost Always (91 - 100%)*, 5 = *Almost Never (0 – 10%)*; $M = 2.51$, $SD = .74$, $\alpha = .90$).

PROCEDURE

Participants were recruited through the Psychology Subject Pool at UCR within a two-month period. The participants completed the study via an online survey. The link to the survey was provided in the subject pool sign-up system. After reading and approving the consent form, participants completed the online survey. After completing the survey, the participants were asked to email the lead researcher a code (GAMBLE2020), which was used to confirm participation and compensate the participants for their time (with research credit).

RESULTS

Associations between Emotion Regulation and Gambling

To test our hypotheses, we conducted Pearson's bivariate correlation analyses between emotion regulation (reappraisal, suppression, and difficulties in emotion regulation) and gambling behaviors and experiences. **Table 1 (bottom of page)** presents the results of these analyses, which are summarized below.

Reappraisal Tendencies

Contrary to our hypothesis, reappraisal tendencies were not significantly correlated with the frequency or recency of gambling behavior. Moreover, reappraisal tendencies predicted controlled gambling, such that participants who had a greater tendency to use reappraisal reported experiencing gambling in a more controlled way. Reappraisal was not significantly correlated with any other gambling experience subscale.

Suppression Tendencies

Contrary to our hypothesis, suppression tendencies were not significantly correlated with the frequency or recency of gambling behaviors. Suppression was not significantly correlated with any gambling experience subscale.

Table 1. *Bivariate Correlations between Emotion Regulation and Gambling*

	Reappraisal tendencies	Suppression tendencies	Difficulties in emotion regulation
Gambling frequency	.02	<.01	-.14*
Gambling recency	-.02	-.16	-.02
Frequency in the past year	-.02	<.01	-.15*
Gambling enjoyment	.15	.16	.30**
Gambling focus	.19	.15	.21+
Controlled gambling	.33*	.16	-.08
Stressful gambling	.03	.12	.16*

Note: **$p < .01$, *$p < .05$, +$p < .10$.

Difficulties in Emotion Regulation

Contrary to our hypothesis, difficulties in emotion regulation were negatively correlated with the frequency of gambling behaviors, such that participants with greater difficulty regulating their emotions reported gambling *less* frequently within the past 12 months. Consistent with our hypothesis, difficulties in emotion regulation predicted gambling enjoyment and stressful gambling, such that participants who had more difficulties in emotion regulation reported experiencing gambling in a more enjoyable but also more stressful way (i.e., a riskier set of perceptions). Difficulties in emotion regulation were not significantly correlated with any other gambling experience subscale.

DISCUSSION

The purpose of this study was to gain a better understanding of how emotion regulation tendencies and difficulties might be associated with individuals' gambling behaviors and experiences. As discussed in detail below, the findings only partially supported our hypotheses.

We first hypothesized that individuals with greater cognitive reappraisal tendencies would report more gambling behavior and riskier perceptions of gambling. Our findings contradict this hypothesis, such that individuals who reported greater tendencies to use cognitive reappraisal to regulate their emotions reported more controlled gambling experiences, not riskier experiences (and not more gambling behavior). Although our hypothesis was grounded in previous research, our measure of gambling experiences was new to this study. Further research is needed to better understand how the types of gambling experiences we assessed align (or do not align) with gambling measures included in previous research.

Also contrary to our hypothesis, our findings indicated that suppression tendencies did not correlate with any of the gambling measures. It may be that suppressing emotional *expression* is not pertinent to gambling but attempting to suppress the *experience* of emotions (not measured in this study) does

predict gambling experiences. Consistent with this possibility, findings from past research studies suggest that cognitive reappraisal, but not expressive suppression, altered the way people experienced their emotions while gambling (Barrault et al., 2017; Miu & Crisan, 2011).

In addition, we hypothesized that individuals with greater difficulties regulating their emotions would report gambling more frequently and report risker perceptions of gambling. We found mixed support for this hypothesis. Opposite to our prediction, difficulties in emotion regulation were associated with how frequently people had gambled within the last 12 months, but such that people with more difficulties gambled less not more. It is worth noting that a portion of our sample population reported not engaging in any gambling activities. Therefore, future research should look at a sample population that may not gamble but witnessed gambling with families and friends to assess their emotion regulation strategies.

However, as anticipated, difficulties in emotion regulation were associated with both more enjoyment and more stressed gambling behaviors (i.e., more intense emotional experiences while gambling, both positive and negative) These findings were consistent with literature that found that some severe gamblers experienced higher levels of stress-related outcomes and used gambling as an attempt to reduce their difficulties in regulating their emotions (Bergevin et al., 2006).

Overall, the results of our study departed from what prior research studies suggested we would find (e.g., Miu & Crisan, 2011, Rogier & Velotti, 2018, Williams et al., 2011). Since our gambling measures were novel to this study, our study took a unique approach to understanding gambling experiences and thus may have captured aspects of gambling that are affected differently by emotion regulation difficulties and tendencies compared to measures in past studies. Therefore, our results open new opportunities to understand the role of emotion regulation in gambling, suggesting for example that difficulties in emotion regulation and tendencies toward reappraisal and suppression are not as risky as previously thought. Fur-

thermore, by understanding more about the role of cognitive reappraisal, individuals can use this emotion regulation strategy as a positive coping mechanism when engaging in risky gambling behaviors. For instance, when individuals are in a gambling setting (e.g., casinos), they can practice cognitive reappraisal by reframing losses as "simply the cost of an enjoyable day gambling" rather than something that needs to be remedied through further gambling.

Although the present investigation had several strengths, we also recognize several limitations. First, our investigation had a limited sample population, consisting of students from the UCR Psychology Subject Pool. Due to this limited sample population, our findings were limited in their generalizability, although our sample was quite diverse in terms of race, ethnicity, and socioeconomic status. Future research should gather a larger sample population to increase generalizability. Furthermore, our study relied on self-report measures of gambling experiences and behavior, and it was cross-sectional and correlational. These self-reported measures are subjective by nature since these measures reflect the participants' personal perspectives, and the correlational nature of our data prevents causal inferences regarding the associations we observed. Follow-up studies should assess gambling behaviors in an experimental design and with objective measures of behavior (e.g., observations of persistence following loss in a gambling game in the lab) to better study these psychological experiences.

Another limitation was that participants could have misunderstood the definition of gambling. We included items that asked participants gambling types (e.g., horse betting, slot machines); however, we also had participants freely answer other gambling types by selecting an open response option ("other"). Future investigations should specify various gambling activities to better assess these activities. Finally, the study did not assess those who identified as problem or non-problem gamblers. Barrault et al. (2019) assessed problem and non-problem gamblers, where those who identified

as problem gamblers displayed different gambling motives (e.g., gambling to win) and increased psychiatric symptoms (e.g., anxiety). Additional research should study more about the relationship between problem and non-problem gamblers alongside difficulties in regulating emotions when engaging in gambling behaviors.

Nonetheless, our study provides insight into the role of emotion regulation tendencies and deficiencies when engaging in gambling. Most notably, our findings suggest that people with emotion regulation difficulties may actually be less at risk for problem gambling, and people who readily engage in cognitive reappraisal to regulate their emotions may also be less at risk for problem gambling due to their tendency to gambling in a controlled way. These findings could contribute to the development of interventions to teach cognitive reappraisal strategies (e.g., see Denny & Ochsner, 2014, for a review of effects of cognitive reappraisal training), thus potentially lowering their risk for problematic gambling behavior.

ACKNOWLEDGEMENTS

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Virus Discovery in Winter Growing Perennial Plants of Southern California Sage Scrub Habitat

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Tessa Shates, *Ph.D. Candidate, Department of Entomology*
Kerry Mauck, *Ph.D., Department of Entomology*

Amani Helo

Amani is a fourth-year Biology major. She has worked for three years as a research assistant in Dr. Kerry Mauck's Entomology lab, under the guidance of PhD candidate Tessa Shates, where she studies vectors and their origin in non-cultivated plants of Southern California. Outside of the sciences, Amani's passions include scenic hikes and painting. Amani enjoys working with patients in the dental field, she spends her time shadowing many dental procedures as she plans to pursue a professional degree in dentistry.

ABSTRACT

Plant viruses cause serious disease and losses in domesticated crops. However, we know little about plant viruses outside of agriculture. One reason for this is the lack of symptoms of virus infection in wild plants to promptly diagnose and identify with targeted methods. This is now changing with the availability of untargeted "next-generation" sequencing technologies to analyze the viromes of asymptomatic wild plants and study virus impacts on plant health. In this study, we determined whether key winter-growing perennials in local reserves are infected with crop-associated viruses. A previous study in the same locations found that summer-growing perennials host co-infections by multiple crop-associated viruses, but winter-growing plants have not been explored. To enrich for virus sequences, we extracted doubled-stranded RNA, a unique feature of virus replication. We sequenced this material using the Illumina NextSeq platform, then assembled and identified viruses using Galaxy software. In contrast to summer-growing plants, we detected just one crop-associated virus in winter plants: the generalist, Cucumber mosaic virus (CMV). Phylogenetic analysis shows this CMV is in subgroup IA, the most prevalent in the United States. Our results suggest that winter-growing plant viromes have minimal overlap with summer-growing plant viromes and that winter plants may be less exposed to crop-associated viruses.

KEYWORDS: Virome, Ecology, Diagnostics, Bioinformatics, Phylogeny

FACULTY MENTOR

Kerry Mauck is an assistant professor in the Department of Entomology. She received her Ph.D. from The Pennsylvania State University in 2012. As a post-doctoral scholar, Dr. Mauck was part of the ETH Zürich Postdoctoral Fellow Program in Zürich, Switzerland. In her current research, she works to understand the emergence, spread, and biology of plant pathogens transmitted by insects. A key Mauck lab researcher working in this area is Ms. Tessa Shates, who directly mentored Ms. Amani Helo during this project. Additional research areas in the Mauck lab include chemical ecology of host manipulation by pathogens, the influence of insect endosymbionts on feeding behavior, and applied research on vector and virus control.

Virus Discovery in Winter Growing Perennial Plants of Southern California Sage Scrub Habitat

INTRODUCTION

Plant viruses are important causal agents to infectious diseases of wild plants and cultivated crops. A better understanding of plant viruses and their origins is essential to manage emerging threats and to measure impacts on conservation efforts. Advancements in scientific technology now allow for the discovery and characterization of the communities of known and novel viruses in wild vegetation using high throughput, next generation sequencing that does not require prior knowledge of the targets. Such technological advancements are increasing the rate at which viruses are discovered and characterized, but there are still only a few studies focused on the communities of viruses infecting wild hosts, especially long-lived perennials that may be exposed to virus infections over multiple seasons. In contrast, there is a vast knowledge of cultivated plants and their corresponding viruses, as well as how they are transmitted among plants by insect vectors and human activities (Shates et al., 2019).

This study addresses the key knowledge gap of virus communities in wild perennial plants by using next-generation sequencing to characterize the viromes of *Solanum xanti* (SX), *Marah macrocarpa* (MM), and *Acmispon glaber* (AG), three cool-season species endemic to Southern California sage scrub habitats. These plants were selected for the study because they are common and abundant. They are also important resources for local insect pollinators, and they are large and apparent to insect herbivore vectors. We chose to sample populations in two natural reserves (Motte Rimrock Reserve [Reserve DOI: 10.21973/N31T0W] and Shipley Skinner Multispecies Reserve) as these areas are adjacent to both urban and agricultural spaces, and thus, plants in these preserved habitats may be exposed to pathogens from these sources. In prior work performed in the same reserves, it was found that plants in the same families as those chosen in this study, which only grow in the summer season, are exposed to insect vectors emigrating from crops, carrying crop-associated viruses (Shates et al., 2019). Crop-associated viruses are common in summer-growing perennials in both reserves, and plants also support large populations of insect vectors found in crops. Based on these results, we expected to find crop-associated viruses in winter season plants, but to potentially find fewer co-infections given that vector populations are much lower in the winter season (Shates et al., 2019).

By studying the viromes of wild plants on a seasonal basis, this study contributes to our understanding of viral interactions with hosts in non-cultivated systems. In the field of virus ecology, most studies focus on virus movement from wild to agricultural plants, with very few studies addressing the movement of viruses from agricultural plants to wild plants from the perspective of how this affects the wild community. A key knowledge gap is the many ways that non-cultivated species are affected by vector insects and their associated pathogens. Pathogens, such as plant viruses, may even impair the expression of functional traits within the host plant that impact the stress response, fitness (Alexander et al., 2017), and interactions with other organisms (Malmstrom et al., 2017). Morphological effects include stunting of growth and distorted leaves, which are symptoms of viral infection. Virus build-up in plants may also affect our efforts of conserving native plant communities. This study will contribute to our knowledge of the virus communities present in wild plants and aid in the understanding of how agriculture impacts wild communities in ways that are less directly observable.

METHODS

Target plant selection

To choose which plants to sample, preliminary surveys and online tracking were performed to identify important cool-season perennials in Southern California. User-generated species occurrence data found on iNaturalist (*iNaturalist*) and Calflora (*Calflora - Search for Plants*) were used to identify common species across locations and determine their leaf-

Figure 1 A-C: Selected perennial plant species. **(A)** Acmispon glaber (AG), **(B)** Marah macrocarpa (MM), and **(C)** Solanum xanti (SX).

out times. Within the list of common species, we further narrowed selections to focus on plants that are related to crops grown in Southern California (same family or same genus). We predicted that these hosts might be especially susceptible to vectors and viruses from crops and urban gardens. Based on these criteria, we selected three plant species for virome characterization **(Figure 1)**.

The plant species chosen are prevalent in Southern California, as well as in the target reserves: Motte Rimrock Reserve (Reserve DOI: 10.21973/N31T0W) and Shipley Skinner Mul-

tispecies Reserve. These plants are confamilial and congeneric to locally grown crop plants. *Marah macrocarpa* is in the Cucurbitaceae family, which contains crops such as squash, pumpkin, and melons. *Acmispon glaber* is in the Fabaceae (legume) family, and is related to alfalfa, a common crop in the area of the reserves. *Solanum xanti* is in the same genus as tomato and potato, both of which are also grown in Riverside county. Following host plant selection, we proceeded with the workflow outlined in Figure 2 and detailed in subsequent sections.

Figure 2. Workflow diagram.
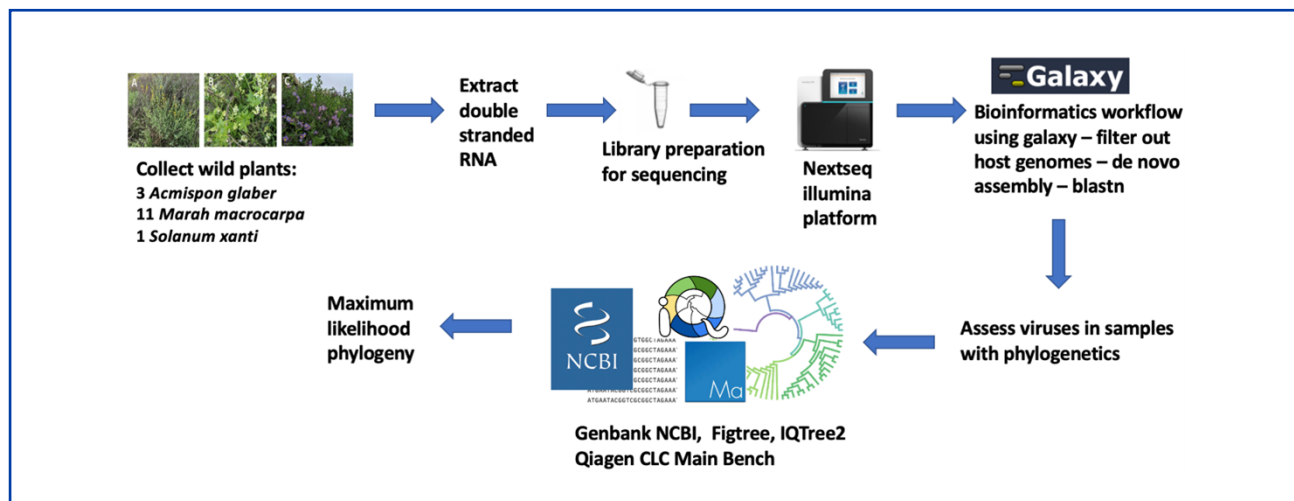
Virus Discovery in Winter Growing Perennial Plants of Southern California Sage Scrub Habitat

Collection & sample preparation methods

In March and April 2018, ten grams of leaf and stem tissues (and *A. glaber* flowers) were removed from each target plant by inverting a Ziploc bag and then cutting off the material before sealing. From Motte Rimrock, collection was as follows: one sample of SX, two of AG, and seven of MM. From Shipley Skinner, only four of MM and one of AG were collected. At the time of sample collection, there were more MM individuals leafed out and available for sampling than AG and SX; therefore, an unequal amount of sampling was done. Samples were stored on dry ice before returning to the lab, where they were processed into 50-mL RNase-free Falcon tubes and stored at −80°C until extracting. We extracted samples and performed sequencing following dsRNA extraction and library preparation protocols from Shates et al. (2019). The pooled library was sent to UCR Genomics Core for sequencing with the Illumina NextSeq platform with 75 base-pair paired ends with adaptors trimmed by Core staff, resulting in two raw data files per sample: one for "forward" and the other for "reverse" paired-end reads.

Virus identification

We used the online Galaxy platform (*Galaxy*) to perform a bioinformatics workflow on the sequencing outputs (originally developed by Shates et al., 2019) (Afgan et al., 2018). An important part of the workflow includes removing host genome sequences using the HISAT2 function, which maps sequences to an uploaded host genome. To filter out host plant sequences, we used the genomes of tomato for *Solanum xanti* (SX), pumpkin for *Marah macrocarpa* (MM), and birds-foot trefoil for *Acmispon glaber* (AG). After removing potential host sequences, we performed de novo assembly using Trinity on unaligned forward and reverse reads (Grabherr et al., 2011). This is required in order to assemble the RNA sequence reads for alignment when lacking the reference genome. We imported a plant-infecting virus database from GenBank at NCBI into the Galaxy Platform and used the nucleotide blast (blastn) function to create a list of putative

virus identity matches in our samples. We used an Excel macro in order to remove the duplicates generated by Galaxy and to create and sort a putative list of viruses. The cutoff for a species match was 90% or greater percent identity. To be included as a putative virus, the cutoff we used was 70% or greater percent identity to a known virus. However, we also used a cutoff of 70% of the genome to be represented in the sequencing to eliminate small fragments that match highly but are potentially false positives. We divided the size of the sequence fragment ("contig") by the full genome size of the virus to find that cutoff.

Phylogenetic analyses

The sample MRMM4 had 3/3 RNAs of the tripartite *Cucumber mosaic virus* (CMV). The most commonly analyzed region of the genome is the third RNA, which includes the coding region for the coat protein. We used an alignment of the coat protein from our sample and the coat proteins of CMV accessions publicly available on GenBank and cited by Lin et al. (2003), Nouri et al. (2014), and Roossinck (2002). We included two outgroups to root the analysis: *Peanut stunt virus* (PSV) & *Tomato aspermy virus* (TAV). Using Qiagen's CLC Main Workbench, we performed model testing on the alignment. The most fitting model for our alignment was the General Time Reversible with Rate and Topography Variation (GTR +G +T). To create the maximum likelihood phylogeny with 1000 bootstrap values, we used the fasta alignment file from CLC and uploaded to the publicly available platform IQTree (Trifinopoulos et al., 2016). We used the Newick Tree file generated from IQTree in subsequent tree visualizations. We used the software, FigTree, to visualize and modify the phylogeny (*FigTree*). When modifying the phylogenetic tree, we distinguished the different isolates (Outgroups, IA, IB, and II) in order to efficiently visualize the tree characteristics. Based on the clades of different isolate subgroups, we could see which subgroup the isolate was most similar to.

Table 1: Summary of virus detections by untargeted sequencing

Plant Code	Species	Reserve	Crop Associated Viruses Detected	Novel Viruses Detected
MRAG1	*Acmispon glaber*	Motte Rimrock	0	0
MRMM1	*Marah macrocarpa*	Motte Rimrock	0	0
MRMM3	*Marah macrocarpa*	Motte Rimrock	0	0
MRMM4	*Marah macrocarpa*	Motte Rimrock	1	0
MRMM5	*Marah macrocarpa*	Motte Rimrock	0	0
MRMM8	*Marah macrocarpa*	Motte Rimrock	0	0
MRMM9	*Marah macrocarpa*	Motte Rimrock	0	0
MRMM10	*Marah macrocarpa*	Motte Rimrock	1	0
MRSX1	*Solanum xanti*	Motte Rimrock	0	2
SSAG1	*Acmispon glaber*	Shipley Skinner	0	0

RESULTS

Virus identification

Of all ten plants that were sequenced, only two contained sequences with a positive match to a known virus: MRMM4 and MRMM10 **(Table 1).** These samples of *M. macrocarpa* both contained *Cucumber mosaic virus*. The samples contain all three RNAs represented by this tripartite RNA-genome virus. Only one plant, MRSX1, has putative matches for novel viruses, one with a 76.9% nucleotide identity to *Verticillium dahliae partitivirus 1* isolate segment of RNA1, and another with 77.1% percent identity to *Verticillium dahliae partitivirus 1* isolate segment of RNA2. This plant also has a match of 72.1% to *Botryotinia fuckeliana partitivirus 1* genomic RNA.

Phylogenetic analysis

Phylogenetic analyses infer relationships based on the number of common ancestors shared. We found that the CMV coat protein sequence from MRMM4 from Motte Rimrock Reserve groups with the CMV IA genetic subgroup **(Figure 3)**. In the phylogeny **(Figure 3 - next page)**, the bootstrap support for the split between subgroups II and IA/IB is 99, which indicates high support. The split between IA and IB is less supported (bootstrap 52), but the clades are consistent with previous publications (Lin et al., 2003; Nouri et al., 2014; Roossinck, 2002).

DISCUSSION

Using non-targeted virome sequencing, we were able to characterize the viromes of cool-season perennials in California sage scrub habitats. Consistent with our prediction that cool-season plants would harbor fewer crop-associated viruses, we only detected one virus CMV in two samples of one host species (*M. macrocarpa*). These detections suggest that *M. macrocarpa* is susceptible to CMV (Ng and Perry, 2004). *Cucumber mosaic virus* (family Bromoviridae) is an RNA plant virus with a tripartite genome and with the broadest host range of all characterized plant viruses (over 1200 known hosts). It is transmitted by over 80 species of aphids through brief probes of plant tissue—meaning the aphids just need to taste the plant to infect it and do not need to stay and feed or be

Virus Discovery in Winter Growing Perennial Plants of Southern California Sage Scrub Habitat
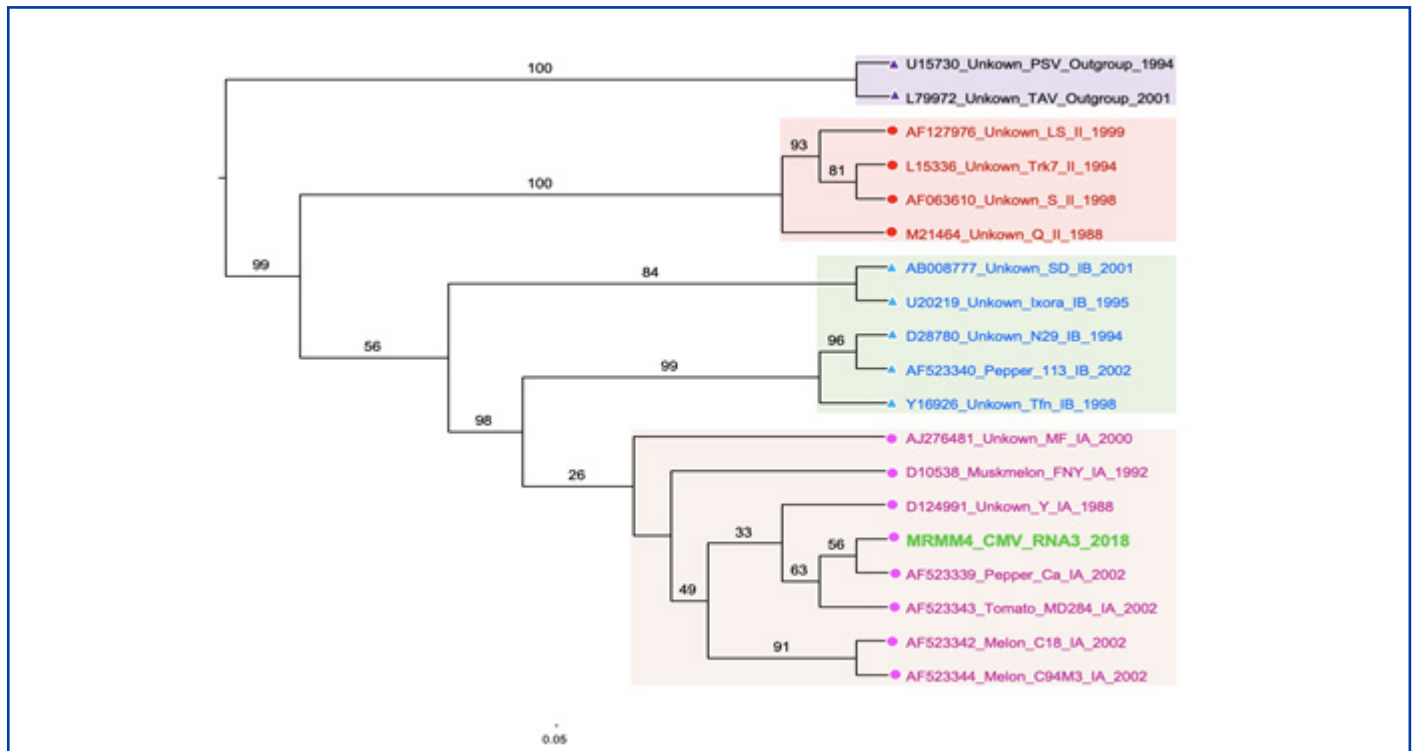

Figure 3. Rooted Phylogenetic tree illustrating results of the maximum likelihood analysis of CMV coat protein nucleotide sequences. The GTR + G +T model was used for tree construction. Color coding and designated shapes have been applied to aid interpretation of isolate origin (purple = unknown outgroups, red = CMV isolate II, green = CMV isolate IB, orange = CMV isolate IA).

able to reproduce on it. Based on this, it is not surprising that CMV was present in at least one of the target species, as it is probably one of the most prevalent viruses in both wild and cultivated habitats worldwide and has the most opportunities for transmission. Previous evolutionary analyses with the coat protein of RNA3 suggest that CMV is subdivided into two main genetic groups (I and II), with group I further divided into subgroup IA, IB (Nouri et al., 2014). We found that the isolate from MRMM4 likely belongs to subgroup IA, which is the most prevalent isolate found in the United States (Nouri et al., 2014). The separation between IA and IB bootstrap support of 56 is low. However, it is still consistent with the split in published literature. This support might be low because of the sequences chosen for this analysis. If other accessions were chosen, the value might be different.

Beyond CMV, very few viruses were detected in these hosts. The only other putative viruses found were in *S. xanti* and matched to sequences of known fungi-infecting viruses in the family Partitiviridae **(Table 1)**. Thus, the only plant virus we detected is CMV, which is in strong contrast with a study performed on hot-season (summer-growing) perennials from the same locations, where all plants were found to be infected with multiple viruses, and a total of six crop-associated viruses were detected (Shates et al., 2019). This contrast may be due to how summer-growing plants are more exposed to crop viruses. These summer-growing plants may also be benefiting from some members of the virus community that aid in tolerating drought conditions, Partitiviridae being among these viruses present (Shates et al., 2019).

CONCLUSION

Viruses are one of the most common microbial effectors in cellular life, including the infectious diseases of plants and commercialized crops. We did an untargeted search for all viruses in three cool-season perennial plants and found only one crop-associated virus (CMV): a species with a very broad host range. This finding prompted further analysis to determine the relationship of the virus to other isolates taken from crops. Our finding that our isolate is likely in subgroup IA was expected, as the subgroup I is most prevalent in the U.S. according to Nouri et al. (2014). Although we did not sample a large number of plants, the lack of other plant virus detections in the target hosts suggests that winter-growing plants may be less exposed to crop-associated viruses (perhaps due to lower vector numbers in winter) and are not routinely acquiring viruses from summer-growing plants that host many co-infections (Shates et al., 2019). Future studies on these undomesticated plants will further close knowledge gaps as we learn more about viromes of wild communities across seasons. This work will also aid in assessing threats to our native plants from local food production at the same time as monitoring for agricultural threats.

ACKNOWLEDGEMENTS

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Well-Being in the Age of COVID-19: The Role of Social Distancing

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ABSTRACT

In March of 2020, the World Health Organization declared COVID-19 an international public health emergency. In an attempt to slow the spread of COVID-19, the CDC recommended implementing social distancing practices. In this study (N = 732), we examined self-reported indicators of social distancing (e.g., avoiding physical contact, declining social gatherings), duration of social distancing (in days), and the number of times participants went outside in the past week as simultaneous predictors of various measures of well-being (i.e., loneliness, emotional states). When controlling for overall satisfaction of life, findings suggested that individuals who reported higher levels of social distancing also reported more negative emotions, less positive emotions, and more anxiety symptoms. Surprisingly, individuals who reported higher levels of social distancing reported less loneliness. Individuals who reported going outside more often also indicated less loneliness, fewer depressive symptoms, and fewer anxiety symptoms. These findings suggest that social distancing practices play a substantial but nuanced role in well-being in the context of the COVID-19 pandemic.

KEYWORDS: Social distancing, COVID-19, Well-being, Loneliness, Anxiety

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Well-Being in the Age of COVID-19: The Role of Social Distancing

INTRODUCTION

The World Health Organization declared the spread of severe acute respiratory syndrome (SARS) coronavirus-2, the cause of the coronavirus disease (COVID-19), an international health crisis in early March of 2020. Since then, many people have lost loved ones to COVID-19 and have been presented with unique challenges as a result of social restrictions. The health and well-being of the world started to be affected by this deadly pandemic in terms of unemployment or job loss, restricted social gatherings, isolation from family and friends, and lockdown guidelines. As the pandemic progressed, the Center for Disease Control and Prevention (CDC) recommended that individuals engage in mask wearing, social distancing, and increased handwashing to slow the spread of COVID-19 (Centers for Disease Control and Prevention, 2020). Prioritizing public health measures continues as various countries attempt to manage the profound effects of COVID-19. The current investigation sought to understand the well-being implications of restrictions that resulted from COVID-19 in the early days of the outbreak in the United States.

Previous SARS Outbreak

The COVID-19 pandemic has paralleled previous outbreaks in the unprecedented series of lockdowns and related restrictions. Public health and infection control measures were put in place following the first outbreak of SARS in 2003. Patients in a Canadian hospital, infected with SARS, expressed frustration regarding their feelings of loneliness and boredom as a result of limited contact with others (Maunder et al., 2003). While the former study examined the effects, SARS had on the well-being of infected patients, similar experiences were reported by non-infected individuals during the outbreak. Longer durations of quarantine, loss of usual routine, and reduced social and physical contact with others were associated with poorer mental health, frustration, boredom, and feelings of isolation (Reynolds et al., 2007). These studies examined both infected and non-infected individuals during the SARS outbreak and found worrying similarities in self-reported psychological impacts.

Following the outbreak in 2003, several studies aimed to examine the long-term psychological implications of SARS on people around the world. One study found that SARS survivors showed higher levels of stress, depression, anxiety, and posttraumatic symptoms one year after the outbreak (Lee et al., 2007), and a study at 30-months post-SARS detected post-traumatic stress disorder, depressive symptoms, and other anxiety spectrum disorders in SARS survivors (Mak et al., 2009). As the SARS outbreak reached containment and a sense of normalcy returned, lasting psychological effects lingered for many people.

Psychological Impacts of COVID-19

Current research on the psychological impacts of the COVID-19 pandemic has raised concerns about the psychological health and well-being of people worldwide. When comparing individuals exposed to varying natural disasters to their pre-exposure state, they were found to have higher levels of psychiatric disorders, including post-traumatic stress disorder and depression (Rashid & McGrath, 2020).

Health professionals fear that the ongoing state of the pandemic and quarantine measures may have serious and lasting consequences on health and well-being. Social distancing measures, including avoiding social gatherings and physical contact, have been mandated by many state and local governments to slow the spread of COVID-19. When public health measures include higher levels of restriction, people suffer in terms of higher loneliness, higher psychological distress, lower life-satisfaction, and poorer mental health (Benke, 2020). Moreover, research on previous pandemics has found long-lasting psychological effects on individuals' well-being; thus, it is likely that the restrictions related to COVID-19 will have similar effects.

The Current Study

The present study seeks to understand the role of social distancing on well-being and emotional health during

COVID-19—specifically whether social distancing and physical restrictions (operationalized as number of days participants had been outside) during the early days of COVID-19 in the U.S. were associated with positive or negative emotion, depressive or anxious symptoms, or loneliness. We chose to focus on these well-being metrics because they combine general emotional states with subclinical mental health symptoms, as well as a key negative experience during a period of social isolation (i.e., loneliness). We hypothesized that engaging in a greater degree of social distancing, engaging in social distancing for a longer duration, and spending fewer days outside would predict poorer well-being overall during this period. This research question is important because well-being is associated with a host of beneficial life outcomes (e.g., Lyubomirsky, King, & Diener, 2005).

METHOD

Participants and Procedure

Adult participants in the U.S. ($N = 732$; 77% female; $M_{age} = 36$; 48% White/Caucasian, 27% Latinx, 17% Asian, 2% Black/African-American, 2% Pacific Islander, 5% prefer not to say) were recruited via snowball sampling in April 2020 at the time of the emergence of COVID-19 social distancing guidelines enforced by the CDC. Participants were asked to complete a self-report questionnaire online using Qualtrics. The survey was completed on a voluntary basis without compensation.

MEASURES

Social Distancing

Social distancing was assessed by the reported number of days spent engaging in social distancing (defined as maintaining a physical distance from other people or minimizing direct contact with individuals in public places; $M = 16.67$, $SD = 7.88$). Additionally, we assessed degree of social distancing by asking participants the extent to which they followed six social distancing practices ("No social gathering with friends," "Cancelling events or plans to go to an event," "Stop going to church or attending other community activities," "No handshaking, hugs, or kisses when greeting," "Wash your hands frequently," "Do not touch your face with your hands"). Participants rated the frequency of these practices on a Likert scale ranging from 1 = *do not consider the following* to 4 = *follow frequently, everyday* ($M = 3.68$, $SD = .28$, Cronbach's α = .55).

Time Spent Outside

Time spent outside was assessed by participant' report of the number of times participants left their house within the past week ($M = 5.06$, $SD = 5.32$).

Measures of Well-Being

Well-being was assessed with measures of loneliness, depression and anxiety, and positive and negative emotions.

Loneliness. Loneliness during the past week was assessed using the three-item Brief Loneliness Measure (Hughes et al., 2004; "How often have you felt that you lacked companionship?" "How often have you felt left out?" "How often have you felt isolated from others?"; 1 = hardly ever, 3 = often; M = 1.78, SD = .62, α = .80).

Depression and Anxiety. Depression and anxiety symptoms experienced in the past week were assessed using the Brief Symptom Inventory (Derogatis & Fitzpatrick, 2004; 1 = not at all, 5 = a great deal). The inventory includes a six-item depression subscale (e.g., feeling no interest in things, feelings of worthlessness; M = 2.16, SD = .87, α = .85) and a six-item anxiety subscale (e.g., feeling fearful, spells of panic; M = 2.48, SD = .96, α = .90).

Positive and Negative Emotions. Emotions experienced in the past week were assessed using the Scale of Positive and Negative Experience (Diener et al., 2009; 1 = very rarely or never, 5 = very often or always). The scale includes a six-item positive emotion subscale (e.g., good, happy; M = 3.17, SD = .74, α = .90) and a six-item negative emotion subscale (e.g., sad, afraid; M = 2.71, SD = .78, α = .87).

Well-Being in the Age of COVID-19: The Role of Social Distancing

Table 1. Associations Between Degree of Social Distancing, Duration of Social Distancing, and Time Spent Outside with Well-being Measures

	Social Distancing	Days Distancing	Time Outside
Loneliness	-.09*	.01	-.10
Positive emotion	-.12**	.02	.03
Negative emotion	.08*	.04	-.03
Anxious symptoms	.09*	.06	-.08*
Depressive symptoms	-.004	-.04	-.12**

Note: *p < .05, **p < .01. Estimates are standardized betas.

Satisfaction with Life

Satisfaction with life was assessed with the 5-item Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffith, 1985; e.g., "I am satisfied with my life"; 1 = *strongly disagree*, 7 = *strongly agree*; $M = 4.80$, $SD = 1.36$, $\alpha = .89$).

RESULTS

We tested our hypotheses using multiple regression analyses predicting well-being (each measure separately) from social distancing duration, social distancing engagement, and days outside, controlling for satisfaction with life (Table 1). Results suggest that engaging in social distancing behaviors (e.g., avoidance of gatherings, cancelling events, frequent of handwashing and touching) was negatively associated with measures of well-being except for loneliness and depressive symptoms. Specifically, greater engagement in social distancing practices predicted more anxiety (p = .04), more negative emotion (p = .05), and less positive emotion (p = .002), but less loneliness (p = .02; unassociated with depressive symptoms, p = .92). Number of days spent social distancing did not significantly predict any measure of well-being. More time spent outside predicted less loneliness (p = .01), less anxiety (p = .03), and less depression (p = .001) but was not associ-ated with positive (p = .45) or negative emotion (p = .59). Overall, complying with social distancing measures in an attempt to slow the spread of COVID-19 was associated with poorer well-being.

DISCUSSION

Our hypotheses were largely, but not entirely supported. Specifically, greater adherence to social distancing guidelines predicted worse well-being on most measures, and more time spent outside predicted better well-being on some measures. These findings are in line with other recent research on the effects of COVID-19 pandemic on well-being (Torales et al., 2020). Contrary to our hypotheses, although adherence to social distancing guidelines was predictive of well-being, surprisingly the duration of distancing was not. We speculate that since data collection was conducted in the very early phases of the pandemic in the U.S., the duration of social distancing may not have had sufficient time to show a significant impact on well-being.

Perhaps the most interesting finding is that adhering to social distancing practices predicted less loneliness, not greater loneliness as we anticipated—which may be logical given the nature of social distancing. Previous research on the associa-

tion between social distancing and loneliness has had mixed results, but in some cases, these results paralleled recent findings. Although a decrease in loneliness paired with social isolation seems counterintuitive, collective adherence to social distancing requirements can be associated with a sense of community and togetherness (Luchetti et al., 2020). In fact, community support improves collective mental health after natural disasters (Torales et al., 2020; Stevenson et al., 2020; Lau et al., 2008). It is also possible that interactions via online platforms (e.g., Zoom happy hours) buffered loneliness, or even reduced it, among those engaging in social distancing practices. Overall, these findings offer insights into the complex role social distancing practices have on well-being in the midst of such a catastrophic pandemic.

LIMITATIONS AND FUTURE DIRECTIONS

The impact COVID-19 has made on the world is significant and will not be easily undone. It is in these times that studying the adverse mental health effects caused by the pandemic can help in the healing process. However, further research is needed to assess the longitudinal impact of COVID-19 and to understand which interventions effectively improve well-being. As this study was cross-sectional, it did not allow us to examine longitudinal patterns of social distancing and well-being, nor were we able to compare participants' well-being before and during the COVID-19 pandemic. A valuable future study would take the same measurements a year later to see if there has been an increase, decrease, or no change in well-being, social distancing practices, and time spent outside in the population. Perhaps well-being has continued to suffer as the pandemic has persisted, or perhaps people have adapted to the current conditions. It is also important to note that the snowball sampling technique used for participant recruitment is not representative of the entire population.

CONCLUSION

The protocols implemented to slow the spread of COVID-19 seem to have negatively affected people's well-being. This result is consistent with previous research, indicating that when public health measures include higher levels of restriction, associations with higher loneliness, higher psychological distress, lower life-satisfaction, and poorer mental health, emerge (Benke, 2020). While this pandemic may continue, we hope that community support and mental health coping skills can assist in increasing the general well-being of the population.

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Acculturation and Its Implications for the Academic Achievement and Subjective Well-Being of East Asian International Students

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ABSTRACT

The U.S. higher education system hosts a wide range of international students with the majority from East Asian countries. East Asian international students may have particular difficulty with acculturating into a novel environment given their predominant interdependent self-construal, which contrasts with the largely independent cultural imperative of the West. The present study investigates the potential associations between international students' acculturation, self-construal (SC), and their academic and psychological adjustment (e.g., achievement goals, academic achievement, subjective well-being) to shed light on how East Asian international students can best adapt to a new culture. Participants included a total of 48 East Asian international students (25 male, 23 female; age range: 18 to 23). Results from a series of correlation analyses indicated that there were no significant correlations between acculturation strategy and self-construal. However, there was a significant correlation between performance-avoidance goals and GPA. Additionally, the separation strategy was negatively associated with negative affect and positively associated with life satisfaction, and the marginalization strategy was positively associated with negative affect and negatively associated with life satisfaction. The findings suggest that acculturation strategy is not directly linked to academic achievement; instead, it has a more prominent influence on well-being among East Asian international students. Further longitudinal research may provide a more comprehensive understanding of the association between acculturation and achievement goals in this unique student population.

KEYWORDS: Acculturation, Self-Construal, Academic Achievement, Achievement Goals, Well-Being

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Acculturation and Its Implications for the Academic Achievement and Subjective Well-Being of East Asian International Students

INTRODUCTION

According to the Open Doors Report of 2020, the United States hosts approximately 1,075,496 international students, indicating a 48.7% increase in foreign student enrollment over the most recent decade (Institute of International Students, 2020). The largest share of students originates from East Asian countries (i.e., China, Hong Kong, Macau, Taiwan, Japan, South Korea, and Mongolia), which accounts for 26.7% of all international students and 62.1% of all Asian students. The influx of East Asian students that participate in foreign study programs gives rise to concerns regarding their well-being and their academic achievement when faced with a new culture, given that they are accustomed to highly collectivist societies. Oftentimes, it is uncertain whether East Asian students would be able to successfully adapt to the host culture for the facilitation of proper academic behaviors and desirable social interactions. The present study focuses on how East Asian international students respond to cultural challenges and the positive (and negative) outcomes that occur as a result. The study's goal is to contribute to an understanding of the areas of the abroad experience that are impacted the most by cultural differences so that they could be focused on in counseling meetings, school workshops, and administrative policies in order to enact a greater sensitivity towards the needs of international students and create positive change.

International students can be categorized as sojourners, or individuals who stay in the host country for a short period of time to attain a particular goal and then return to their home country (Li, Wang, & Xiao, 2019). They are immersed in an educational environment where they have a unique set of experiences within a specialized population. International students of East Asian descent, among other ethnic backgrounds, may experience particular difficulty in a Western university because of the stark cultural differences that they are not accustomed to. For instance, many international students are trained to listen to instructors rather than speak in class (Selvadurai, 1990). When exposed to the Western learning environment, their reluctance to participate in class may prove inhibiting in achieving a higher grade or expanding their network. It has been found that the norms, values, and beliefs of a culture can affect an individuals' self-construal, or their views of the self in relation to others. Individuals accustomed to Asian cultures (e.g., China, Japan), which are highly collectivist, tend to view the self as an *interdependent* entity, in which one's behavior is determined, and contingent on, the perceived thoughts of *others* in a situation (Markus & Kitayama, 1991). On the contrary, individuals in Western countries are predisposed towards an *independent* self-construal, where they view themselves as bounded, integrated wholes that are separate from others and have a unique configuration of internal attributes. Western society underscores the independent self-construal, such that individuals generally act with the intent to satisfy internal needs—enhancement of self-esteem, self-actualization, motive to achieve—and attain a level of autonomy and separateness. Students from Asian cultures who maintain an interdependent self-construal may feel that their inclination to restrain their inner attributes and demands may not be beneficial, and in fact detrimental, in meeting the Western culture imperative (Murray, 1938).

ACCULTURATION

Acculturation occurs when groups or individuals from one culture make contact with groups or individuals from another culture, and it results in cultural and psychological change in both the group acting and the group being acted upon. Through acculturation, individuals can adopt a variety of strategies in order to adapt to a new culture successfully. Berry's (1980) model of acculturation proposed four different kinds of acculturation strategies: integration, assimilation, separation, and marginalization. The strategy utilized largely depends on two key issues: 1) the preference to maintain one's heritage culture and identity and 2) the preference to participate in the larger society. When one wishes to maintain

their cultural beliefs and values and participate in the larger society, then the integration strategy is defined. The assimilation, separation, and marginalization strategies are adopted when an individual prefers solely the host culture, solely the home culture, or neither culture, respectively. The strategy used can influence whether an individual or group becomes well-adapted or maladapted to a novel environment.

Achievement Goals

The acculturation strategy chosen may influence academic achievement through the type of achievement goals that international students set for themselves as they study abroad. An achievement goal can be defined as "the purpose for engaging in competence-related behavior" (Elliot & Hulleman, 2017). According to the 2 x 2 achievement goal framework proposed by Elliot and McGregor (2001), individuals who adopt mastery-approach goals strive for competence, performance-approach goals strive to outperform others, mastery-avoidance goals avoid incompetence, and performance-avoidance goals avoid underperforming relative to others.

Research on which achievement goals lead to the highest academic performance has resulted in mixed findings. Generally, it was found that approach goals were associated with higher academic achievement and avoidance goals with lower academic achievement (Huang, 2012; Elliot & McGregor, 2001). However, a recent study by Brockbank and colleagues (2020) found that both approach and avoidance goals positively predicted academic performance, though approach goals did so more than avoidance goals. Students who strive to avoid incompetence and underperforming may perceive these goals as the ultimate desired outcome; thus, mitigating negative behaviors that may inhibit successful academic performance.

Subjective Well-Being

Subjective well-being (SWB) is synonymous with the hedonic view of well-being, which is attained through experiences of pleasure and enjoyment (Henderson, Knight, & Richardson, 2013). It can be measured by level of positive affect (PA), level of negative affect (NA), and satisfaction with life (Diener & Emmons, 1984; Diener et al., 1985). A study by Zheng, Sang, & Wang (2004) found that the SWB of Chinese international students in Australia significantly differed across adoption of acculturation strategies. In particular, students who were integrated into the host society had significantly higher SWB than their peers who were assimilated, separated, or marginalized. Furthermore, Berry & Hou (2016) found that immigrants who used the integration and assimilation acculturation strategies had the highest scores of life satisfaction, while those who used the separation and marginalization strategies had significantly lower scores.

The Present Study

The first goal of the present study was to explore the associations between self-construal and acculturation strategy. The present study hypothesized that students who utilize the following strategies will maintain the corresponding self-construals: integration → high independent and interdependent SC; assimilation → high independent, low interdependent SC; separation → low independent, high interdependent SC; marginalization → low independent and interdependent SC. It was also predicted that the longer a student stayed in the US, the greater the prevalence of the integration and assimilation acculturation strategies.

The second goal was to explore the associations between acculturation strategies, achievement goals, and academic achievement of East Asian international students. With the integration strategy being the most beneficial to academic and well-being adaptations (Cemalcilar & Falbo, 2008), it was hypothesized that students who utilize integration, followed by assimilation, will have a greater degree of approach goals than avoidance goals. Students who utilize separation and marginalization strategies, on the other hand, will have more avoidance goals than approach goals, and less goals overall than assimilation or integration strategies. It was also predict-

Acculturation and Its Implications for the Academic Achievement and Subjective Well-Being of East Asian International Students

ed that approach-oriented goals will positively correlate with student GPA more than avoidance-oriented goals.

The final goal of the present study was to determine which acculturation strategies lead to higher positive affect, lower negative affect, and higher satisfaction with life in East Asian international students. It was hypothesized that the integration strategy will lead to higher subjective well-being, followed by the assimilation and separation strategies. The marginalization strategy will result in the lowest well-being scores.

METHOD

Participants

The sample for the present study consisted of 48 (52.1% male, 47.9% female) undergraduate students from an accredited, postsecondary, and minority-serving institution in southern California. Participants ranged from 18 to 23 years of age, with a mean age of 20.02. The targeted sample consisted of students who were of East Asian ethnicity and nationality (home country is an East Asian country), and who were studying abroad in the United States for the Fall and Winter quarters. East Asian countries and regions included China, Hong Kong, Japan, South Korea, Taiwan, Macau, and Mongolia. Data collected showed that 34 participants (70.8%) of the sample identified as Chinese, 2 participants identified as Japanese (4.2%), 3 participants identified as South Korean (6.3%), 5 participants identified as Taiwanese (10.4%), 3 participants identified as Cantonese (6.3%), and 1 participant identified as Macanese (2.0%). None of the participants were from Hong Kong or Mongolia. The average time these students spent in the U.S. was 4.19 years. All participants were able to speak and read English.

Procedure

With approval from the UCR IRB-SB, participants were recruited with the assistance of the International Affairs office, the UCR extension center, and a number of student organizations. Two recruitment groups were formed: students who signed up through the Psychology Research Participa-

tion System (SONA Systems) and students who were directly administered the survey following completion of an interest form (non-SONA). SONA participants were compensated with one unit of course credit, and non-SONA participants were compensated with a raffle entry to potentially win 1 of 3 $25 gift cards. Participants from both groups were administered a single, online survey that was prefaced with the informed consent form. Participants' emails were collected in order to debrief them and provide them with a summary of the study's results; however, names were not collected to protect the participants' privacy. Reminders were sent to participants who signed up for the study through SONA systems or who completed the interest form but had not yet completed the survey a week thereafter. Student identifiers were deleted following completion of the study report.

MATERIALS

An online survey was developed and administered using Qualtrics software. There were 118 items on the survey that included demographic questions, seven scales, and GPA and TOEFL information. Several scales were divided into subscales, and two of the scales—the reasons for learning scale and the flourishing scale—have been omitted to allow for a closer examination of the other research variables. All measures except GPA and TOEFL score were answered on a five-point Likert-type scale with a '1' indicating 'strongly disagree/never' and a '5' indicating 'strongly agree/always.' An average across all items was taken for each scale.

Demographics. Items include indication of nationality, home country, years lived in home country, post-graduate plans, gender, age, current academic year, and major.

Self-Construal Scale. The latest version of the Self-Construal Scale (SCS) developed by Singelis (1994) was used. There were fifteen questions that address an independent self-view (e.g., 'I do my own thing, regardless of what peo-

ple think') and 15 questions that address an interdependent self-view (e.g., 'I feel good when I cooperate with others'). The independent and interdependent subscales were shown to be two separate factors rather than opposite poles of a single construct; thus, each subscale was calculated and considered independently.

The East Asian Acculturation Measure. The East Asian Acculturation Measure (EAAM) is a scale developed by Barry (2001) that measures the four different acculturation strategies as it pertains to East Asian immigrants. The 29-item scale is comprised of 8 *assimilation* (e.g., 'I get along better with Americans than Asians'), 7 *separation* (e.g., 'I prefer going to social gatherings where most of the people are Asian'), 5 *integration* (e.g., I feel very comfortable around both Americans and Asians'), and 9 *marginalization* (e.g., 'Generally, I find it difficult to socialize with anybody, Asian or American') items. Attitudinal and behavioral aspects of social interaction and communication styles are addressed.

Achievement Goals Questionnaire-Revised. The achievement goal questionnaire-revised (AGQ-R) consists of 12 items which represent the four goals in the 2 x 2 model of goal achievement. In the present study, the AGQ-R was used to determine which types of goals East Asian international students tend to adopt. Each item was scored and averaged to form four different indexes: performance-approach (e.g., 'It is important for me to do better than other students'), mastery-approach (e.g., 'I want to learn as much as possible from this class'), mastery-avoidance (e.g., 'I worry that I may not learn all that I possibly could in this class'), and performance-avoidance (e.g., 'My goal in this class is to avoid performing poorly'). Additionally, both approach profiles and both avoidance profiles were combined to create two general approach and avoidance profiles for analysis.

The International Positive and Negative Affect Schedule Short Form. The I-PANAS-SF is composed of two five-item affect scales: one to measure positive affect (e.g., in-

spired, determined) and the other to measure negative affect (e.g., upset, ashamed). The present study uses the scale to ask to what extent students generally feel 1 of 10 affective states.

The Satisfaction with Life Scale. The SWLS is a five-item scale that was developed by Diener et al. (1985) in order to measure the global cognitive judgements of one's satisfaction with life. The scale was adjusted to a five-point Likert scale to maintain compatibility with the rest of the survey measures and to minimize the cognitive load for respondents completing the survey. Sample questions include "In most ways my life is close to ideal" and "So far I have gotten the important things I want in life."

GPA. Participant GPA was an indicator of their level of academic achievement.

TOEFL. Participant TOEFL score was an indicator of their English writing, reading, and comprehension ability. It was not directly used in any analyses, as it was just a marker of general language competence.

RESULTS

In general, there were only weak associations between acculturation profiles and self-construals, and these associations did not reach statistical significance (**see Table 1 - next page**). Three acculturation profiles were positively associated with each other: assimilation, separation, and integration. That is, individuals who used one of these strategies tended to use at least one of the other two strategies as well. Marginalization, on the other hand, was found to not be associated with the first three strategies, meaning individuals who avoided both the home and host culture tended to not adopt other strategies during their stay. In addition, time in the US was not associated with students' use of acculturation strategies.

Results for the second hypotheses show that there were no correlations between acculturation strategies and achievement goals. That is, students who used a particular acculturation strategy, or set of strategies, did not tend towards adopt-

Acculturation and Its Implications for the Academic Achievement and Subjective Well-Being of East Asian International Students

Table 1. Correlations for Acculturation Strategies, Self-Construal, Achievement Goals, Subjective Well-Being, and Time in the U.S.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 TIME IN THE US	-																
2 INDEPENDENT SC	-.24	-															
3 INTERDEPENDENT SC	-.05	.08	-														
4 ASSIMILATION	-.02	.02	.23	-													
5 SEPARATION	-.03	.19	.08	-.61**	-												
6 INTEGRATION	.07	.05	.08	.43**	-.51**	-											
7 MARGINALIZATION	.19	-.25	-.25	.28	-.22	-.26	-										
8 MASTERY APPROACH	-.28	.27	.38**	.14	-.09	-.12	-.06	-									
9 MASTERY AVOIDANCE	-.03	.13	.14	.12	-.12	.14	.12	.40**	-								
10 PERFORMANCE APPROACH	-.10	.22	.53**	.05	.19	-.02	-.27	.33*	.13	-							
11 PERFORMANCE AVOIDANCE	.01	-.10	.43**	.05	.08	-.09	-.09	.35*	.35*	.72**	-						
12 APPROACH	-.22	.29*	.57**	.11	.09	-.07	-.22	.75**	.30*	.87**	.68**	-					
13 AVOIDANCE	-.04	.05	.40**	.08	.04	.02	-.06	.50**	.69**	.63**	.90**	.70**	-				
14 GPA	-.18	.11	.10	.11	-.13	.21	-.19	.14	.30*	.12	.16	.16	.26	-			
15 POSITIVE AFFECT	-.42**	.39**	.10	.08	-.16	.15	-.18	.40**	.30*	.17	.02	.33*	.18	.45**	-		
16 NEGATIVE AFFECT	.08	-.09	-.14	.00	-.34*	.03	.44**	.11	.30*	-.22	-.06	-.10	.07	.14	.30*	-	
17 SATISFACTION WITH LIFE	-.18	.31*	.30*	.01	.31*	-.13	-.33*	.12	.15	.17	.05	.18	.12	.13	.20	-.41**	-

Note. *$p < .05$. **$p < .01$, two-tailed.

ing any particular achievement goals. Mastery-avoidance goals were related to student GPA, such that students with a stronger tendency to avoid poor performance had better GPAs. In addition, there was a positive correlation between independent SC and approach goals, and interdependent SC and all goals except mastery avoidance goals.

The separation strategy was negatively associated whereas marginalization strategies were positively associated with negative affect. Perhaps surprisingly, separation was associated with heightened life satisfaction, whereas marginalization was negatively associated with life satisfaction. Independent SC was positively correlated with positive affect and life satisfaction, whereas interdependent SC was positively correlated with only satisfaction with life. Interestingly, positive affect was associated with negative affect, meaning those who experienced generally positive emotions also experienced generally negative emotions.

DISCUSSION

Findings show that acculturation strategies and self-construal patterns, though sharing similar conceptualizations, are not directly related to each other. To reiterate, the type of acculturation strategy utilized is contingent on the preference to maintain one's culture and the preference to adopt the culture of the host society. Yamada and Singelis (1994) have proposed that because different individuals vary in their acculturation experience, they might portray distinct self-construal patterns. The bicultural self-construal pattern, for instance, exhibits a high interdependent and independent score, which parallels the integration acculturation strategy. However, the present study found that each acculturation strategy was not correlated with either the independent or interdependent self-construals. As the adopted self-construal pattern has been found to correlate with the acculturation strategy utilized (Shim et al., 2013), it is likely that the sample size in the present study was not large enough to indicate

Table 2. Descriptive Statistics for Acculturation Strategies, Self-Construal, Achievement Goals, Subjective Well-Being, and Time in the U.S.

	Mean	Std. Deviation
TIME IN THE US	4.19	2.39
INDEPENDENT SC	3.51	0.50
INTERDEPENDENT SC	3.57	0.47
ASSIMILATION	2.15	0.79
SEPARATION	3.56	0.63
INTEGRATION	3.65	0.89
MARGINALIZATION	2.48	0.99
MASTERY APPROACH	3.61	0.60
MASTERY AVOIDANCE	3.47	0.75
PERFORMANCE APPROACH	3.42	0.82
PERFORMANCE AVOIDANCE	3.56	0.77
APPROACH	3.52	0.58
AVOIDANCE	3.56	0.61
GPA	3.36	0.41
POSITIVE AFFECT	3.11	0.60
NEGATIVE AFFECT	2.65	0.73
SATISACTION WITH LIFE	3.10	0.86

similar results. Given that there were no general trends towards significance, a substantial increase in the sample size may be necessary to begin seeing correlations. It may also be the case that moderating factors unaccounted for could have further limited the development of significant associations. If that is the case, significance may not be reached even with a larger sample size, and a different set of measures may need to be used to see results that align with past research. Furthermore, the acculturation strategies adopted were not influenced by length of stay in America. This contrasts with Barry's (2001) finding that individuals who stay longer in America tend to utilize the integration strategy. It may be

the case that the self-construal type and acculturation strategies espoused when an international student first arrives in America remain relatively constant throughout the duration of their sojourn.

The hypotheses regarding the associations between acculturation strategies, achievement goals, and academic achievement received limited support as well. All four acculturation strategies were not correlated with either approach or avoidance goals. Given that the 2 x 2 achievement goal theory emphasizes competence along two dimensions, it may be the case that one's cultural preference does not directly influence how competent an individual is in adhering to such preferences. It is also possible that the attitudes and behaviors that derive acculturative strategies are more so utilized in intercultural encounters rather than in goal-setting behavior. Thus, the acculturation strategy may have a greater influence on whether individuals set goals at all, as opposed to their mastery/performance or approach/avoidance tendencies in goal pursuit.

The finding that mastery-avoidance goals correlated with student GPA was particularly interesting, as mastery-avoidance goals were the only type of goal to not have a correlation with interdependent SC—of which is the dominant SC for East Asian culture. Juxtaposing this finding with the pattern that other achievement goals did not correlate with GPA, it is possible that student GPA may be more an indicator of the effort put towards a goal rather than the type of goal maintained. For instance, if a student who primarily maintained performance-avoidance goals invested more effort into reaching such goals, he or she may academically succeed more than an individual putting less effort in fulfilling performance-approach goals, and vice versa.

The last set of hypotheses regarding acculturation and well-being were somewhat supported. Separation was correlated with dampened negative affect and heightened life satisfaction. This suggests that individuals who utilize the separation strategy are still able to pull resources from one

Acculturation and Its Implications for the Academic Achievement and Subjective Well-Being of East Asian International Students

culture in order to cope with demands from the new environment. Because of international students' sojourner status, they may feel that using resources from their home culture is the most comforting or convenient when experiencing a new culture. Contrastingly, marginalization was associated with higher self-reported negative affect and lower life satisfaction. Consistent with prior research, individuals who use the marginalization strategy may have the least access to resources, most acculturative stress, and worse psychological and sociocultural adaptation outcomes (Berry, 2005; Berry et al., 2006). Interestingly enough, the integration strategy did not have a relationship with positive affect at all. This contrasts with Zhang, Sang, and Wang's (2004) finding that the integration strategy was associated with the highest subjective well-being versus the other acculturation strategies. Lastly, the finding that positive affect is correlated with negative affect is consistent with past literature that shows that individuals who predominantly exhibit an interdependent SC are likely to view both positive and negative emotions as integral to an overall positive experience, as long as the emotions shown are socially engaging (Kitayama, Markus, & Kurokawa, 2010). Though the sample in the present study, on average, exhibited elevated independent SC, the sample also maintained a rather high interdependent SC; thus, the study's sample aligns with this finding.

LIMITATIONS AND FUTURE DIRECTIONS

There were several limitations to the study that may have impeded a more comprehensive analysis. Regarding methodological limitations, there was a relatively small sample of East Asian international students assessed. This could reduce the statistical power for detecting meaningful associations among the variables. In addition, the relatively small sample may not be representative of the general East Asian student population in Southern California. The study was also self-report, which means that social desirability could have played a role in the responses inputted. Additionally, recruitment did not include random sampling; instead, inter-

ested students who may share similar qualities (such as proactiveness and competency) may have influenced the results. Thus, the sample may have not been fully representative of the East Asian international student body.

Albeit providing weak support to the study hypotheses, the current endeavor represented an important first step into understanding the interplay between acculturation, self-construal, academic achievement, and well-being. Future research could employ a moderation approach to understand if the associations between acculturation and student academic and wellbeing outcomes depended on their achievement goals. One could also dive a little deeper and examine if there are any mediators of acculturation and achievement goals, or they can attain a more macro-perspective and investigate other connections between acculturation and academic achievement. Moreover, a longitudinal design could be applied to the constructs presented in the study in order to determine if the relationship between particular variables such as achievement goals with acculturation strategy can change over time.

CONCLUSION AND IMPLICATIONS

Though findings from the present study were limited, evidence was found of relationships between achievement goals and academic achievement, and acculturation strategy and well-being. The influence of acculturation on achievement goals is a unique aspect that warrants further attention, as the type of acculturation strategy utilized could potentially have profound effects—both positive and negative—on the academic achievement of international students. Increased understanding of goal achievement and well-being in school counseling, administration, and public policy could help orient students towards the optimal acculturation strategies and self-construal patterns. Students could then develop adaptation behaviors that reinforce the adoption of achievement goals that increase academic success and lessen problems in a collegiate environment. Adjusting to support East Asian

international students and their unique set of difficulties, whether they be through their perceived construals or not, can result in a meaningful impact on students from collectivist societies in general.

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Neuroticism Predicts Increased Sensitivity in Identifying Negative Facial Affect in Young Adults

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ABSTRACT

Our personalities color how we interpret others' emotions. Some people have an increased tendency to identify others' facial affect as negative or threatening, which may lead to the misinterpretation of social cues, poor responses in social settings, and could exacerbate feelings of stress or anxiety in social situations. Yet, studies linking personality traits on the Big Five Inventory (BFI), specifically neuroticism, to emotion recognition are mixed (Cunningham, 1977; Matsumoto et al., 2000). This study investigated the effect of neuroticism on people's discriminability and speed when identifying others' facial emotions. Participants (n = 37) judged the emotion of faces that were morphed along two emotion spectra: happiness to fear and happiness to anger. Responses determined participants' negativity threshold, or the point on the spectrum where their judgment switched from happy to angry or fearful. We tested the hypothesis that people who scored high on the neuroticism scale of the BFI would detect negative emotions more readily than people scoring low on neuroticism. We also measured the influence of personality traits on response time. As expected, we observed that high neurotic people were more sensitive to negative facial affect than low neurotic people. This extends on the research finding that individuals high in neuroticism have high emotional reactivity to negative stimuli to include ambiguous facial expressions. However, contrary to our hypothesis, response time was not associated with neuroticism level. Together, our findings suggest that people high in neuroticism have an increased sensitivity to detect negative facial emotions. Future studies should test whether the misinterpretation of social cues leads to impoverished social connections.

KEYWORDS: Big Five Inventory, Neuroticism, Emotion Recognition

FACULTY MENTOR

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Neuroticism Predicts Increased Sensitivity in Identifying Negative Facial Affect in Young Adults

INTRODUCTION

Personality is multifaceted and has wide-ranging consequences for a person's life, wellbeing, and social connections (Lucas & Diener, 2009; Côté, & Moskowitz, 1998). For example, neuroticism is a personality disposition to experience negative affect that has been reliably shown to relate to mood and anxiety symptoms (Brandes & Tackett, 2019; Kotov et al., 2010). Even though accumulating evidence supports the characterization of neuroticism as a risk factor for psychopathology and impaired social connections (Hengartner et al., 2016; Kotov et al., 2010; Roberts & Kendler, 1999), the psychological mechanisms by which neuroticism may confer risk are not well characterized. Here we ask whether people who are high on neuroticism perceive the social world around them differently than those low on neuroticism, which may, in turn, lead to impoverished social interactions and psychopathology. Specifically, we examined the impact of the Big Five Inventory (BFI) personality trait neuroticism on participants' discriminability and speed of identifying others' displays of facial emotions.

Accurate identification of other people's emotional expressions provides us with cues to important features of the emotional state of our interaction partners. For example, when someone frowns or glares at us during a conversation, we might adjust our tone so as to appease them. However, some people display aberrations in their emotion recognition abilities, like the increased tendency to mistakenly view others' ambiguous facial emotions as negative or threatening. This decrease in "negativity threshold" is often associated with psychopathology like anxiety and depression (Dalili et al., 2015; Maoz et al., 2016; Reeb-Sutherland et al., 2015). Identifying the source of changes in negativity threshold is important because a skewed perception of social interactions might lead a person to misinterpret social cues, respond poorly in social situations, and potentially exacerbate underlying psychopathology due to negative feedback loops. Given that personality influences social relationships

and wellbeing (Lucas & Diener, 2009; Côté, & Moskowitz, 1998), certain personality traits may also influence how people interpret emotional expressions. Neuroticism, which measures emotional instability and the tendency toward negative emotions like anxiety, depression, and self-doubt (John et al., 1991), is one personality factor that has been linked with biases in interpreting socioemotional stimuli. Individuals scoring high on neuroticism display elevated emotional reactivity to negative events (Canli, 2008; Lommen et al., 2010), experience increased negative emotions (John et al., 1991), and are more likely to develop disorders such as depression (Spijker et al., 2007) and anxiety (Lahey, 2009). Neuroticism has also been associated with an increased tendency to interpret stimuli or situations as negative (Byrne & Eysenck, 1993; Salemink & van den Hout, 2010; Vinograd et al., 2020). Only a few studies have examined how neuroticism specifically influences facial emotion recognition with mixed results (Andric et al., 2014; Cremers et al., 2010; Lommen et al., 2010; Saylik, 2018) and none to our knowledge have tested the impact of neuroticism on emotion gradients. This study addresses this gap in the literature and aids in a broader understanding of how high neurotic individuals interpret facial cues which may influence their subsequent socio-behavioral understanding. Finding that neuroticism is associated with biases in the recognition of facial affect might open up new avenues for treatment and inform interventions for children or adults with high levels of negative emotionality.

We examined negativity thresholds in emotion recognition by testing how people identified photographs of ambiguous facial expressions because it provides a realistic representation of real-world emotion recognition (Pollak, & Kistler, 2002). In daily life, we often encounter people whose facial emotions we must decode and interpret to enable effective communication. Only seldom do people express extremely negative emotions. More often, negative facial expressions are ambiguous, and people only display hints of annoyance, frustration, or disappointment, which they might try to cov-

er up. Therefore, rather than testing how accurately people identify obvious facial expressions, it is more ecologically valid to ask people to categorize ambiguous emotions, for instance, faces that are a blend of two different emotional expressions.

The present study examined how the BFI personality trait neuroticism influences young adults' emotion recognition. We utilized an emotion identification task and administered the BFI to test the effect of neuroticism and negativity biases in emotion identification. Because neurotic individuals have a tendency to interpret ambiguous stimuli and experiences as negative (Byrne & Eysenck, 1993; Salemink & van den Hout, 2010; Vinograd et al., 2020), we hypothesized individuals high in neuroticism would display greater sensitivity in detecting negative facial emotions (fear and anger) than those low in neuroticism. We also hypothesized that this may result in a reduced response time when identifying emotions. In addition, as neuroticism peaks in the period between late adolescence and early adulthood (Lahey, 2009), testing the influence of neuroticism on emotion identification in young adults may provide insights into the effects of negative emotionality in a population that may be most vulnerable. If neuroticism is a meaningful source of negativity bias during emotion recognition, the current study may elucidate potential prevention targets for anxiety and depression and inform a nascent evidence base.

METHOD

Participants

Undergraduate students were recruited from the University of California, Riverside (UCR) psychology subject pool (see **Table 1** (below) for demographic information) to participate in a two-part study. In part one, participants completed a series of online questionnaires, collected via Qualtrics. Within 10 weeks of finishing part one, interested participants completed a computer-based emotion identification task conducted through the online platform Inquisit. Consent was collected at the start of both online visits. Participants received course credit for participation in each part of the study. Participants were excluded from analysis if they did not complete the task (see Methods) resulting in a total of 37 participants. This study was approved by the UCR Institutional Review Board.

Big-Five Inventory Trait: Neuroticism

Participants' self-reported personality traits were assessed via the Big Five Inventory (John et al., 1991; John, Naumann, & Soto, 2008). The BFI is a 44-item self-report questionnaire that measures openness, conscientiousness, agreeableness, extraversion, and neuroticism on a Likert scale from 1 (disagree a lot) to 5 (agree a lot). We studied the influence of neuroticism on emotion identification because neuroticism predicts anxiety and depression (Brandes & Tackett, 2019;

Table 1. Participant Demographics

Neuroticism Split			Ethnicity				
High Neuroticism (M, SD)	Low Neuroticism (M, SD)	Female (%)	Hispanic	Asian	Native Hawaiian / Pacific Islander	Black	White
45.38, 6.32	32.33, 5.92	40.5	35.1%	35.1%	8.1%	5.4%	2.7%

Neuroticism Predicts Increased Sensitivity in Identifying Negative Facial Affect in Young Adults

Figure 1. Happiness to Anger Spectrum and Happiness to Fear Spectrum
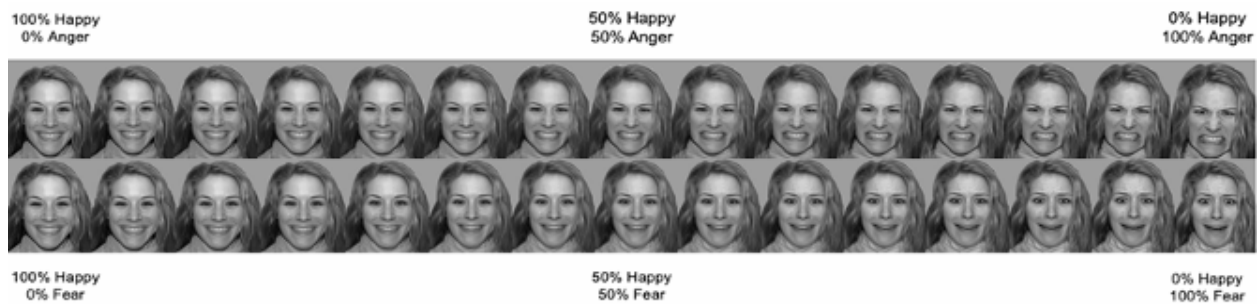
Faces were morphed from happy to anger or fear in steps of ~7%, resulting in 15 stimuli equally spaced along the continua. The seventh face is the midpoint between the 100% happy facial expression and the 100% fearful/angry facial expression.

Kotov et al., 2010) both of which are associated with biases in emotion identification (Spijker et al., 2007; Maoz et al., 2016). The 8-item neuroticism subscale measures emotion instability and tendency to experience negative emotions (e.g., worries a lot). Participants with scores above (≥ 50th percentile) or below (< 50th percentile) the median personality factor score were categorized as high or low neuroticism, respectively.

Emotion Identification Task

Face stimuli were black and white pictures of four ethnically diverse people expressing happy, angry, and fearful facial expressions (Tottenham, 2009). Each face identity was morphed along two emotion spectra: a happiness to fear spectrum and a happiness to anger spectrum. The stimuli were morphed in steps of ~7% using FantaMorph software v5.0 (Abrosoft), totaling 15 morphs per face identity and emotion spectrum (**Figure 1**). To control the percentage of each emotion present, we identified key anatomical locations which shift incrementally from happiness to anger or fear (Pollak, & Kistler, 2002).

Each participant completed a 20-minute, computer-based emotion identification task (Maoz et al., 2016; Pollak & Kistler, 2002; Stoddard et al., 2016) in which they judged the emotion of faces morphed along each emotion spectra. In each trial, participants were shown a fixation cross (1000ms), followed by a stimulus (200ms), a visual noise mask consisting of a scrambled face stimulus (200ms), and a response screen (2000ms) (**Figure 2**). Stimuli were randomized and

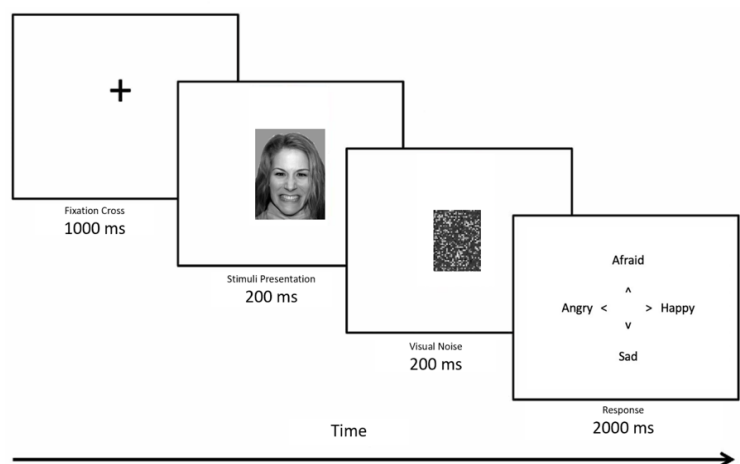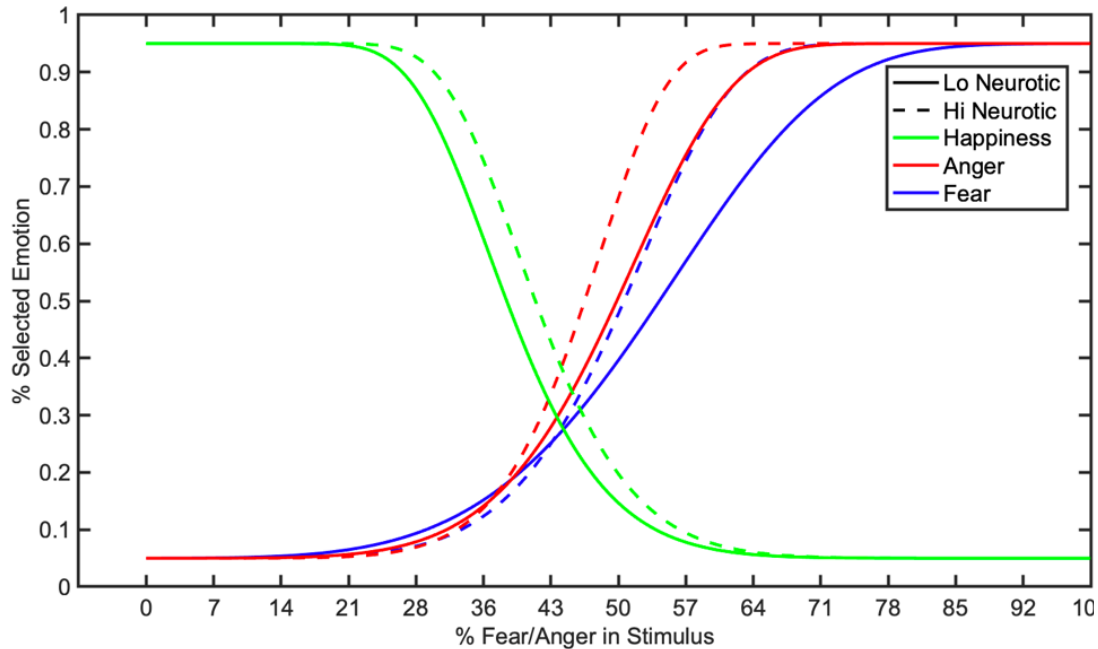**Figure 2.** Emotion Identification Methodology

Figure 3. Negativity Threshold by High versus Low Neuroticism

The average proportion of trials that participants selected anger or fear is plotted against the morph level for participants with high versus low neuroticism. Participants with scores above (>50th percentile) or below (< 50th percentile) the median neuroticism score were categorized as high or low, respectively, in neuroticism.

each stimulus was presented three times for a total of 360 trials. Participants used a keyboard to select whether the face displayed happiness, sadness, fear, or anger. Of note, none of the stimuli displayed sadness and the sadness response option was included as a quality check to help identify participants who selected answers at random. Participants' data were excluded if they did not correctly identify the facial expressions that were 100% happy (0% fearful/angry) with at least 60% accuracy ($n = 0$).

Data Analysis

Participants' emotion judgments were used to determine their sensitivity to negative facial emotions via their fear and anger "thresholds". Each participant's fear and anger thresholds (i.e., the point at which the participant's judgment switches from one emotion [happy] to the other [fearful/angry]), were calculated as the point of subjective equality (PSE) via psychometric functions fit to their emotion judgments (**Figure 3**). A psychometric function models the relationship between a feature of a stimulus (emotion intensity) and the probability that someone detects the stimulus (emotion). We implemented a Weibull cumulative density function, a standard psychometric function for force-choice decisions, using the Palamedes Toolbox in Matlab (Prins & Kingdom, 2018) with a fixed guess rate of $\gamma = .05$ and lapse rate of $\lambda = .05$. A smaller PSE value (lower fear/anger threshold) indicates greater sensitivity to detect fear or anger. To test whether neuroticism was related to biases in emotion identification, we conducted a mixed-design analysis of vari-

Neuroticism Predicts Increased Sensitivity in Identifying Negative Facial Affect in Young Adults

ance (MD-ANOVA) with emotion threshold (fear, anger) as a within-subject factor, neuroticism (high, low) as a between-subject factor, and participants' emotion threshold as the dependent variable. To whether neuroticism influences response times, we ran a separate MD-ANOVA for neuroticism with emotion as a within-subjects effect, neuroticism as a between-subjects effect, and response time as the dependent variable.

RESULTS

Fear and Anger Thresholds

In line with our hypothesis, an MD-ANOVA revealed an effect between neuroticism and increased sensitivity to negative facial affect. Specifically, there was a significant main effect of neuroticism on emotion identification, $F(1, 32) = 7.98$, $p = .029$, such that high neurotic individuals (scores ≥50th percentile) had smaller negativity thresholds than participants who were low in neuroticism (scores <50th percentile), $t(32) = 2.29$, $p = .029$. In other words, high neurotic people were more likely to identify ambiguous facial images as fearful or angry than individuals low in neuroticism (Figure 3). On average, the high neurotic group began to identify faces as angry when they were 55.0% angry/45.0% happy whereas people with low neuroticism identified faces as angry when they were 60.1% angry/39.9% happy. Similarly, people high in neuroticism began to identify fear in faces with an average of 60.9% fearful/39.1% happy expressions and people low in neuroticism began detecting fear when faces averaged 66.1% fearful/34.9% happy expressions (**see figure 1 for facial image percentages**). In other words, high neurotic people detected anger and fear when there were fewer traces of negative emotion presented in the face. This tendency to see negative information with fewer cues present could result in misinterpretations of social cues in everyday life leading to impoverished social connections.

Response Time

Next, we evaluated how participants' neuroticism influenced their response time when identifying facial emotion. We conducted an MD-ANOVA on neuroticism to test if neuroticism scores impacted how fast they could identify the emotion present in the faces. We included emotion (fear, anger) as a within-subject factor and neuroticism (high, low) as a between-subject factor. Response time was not significantly influenced by neuroticism, $F(1, 32) = .768$, $p = .382$, indicating neuroticism level did not impact the speed the participants identified emotions.

However, an MD-ANOVA did reveal a main effect of emotion on response time across all participants, regardless of neuroticism level, $F(2, 64) = 102.02$, p < .001. Follow-up paired-samples t-tests revealed that participants were significantly faster to respond to happy faces ($M = 517.57$ms, $SD = 111.62$ms) compared to angry ($M = 643.58$ms, $SD = 131.56$ms; $p < .001$) and fearful faces ($M = 787.70$ms, $SD = 161.94$ms; $p < .001$). Participants were also significantly faster to respond to fearful faces ($M = 787.70$ms, $SD = 161.94$ms) than angry faces ($M = 643.58$ms, $SD = 131.56$ms; $p = .001$). These results imply that, while neuroticism does not influence the speed of emotion identification, certain emotions took longer to identify for all participants, regardless of neuroticism level.

DISCUSSION

The present study examined how young adults' neuroticism was associated with their performance on an emotion recognition task. Three main findings emerged. First, we observed that individuals high in neuroticism were more sensitive to recognizing negative emotions than people low in neuroticism. Second, we found that neuroticism levels did not influence the time it took for participants to identify facial affect. Third, we observed a main effect of emotion on response time, such that participants identified happy faces faster than both fearful and angry faces. Our study provides promising preliminary evidence that neuroticism level is associated not only with high-level social behaviors, emotions, and moods,

but also lower-level psychological processes like facial emotion perception and identification.

Our primary goal was to examine how neuroticism influenced young adults' emotion recognition abilities. In line with our hypotheses, we observed that elevated neuroticism predicted increased sensitivity in detecting negative emotions upon viewing ambiguous facial affect. Previous research finds that neuroticism is associated with negativity thresholds that increase sensitivity to negative social cues (Byrne & Eysenck, 1993; Salemink & van den Hout, 2010; Vinograd et al., 2020). However, many of these studies examined people's responses to obvious or extreme emotional cues, which occur less frequently in daily life. Expanding on this prior literature, we found that high neurotic young adults were more likely to detect subtle traces of negative affect when faces show conflicting emotional expressions, compared to those with low neuroticism. Future research should investigate whether increased sensitivity to negative facial affect is also associated with social impairments for neurotic individuals.

Our second aim was to test whether response times differed based on neuroticism level. We hypothesized that neurotic people would be faster to identify negative affect because of their increased levels of emotional reactivity and negative emotionality. However, we found no evidence that neuroticism influenced participants' response times. It may be that, although neurotic people have an increased tendency to interpret emotions more negatively, each participant may need a similar amount of time to process each image before interpreting the emotion. Furthermore, this study was conducted online, thus, external distractions may have influenced participants' response times on certain trials more so than would have occurred in a controlled laboratory environment. Future research should investigate if response time in identifying ambiguous facial expressions is influenced by other personality traits.

Lastly, we observed a main effect of emotion type on emotion recognition. Both anger and fear took longer to identify than happy emotions. This is in line with research finding that adults and children are faster to detect happy facial expressions than angry or fearful expressions (De Sonneville et al., 2010), possibly because people encounter happy facial expressions more often in daily life. Additionally, fear is one of the more difficult emotions to categorize as it is often confused with neutral and surprised faces (Tarnowski et al., 2017). The increased response times for fear and anger may also have been due to the options of two negative emotions to choose from in comparison to only one positive emotion.

In an ethnically diverse sample of young adults, we examined the relationship between neuroticism and biases in emotion recognition. The present study has several important strengths. We implemented a precise psychophysical paradigm with carefully controlled stimuli to ensure that no aspect of the design or stimulus features interfered with participants' perceptions. We also recruited diverse ethnic populations that are often understudied and employed ethnically diverse emotional stimuli. Despite these strengths, the present study is limited by recruitment within the university setting. Future in-person studies will explore physiological and neural responses to emotional stimuli in participants on a wider range of personality traits and other psychopathology.

In conclusion, our findings that high neurotic individuals have an increased sensitivity in detecting negative affect extends findings from prior research to include the interpretation of ambiguous facial expressions. Our research also helps better understand how neurotic individuals interpret emotions in more realistic situations which may help identify the negative consequences of holding such personality characteristics.

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Generational Status and Academic Performance

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ABSTRACT

This paper examines the relationship between students' generational status (i.e., first-generation immigrant students compared to second and third-generation students) and academic achievement. Specifically, it explores the role of identity variables including self-concept clarity (an individual's degree of awareness regarding their personal attributes) and academic identity (a student's choice to adopt and commit to a set of academic values throughout their academic career). Self-concept clarity was investigated for mediation effects between the generational status of Latinx and Asian students and their GPA (both overall and major-specific). Lastly, generational status was examined as a moderator of the relationship between GPA and the four types of academic identity statuses (achieved, foreclosure, moratorium, and diffusion). The participants were 857 undergraduate students from a southern California university. The results indicate that self-concept clarity did not mediate the relationship between generational status and either form GPA; additionally, generational status did not moderate the relationship between either form of GPA and the hypothesized academic identity sub-constructs. However, the results yield an important finding; there were two interaction effects between generation and each of the moratorium and diffusion identity statuses on overall GPA in both the full dataset and the Asian subsample. Additionally, there was an interaction effect between generation and the moratorium identity on major GPA in the full dataset and a second interaction effect between generation and the diffusion identity on major GPA in the Asian subsample. Lastly, there was a main effect of generational status on students' overall GPA in the Asian subsample, but not in the Latinx subsample, which is indicative of differences between ethnic groups in terms of first-generation experience. Limitations and future directions are also discussed.

KEYWORDS: Generational Status, Self-Concept Clarity, Academic Identity, Academic Performance, Identity, Immigration.

FACULTY MENTOR

Dr. Carolyn B. Murray is currently a Professor in the Psychology Department. She received her PhD from the University of Michigan and has published numerous journal articles and book chapters. A few of her many awards include the Chancellor's Award for Excellence in Undergraduate Research, the Association of Black Psychologists' Distinguished Psychologist Award, the UCR Distinguished Teaching Award, and the NAACP's 2018 Dr. William Montague Cobb Award. Presently, Dr. Murray is the founder and Executive Director of the University STEM Academy (USA). USA is a very successful Science, Technology, Engineering and Math (STEM) program designed to stimulate more interest and enhance performance in technical subjects by students in the Black Community.

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Generational Status and Academic Performance

INTRODUCTION

First-generation immigrant students who identify as ethnic minorities rely heavily on their academic performance as a means of establishing or redefining their social status (Bui, 2002). However, this student group consistently encounters factors that threaten their college enrollment including lack of financial stability, lack of familial academic support, and psychological variables such as fear of failure. Each of these can have a significant negative impact on students' self-confidence and, in turn, their academic performance (Bui, 2002). Therefore, it is important to consider psychological processes such as academic identity that may help students navigate these difficulties.

Past literature has mainly focused on the effects of self-efficacy, often as a mediator for the relationship between generational status and academic performance (Ramos-Sánchez & Nichols, 2011). However, previous research has not fully examined other identity variables that may aid in understanding the psychological changes that take place in immigrants, both at the individual level during the immigration process, and also at the population level across generations of immigrants. To address this gap in the literature, the current paper examines the relationships between generation status, academic performance, and two less frequently examined identity constructs, self-concept clarity, and academic identity.

Self-Concept Clarity

Self-concept clarity (SCC; Campbell, 1990) is a structural aspect of self-concept. It refers to the degree to which a person is aware of their personal attributes, or the contents of their "self." More importantly, SCC focuses on how confidently and clearly these personal attributes are defined, as well as their consistency and stability (Campbell et al., 1996). Self-concept clarity has been shown to relate to academic adjustment and performance. For example, Ting (2003), in a four-year longitudinal study, examined the effectiveness of non-cognitive variables (i.e., self-concept, long-term plan-

ning, and self-appraisal) in predicting the academic success of first-generation students compared to cognitive variables such as SAT scores. Results indicated that non-cognitive variables were better indicators of GPA for students of color, and better at predicting the continuation of college enrollment of nontraditional students (Ting, 2003, p. 28).

Immigrant students often have to navigate unique problems as a result of their bicultural identity. Snyder (1990) argued that juggling expectations of academic success while learning to navigate a bicultural identity can threaten one's self-concept, increase self-doubt, and harm academic performance. For immigrant children who are first-generation college students, this expectation management only adds to the difficulty of adjusting to the university community. Self-concept clarity appears to aid first-generation students in navigating the conflict within their bicultural identity and may lead to increased academic performance. This gives rise to the following hypotheses:

> *Hypothesis 1a.* As generational status increases, each form of GPA (overall GPA and major GPA) will also increase.
>
> *Hypothesis 1b.* Self-concept clarity will mediate the relationship between generational status and both forms of GPA.

Academic Identity

Was and Isaacson's (2008) Academic Identity Measure (AIM) was created based on Marcia's (1966) identity statuses. The AIM consists of four subscales, each representing a different identity status situated along the two dimensions of identity exploration and identity commitment. The *achievement* identity status refers to a student who has fully committed to a set of academic values after a period of exploring different options. The *foreclosure* identity status refers to a student who has committed to and adopted academic values without having explored, often due to pressure from loved ones.

The *moratorium* identity status describes a student who is indecisive toward their academic career, who is exploring options in hopes of reaching an educated decision. The *diffusion* identity status refers to a student who lacks both exploration and commitment, often delaying decisions about academia.

First-generation immigrants travel to new cultures to create a secure future for their children and themselves. This strong dedication implies high commitment to academics, which in Was and Isaacson's (2008) framework should translate into either the *achieved* or the *foreclosure* identity status. These two statuses could have been adopted by the students prior to their immigration and are resumed and/or maintained when attending a four-year institution in the United States. This may appear to contradict Hypothesis 1 in theory; however, this is not the case. Commitment in first-generation students does not translate into academic success, as many first-generation immigrant students face institutional challenges, language barriers, and overwhelming struggles with their identity and self-esteem. This literature suggests two hypotheses regarding the AIM in relation to generation and academic performance:

> *Hypothesis 2.* First-generation students will score higher on the *achieved* (*H2a*) and *foreclosure* (*H2b*) identity statuses than second and third-generation students.

> *Hypothesis 3.* Generational status will moderate the relationship between the *achieved* and *foreclosure* identity statuses and both overall (*H3a*) and major GPA (*H3b*).

METHODS

Participants

Participants consisted of 857 undergraduate students from a southern California university, ranging from 17 to 30 years of age ($M = 19.40$). In terms of gender, 62.62% indicat-

ed they were female, 35.98% indicated they were male, and 1.40% declined to state their gender. In terms of ethnic groups, there were 39.91% Asian Americans, 34.66% Hispanic/Latinos, 8.75% Caucasians, 5.02% African Americans, 4.78% Mixed Heritage, and 6.88% other. Students were primarily freshman and sophomores; 51.29% of the students were in their freshman year, 26.05% were in their sophomore year, 13.55% were in their third year, and 7.71% were either fourth or fifth year. In terms of generation, 26.29% were first generation, 58.29% were second generation, and 13.90% were third generation, while 1.52% of participants did not specify.

Procedure

The full research protocol was approved by the institutional IRB prior to the start of the study. Data was collected in multiple waves over the course of two years. Data collection was conducted at the primary researcher's lab. Upon arrival, each participant signed an informed consent form and was assigned an identification number. Participants then took an online survey containing multiple personality measures, including the primary measures used in the current study. After completion, participants were asked to report their demographic information, including their sociodemographic information and generational status, as well as information regarding their academics, such as their overall GPA, major GPA, and their year in college. The estimated time for completing the study was sixty minutes. After finishing, participants were debriefed. All participants were awarded course credit for their participation in the study.

Measures

Self-Concept Clarity Scale. The Self-Concept Clarity Scale (SCC) assesses an individual's self-concept clarity. Campbell et al. (1996) defines self-concept clarity as "the extent to which self-beliefs are clearly and confidently defined, internally consistent, and stable." The SCC is a 12-item measure using a 5-point Likert-type scale (1 = strongly disagree, 5 = strongly agree). The Cronbach's alpha for the SCC is $\alpha = .88$,

indicating high reliability.

Academic Identity. The academic identity statuses were measured using the Academic Identity Measure (AIM; Was & Isaacson, 2008). The AIM is a 40-item scale consisting of four subscales; each subscale represents one of the four academic identity statuses. The four AIM subscales—achieved (α = .82), foreclosure (α = .79), moratorium (α = .84), and diffusion (α = .77)—are 10-item scales using a 5-point Likert-type scale ranging from 1 (Not at all like me) to 5 (Very much like me). All four subscales show acceptable reliability.

RESULTS

Hypothesis 1

Hypothesis 1a predicted that generation would be positively correlated with GPA, while Hypothesis 1b predicted that the relationship between generation and GPA would be mediated through self-concept clarity. Hypothesis 1a was examined through calculating Pearson's bivariate correlation for the relationship between generational status and each form of GPA (both overall GPA and major GPA). Pairwise deletion was used to address the missing data in the datasets. The correlations can be seen in **Table 1**. In the full dataset,

generational status had a marginally significant correlation with overall GPA ($r(801)$ = .063, p = .076) which suggests that this relationship may be worth examining further. However, there was no correlation between generation and major GPA ($r(572)$ = .057, p = .172). Since the results for the tests of Hypothesis 1a indicate that there was no relationship between generational status and GPA, a mediation test was not needed to test Hypothesis 1b. This decision aligns with Baron and Kenny (1986), who recommended that if there is no relationship between the predictor and outcome, further testing is unnecessary since there is no relationship that requires a mediation test to be explained.

To further examine the first hypothesis, the full dataset was divided into two sub-datasets based on the most prominent ethnic groups in the dataset: Asian students and Latinx students. There was no significant correlation between generational status and either form of GPA within the Latinx subsample. There was a positive correlation between generational status and overall GPA in the Asian subsample ($r(332)$ = .165, p = .003), but a follow-up test showed no significant correlation between generational status and the proposed mediator, self-clarity (r = -.036, p = .519), therefore medi-

Table 1. *Pearson Bivariate Correlation Data on Academic Performance and Personality Constructs of all Study Participants*

	Overall GPA		Major GPA		Self-clarity		Achieved		Foreclosure		Moratorium		Diffusion	
	Full Data Set													
	r	p	ρ	P	ρ	P	ρ	P	ρ	P	ρ	P	ρ	P
Generation	.063	.076	.057	.172	-.049	.157	.070	**.042**	-.073	**.034**	-.089	**.010**	-.128	**<.001**
Overall GPA	-	-	-	-	-.055	.119	.191	**<.001**	-.029	.414	-.230	**<.001**	-.211	**<.001**
Major GPA	-	-	-	-	-.067	.109	.188	**<.001**	-.018	.664	-.205	**<.001**	-.180	**<.001**

Note: *p < .05. **p < .01. ***p < .001

Table 2. *Regression Analyses: Main Effects and Interaction Effects with Overall GPA as an outcome*

		Outcome: Overall GPA									
		Self- Concept Clarity		Achieved		Foreclosure		Moratorium		Diffusion	
		β	P	β	P	β	P	β	P	β	P
Full Dataset	Generation	.057	.107	.047	.175	-062	.079	.042	.226	.036	.297
	Predictor	.049	.174	.183	**<.001**	-.028	.441	-.216	**<.001**	-.201	**<.001**
	Gen x Pred	-.046	.176	.031	.379	.005	.881	-.069	**.033**	-072	**.031**
Asian Dataset	Generation	.159	**.003**	.161	**.003**	.179	**.001**	.195	**<.001**	.194	**<.001**
	Predictor	-.036	.574	.154	**.008**	-.016	.797	-.121	**.048**	-.185	**.001**
	Gen x Pred	-.015	.803	.017	.762	-.085	.151	-.125	**.037**	-.175	**.002**
Latinx Dataset	Generation	.020	.741	.031	.619	-.024	.690	.031	.601	.024	.688
	Predictor	-.015	.792	.152	**.009**	-.038	.533	-.217	**<.001**	-.157	**.011**
	Gen x Pred	-.009	.881	-.041	.530	.071	.210	.034	.581	.054	.380

Note: *N*= 801. *p < .05. **p < .01. ***p < .001

ation was not tested further. As a whole, Hypothesis 1 was unsupported.

Hypothesis 2

Hypothesis 2a predicted that there would be a negative correlation between generational status and achieved identity status, while Hypothesis 2b predicted a negative correlation between generational status and foreclosure identity status. Hypothesis 2a was directly contradicted by the findings; rather than the hypothesized negative correlation between generational status and achieved identity, the results showed a significant positive correlation (r(833) = .070, p =.042). However, Hypothesis 2b was supported by the findings; there was a significant negative correlation between gener-

ational status and the foreclosure identity status (r(833) = -.073, p =.034), as predicted. Additional bivariate correlation analyses on the remaining two academic identity statuses, moratorium identity status and diffusion identity status, also yielded important findings, even though these were not hypothesized. As shown in **Table 1 (previous page)**, both the moratorium and diffusion academic identity statuses had a strong negative correlation with generational status. Lastly, correlations between generational status and each of the AIM subscales were examined in both the Asian and Latinx subsamples. No significant correlations were found between generational status and the four academic identity statuses in either subsample.

Hypothesis 3

Hypothesis 3a predicted that generational status would moderate the relationship between achieved and foreclosure identity status and overall GPA while Hypothesis 3b predicted that generational status would moderate the relationship between achieved and foreclosure identity status and major GPA. Regression analyses were conducted to examine the variables within each of the two hypotheses with generational status as a moderator. Generations two and three were combined in the analyses due to the noticeably smaller number of students in generation three. Students who failed to report their generational status were excluded from the analyses. Hypothesis 3a was not supported in either the full dataset or the Asian and Latinx subsamples. To follow-up on these tests, moderation analyses were conducted for moratorium and diffusion academic statuses. There was a strong moderation effect of generational status on the relationship between overall GPA and both the moratorium and diffusion identity statuses. This moderation effect was found within both the full dataset and the Asian sample, as shown in **Table 2 (shown on previous page)**. There was no similar moderation effect of generation on the relationship between overall GPA and SCC subscales. Hypothesis 3b was also not supported; there was no main effect of generational status on the relationship between the academic identities and major GPA in the full dataset, the Asian subsample, or the Latinx subsample, as shown **in Table 3 (below).**

Table 3. *Regression Analyses: Main Effects and Interaction Effects with Major GPA as an outcome*

		Outcome: Major GPA									
		Self-Concept Clarity		Achieved		Foreclosure		Moratorium		Diffusion	
		β	P	β	P	β	P	β	P	β	P
Full Dataset	Generation	.045	.289	.037	.388	.054	.203	.038	.363	.030	.484
	Predictor	-.061	.139	.176	**<.001**	-.017	.699	-.179	**<.001**	-.168	**<.001**
	Gen x Pred	-.100	**.015**	.032	.442	-.038	.351	-.116	**.002**	-.075	.067
Asian Dataset	Generation	.076	.229	.072	.252	.095	.152	.115	.092	.105	.105
	Predictor	-.050	.504	.133	**.058**	-.002	.981	-.058	.440	-.193	**.005**
	Gen x Pred	-.067	.346	.015	.824	-.080	.264	-.119	.089	-.149	**.024**
Latinx Dataset	Generation	.079	.309	.087	.251	.078	.315	.092	.225	.096	.211
	Predictor	-.012	.860	.244	**<.001**	.034	.653	-.254	**<.001**	-.174	**.018**
	Gen x Pred	-.007	.919	-.053	.477	.026	.742	-.022	.776	.107	.171

Note: *N*=572. *p < .05. **p < .01. ***p < .001

DISCUSSION

Only one of the three major hypotheses in the study was supported by the data. However, there were important findings in the exploratory analyses. There was a strong moderation effect of generation on the relationship between overall GPA and two identity statuses (moratorium and diffusion) in the Asian subsample. There was also a main effect of generation on students' overall GPA in the Asian subsample.

Hypothesis 1 was not supported. Self-concept clarity was not related to either of the measures of academic performance—overall GPA or major GPA—used in this study and therefore could not have mediated the relationship between generational status and GPA. Additionally, SCC cannot mediate the significant relationship between generation and overall GPA that was found within the Asian subsample due to the absence of a correlation between SCC and generational status, the predictor. According to this finding, if an immigrant student is struggling with navigating their bicultural identity, SCC does not seem to play a substantial part in the ability to navigate the identities within the context of academic performance.

Hypothesis 2a was contradicted by the results, which showed a significant positive relationship between generational status and the achieved identity status, instead of a negative one. However, Hypothesis 2b was supported, and prompted further analyses that yielded findings regarding the relationship between generational status and the moratorium and diffusion academic identity statuses. Hypothesis 2b predicted that generational status would be negatively correlated with the foreclosure identity status and that prediction was strongly supported by the test results. Although moratorium and diffusion were originally thought not to fit the general profile of first-generation immigrants, correlation tests showed a significant negative relationship between generation and both the moratorium and diffusion statuses. To summarize, more first-generation students claimed the foreclosure, moratorium, and diffusion identities than second or third generation students. The opposite is true for the achieved identity status. However, these effects were not found in either the Asian or the Latinx subsamples, suggesting that they may be driven by the ethnic groups in the dataset that were not analyzed due to their smaller sample size.

Finally, the tests for Hypothesis 3 showed no moderation effect of generatial status on the relationship between overall GPA and either the achieved and foreclosure identity statuses. Therefore, hypothesis 3a was not supported by the results. However, generational status did moderate the relationship between overall GPA and the moratorium and diffusion identity statuses. These moderation effects also were present to a lesser degree when major GPA was the outcome. There was a moderation effect of generational status on the relationship between major GPA and the moratorium identity within the full dataset. There was also another moderation effect of generation on the relationship between major GPA and diffusion identity status within the Asian subsample. As seen in **Tables 2** and **3**, the moderation effect sizes were often similar in the models with both overall GPA and major GPA as an outcome. However, in the models with Major GPA as an outcome, two of the moderation effects were not significant, even though the beta values were similar. In the full dataset, the effect size (β = -.072) of the interaction between generational status and diffusion identity status on overall GPA is almost identical to the effect size (β = -.075) of the interaction effect between generational status and the diffusion identity status on major GPA, which is not statistically significant. This difference in significance may be due to fewer participants reporting their major GPA (N = 572) than their overall GPA (N = 801).

LIMITATIONS AND FUTURE DIRECTIONS

This study has certain limitations. First, the first-generation

students in this study only provided information pertaining to their generational status and did not address the duration of their stay within the United States or the duration of their enrollment in university. Knowing this would help clarify the effect that self-concept clarity and academic identity status have on the relationship between generation and academic performance. For instance, first-generation immigrant students who moved to the United States during their childhood or adolescence have a clear advantage in navigating their undergraduate experience compared to first-generation immigrants who moved to the United States permanently to attend college or as exchange students. In future studies, the duration of stay can be accounted for by asking the participants to report the month and year of their arrival date to the United States. Another way is to conduct a longitudinal study with a single cohort of first-generation immigrants to monitor their duration of stay, changes to personality measures responses, and their academic performance over time.

Another limitation was the difference in sample sizes between the three generation groups. The percentages for the three generations in this study were 26.29% first generation, 58.29% second generation, and 13.90% third generation. This gap between the number of participants in each of the three groups may affect the accuracy of the findings; however, this can be resolved in future research through a more carefully targeted recruitment procedure. In this study, this was addressed by combining the second and third generation samples for the moderation analyses.

In addition to addressing the above limitations, future studies should also examine ethnic groups other than Asian and Latinx. As shown through the moderation tests in this study, different ethnic groups have different experiences with adopting and navigating bicultural identities as first-generation immigrants. Therefore, addressing these questions in future studies will paint a clearer picture of the struggles that first-generation immigrants encounter and how that shapes their academic experience.

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Beyond an OSN Post: Looking at Emotional Valence and Request of Support/Information

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ABSTRACT

Rheumatoid arthritis is a chronic autoimmune disease that does not have a cure. Therefore, it is important for patients to receive support, which would allow them to ask questions and express their feelings. This study examined online social networks for patients with rheumatoid arthritis to better understand the emotional valence of their initial posts and whether there was an association between posts with negative emotional valence and requesting support/information. We hypothesized that the majority (more than 50%) of the emotional valence of initial posts would be negative, and that there would be an association between negative emotional valence and support/information. Nine hundred eighty-six initial posts from a rheumatoid arthritis online social network via Reddit were coded as either positive, negative, neutral, or mixed. In addition, the initial posts were coded as either requesting support/information, offering support/information, neither requesting nor offering support/information, or both requesting and offering support/information. Negative was the most common emotional valence in the initial posts followed by mixed, neutral, and positive. There was also an association between initial posts that had a negative emotional valence and requested support/information, and initial posts that had a negative emotional valence but did not request support/information. As a result, the implications of this study indicate the need for additional information and support to be provided to patients with rheumatoid arthritis, so they can have a better experience and an easier way to cope with their illness.

KEYWORDS: Online Social Networks (OSNs), Emotional Valence, Support, Information, Rheumatoid Arthritis (RA), Cope

FACULTY MENTOR

Dr. Megan Robbins is an Associate Professor of Psychology at the University of California, Riverside. She received her PhD in social psychology at the University of Arizona, where she initially developed her line of research on people's daily social interactions as it relates to their health and well-being. By using naturalistic observation methods, she hopes to understand the implications of mundane interactions and expressive behaviors to elucidate effective strategies and interventions people can naturally incorporate into their daily lives.

Beyond an OSN Post: Looking at Emotional Valence and Request of Support/Information

INTRODUCTION

Chronic pain affects a variety of aspects of life including relationships, work, and leisure (Kristiansen et al., 2012). In order to learn more about how individuals with rheumatoid arthritis receive support, we examined the emotional valence of initial posts on an online social network for patients with rheumatoid arthritis. This information will provide an understanding of the experiences rheumatoid arthritis patients are having, how they are coping with their illness, and will indicate whether additional information or support from healthcare professionals is needed.

Rheumatoid Arthritis

Rheumatoid arthritis (RA) is defined as, "a chronic progressive autoimmune disease characterized by inflammation of synovial joints, causing immense pain and joint stiffness" (Barker & Puckett, 2010, as cited in Poh et al., 2017, p. 374). Throughout the duration of their illness, patients may experience a decline in physical functioning, psychological challenges, and emotional challenges (Kristiansen et al., 2012; Iaquinta & Larrabee, 2004). Activities that patients may have previously enjoyed may be affected by the physical pain they endure daily (Krol et al., 1993). Additionally, negative feelings such as anger, frustration, depression, and fear all play a part in how patients view their illness and how they cope with it (Iaquinta & Larrabee, 2004). These different challenges affect the overall quality of life of RA patients.

Types of Support

In order to discuss aspects of their illness and receive support, many patients use different resources including physicians, family, and online social networks (Mehta & Atreja, 2015; Poh et al., 2017). Support from a doctor is necessary in order to gain trust and learn how to cope with a new diagnosis. Physicians are able to provide choices, listen to patients, and encourage patients to ask questions (Gensichen et al., 2009). In addition to a strong doctor-patient relationship, family support for patients with an illness is also extreme-

ly important because they are able to provide the support that is necessary for patients to have a better experience and health outcome (Cooper & Gilbert, 2017; Poh et al., 2017). They may also be able to help manage the condition by ensuring access to treatment and easing any obligations (Cooper & Gilbert, 2017).

Finally, online social networks (OSNs) are a relatively accessible and easy way for patients to connect with other people (Mehta & Atreja, 2015). OSNs and online support groups are online communities where participants help and support each other and discuss their lives with their diagnosis (Mehta & Atreja, 2015; Wright et al., 2020). According to Mehta and Atreja (2015), OSNs serve two purposes: emotional support and information-seeking. By seeking out information anonymously, patients are asking questions about their illness and are learning about different ways to identify or live with their illness.

Online Social Networks for Chronic Pain

Researchers have examined how patients with chronic pain such as endometriosis and fibromyalgia use OSNs like Instagram to inform and give visual representations of their illness, but research examining OSNs and RA is relatively rare (Sendra & Farré, 2020). Wright and colleagues (2020) examined pain disclosure in OSNs for patients with rheumatoid arthritis and fibromyalgia. They found that initial posts with pain disclosure had more engagement from OSN users and more replies than initial posts without discussion of pain disclosure. Given that OSNs have been effective for patients with endometriosis and fibromyalgia, it would be beneficial to learn more about patients with RA and their viewpoint of their illness.

Current Study

Based on the use of OSNs for other chronic conditions and research about RA, this study examined OSNs for patients with RA to better understand the emotional valence of their initial posts, and any association between posts with negative

emotional valence and requesting support/information. In doing so, two questions arose: the first question focused on the emotional valence of initial posts, and the second question focused on whether there was an association between emotional valence and requesting support/information. Due to the decline in physical functioning, psychological challenges, and emotional challenges that patients with RA often face, it seems more likely that RA patients would discuss more negative experiences than positive experiences on an OSN (Kristiansen et al., 2012; Iaquinta & Larrabee, 2004).

Therefore, we hypothesized that the majority (greater than 50%) of the emotional valence of initial posts on this online social network would be negative (*Hypothesis 1*). Additionally, posts may be more negative because patients may want to supplement information from their healthcare professionals to gain more information, reassurance, and additional support (Poh et al., 2017). Thus, if the majority of the posts

are negative, patients may be in need of help or additional support and/or information. Consequently, an exploratory hypothesis was developed: There will be an association between posts with a negative emotional valence and requesting support/information (*Hypothesis 2*).

METHOD

Procedure

Public data was acquired from the Reddit RA OSN (http://www.reddit.com/r/rheumatoid) using jsoup, a Java-based code library for HTML parsing (Hedley, 2017). The IRB of the University of California, Riverside allowed an exception from review due to the public availability of the data from the RA OSN. This data was also used in a previous study that found evidence of how pain disclosure unfolds in everyday naturally occurring social contexts (Wright et al., 2020). The data retrieved included the individual posts with the user-

Table 1a. *Emotional Valence Definitions and Examples*

Coding Category	Definition	Example
Positive	Any indication of positivity including positive topics, positive reframing of situations, or any indication of happiness, hopefulness, etc.	"You're all so wonderful and supportive!! I hope you all find remission and stay there :) and realistically, may the flares be mild and the meds effective!!"
Negative	Any indication of negativity including negative topics, or any indication that the user was sad, angry, worried, etc.	"Curling my fingers around the steering wheel aches. Gripping the steering wheel aches. Taking a shower aches. But driving. Oh my god. Sorry. I'm in flare up mode and just needed to whine. :(thanks for listening."
Neutral	No indication of being positive or negative and it is written in a matter-of-fact way.	"Has anyone else made the shift from Enbrel to Humira and been successful? Has anyone ever been able to go back to Enbrel after taking a "break" with a different med?"
Mixed	A combination of both positive and negative tones.	"I'm scared, excited and sore (medrol injection started wearing off 2 days ago) and finding concentrating on work to be impossible today"

Note: The sample posts were copied verbatim from the OSN.

Beyond an OSN Post: Looking at Emotional Valence and Request of Support/Information

Table 1b. *Support/Information Definitions and Examples*

Coding Category	Definition	Example
Requests Support or Information	Any explicit or implicit request of support, information, comfort, validation, advice, suggestions, etc.	"If you've got a cold or the flu do you take your weekly dose? I'm set to take mine today and have come down with a nasty flu."
Offers Support or Information	Offering support, information, advice, or suggestions. Does not include any background information provided when requesting support or information.	"If there are any young people out there who are fearing the worst or any older people! Ask me your questions! I've been on all the common NSAIDs and I'm on my 3rd biologic. GO!"
Neither Requests nor Offers Support or Information	Does not request or offer support or information.	"My boyfriend has been giving me my injections because I couldn't bring myself to do it. Tonight he fell asleep on the couch and I didn't have the heart to wake him. So, I just grabbed my shot, took a deep breath, and DID IT!"
Both Requests and Offers Support or Information	Any indication of asking a specific question or for support or advice and providing support or information that may help someone else.	"So, when I am feeling sore and stiff I try to stretch it out as much as possible. One thing that really helps me is hanging upside down off of the couch. Sometimes I even try to do a hand stand against the wall. Am I strange? What sort of stretches do you do?"

Note: The sample posts were copied verbatim from the OSN.

name, post time, and position in the thread. A total of 1,122 posts were retrieved over a period of four years, but 136 posts were excluded from analyses due to broken links, links without any text from the original user, and titles without an initial post. There is no demographic data from the participants because contact was not made with any of the users from the OSN.

MEASURES

Emotional Valence

The four coding categories for emotional valence were positive, negative, neutral, and mixed. Each coding category was mutually exclusive, which means only one of the four coding categories was coded for each initial post. See **Table 1a** (previous page) for coding definitions and examples.

Four research assistants coded coding categories as either present (1) or absent (0). The coding team reviewed the definitions of the four coding categories and looked at different examples for each. The coding team then coded a sample subset of 200 posts and kappa was calculated to make sure agreement was acceptable. Any discrepancies between the coding team were discussed and reviewed. The coding team then coded the rest of the posts, and kappa (a measure of inter-rater reliability for categorical data) was calculated again for the full data set. When one coder was removed from analyses due to low agreement with the other three coders, kappa was 0.68, an increase from 0.59 with all coders. A total of four posts for emotional valence had no majority rule because each coder coded a different mutually exclusive coding category. In those four cases, the second author served as a tie breaker.

Table 2. *Association between Negative Emotional Valence and Requesting Support/Information*

	Requests Support/Information	Does Not Request Support/Information
Negative emotional valence	399	49
Other emotional valence	417	121

Note: The numbers indicate the frequency of posts.

Support/Information

The four coding categories for support/information were requests support or information, offers support or information, neither requests nor offers support or information, and both requests and offers support or information. See **Table 1b** for coding definitions and examples.

The coding procedure was identical to that of emotional valence. Overall agreement for support/information for all coders yielded a kappa of 0.82 and increased to 0.86 upon removal of one coder due to low agreement. Again, one post for support/information had no majority rule, so the second author served as a tie breaker. Note that the coding procedure for support/information requests was distinct from the coding procedure for emotional valence. That is, the negativity of posts was not considered in coding for support/information requests, only whether the user explicitly made a relevant request.

Analytic Plan

Descriptive statistics assessed the frequency and percentage of initial posts that were negative in comparison to positive, neutral, and mixed (testing *Hypothesis 1*). Because the data are categorical, a chi-square test of independence was used to examine the association between initial posts that had a negative emotional valence and requested support or information (testing *Hypothesis 2*).

RESULTS

Emotional Valence

In descending order, the frequency of emotional valence coding categories is negative ($n = 448$, 45.44%), mixed ($n = 313$, 31.74%), neutral ($n = 162$, 16.43%), and positive ($n = 63$, 6.39%). Thus, *Hypothesis 1* is not strongly supported. Instead, the data shows that just under half (45.44%) of the initial posts are negative. However, in combination with the mixed category, there are a total of 77.18% ($n = 761$) of initial posts with some indication of negative emotional valence, providing some support for *Hypothesis 1*.

Figure 1. Association between Negative Emotional Valence and Requesting Support/Information
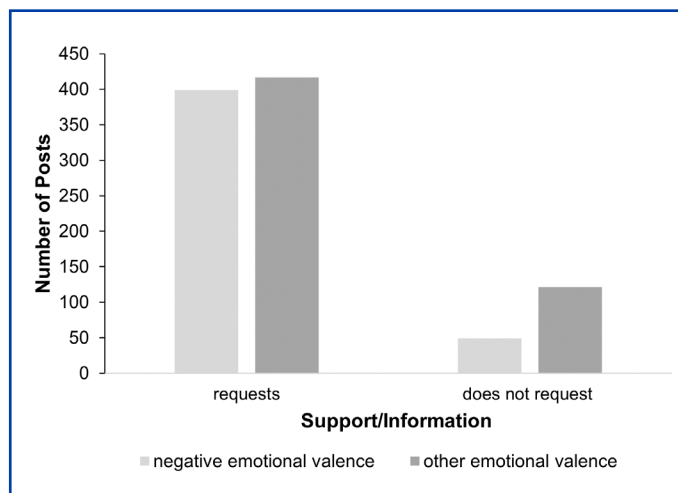
Beyond an OSN Post: Looking at Emotional Valence and Request of Support/Information

Support/Information

A chi-square test of independence reveals that the pattern of support/information requests differ significantly between negative and non-negative posts, $X^2(1, N = 986) = 22.064$, $p < .001$, $\varphi = 0.17$ (**Table 2** and **Figure 1**). Within negative posts, 89% of posts requested support or information, whereas only 78% of non-negative posts included a support or information request. Put another way, 49% of posts that requested support or information were negative, whereas only 29% of posts that did not request support or information were negative. These results support the exploratory hypothesis of an association between initial posts with a negative emotional valence and requesting support/information, such that requests for support/information tend to co-occur with negativity in posts.

DISCUSSION

It is especially important for patients with rheumatoid arthritis to receive support, ask questions, and express their feelings, because rheumatoid arthritis is a chronic autoimmune disease without a cure. We examined emotional valence and support/information requests on an OSN to understand naturally occurring conversations about RA. The results showed that a plurality of posts were negative, with the least common type of post being positive, and that there was a small but significant association between posts with negative emotional valence and requests for support/information.

The initial posts from the RA OSN included more negative posts than any other category. In combination with the mixed category, there was a much higher percentage of some amount of negativity than purely neutral or positive posts. This may be because patients with RA have psychological and emotional challenges, which include feelings of anger, frustration, sadness, despair, and helplessness (Poh et al., 2016). These feelings often arise when others in their lives are unable to empathize with their situation, or when they feel as if they have lost independence due to RA (Poh et al., 2016). These reasons are an indication as to why patients may go on an OSN and discuss these negative feelings with others.

According to Cho (2017), negative emotional disclosure is a sign of others seeking help due to stress from a negative event. By going on an OSN and writing a negatively-valanced post, patients may be indicating that there is something wrong with the treatment they are receiving, that they are not coping well with their illness, or that they may be having a bad day. Additionally, some information patients seek include questions about their course of treatment, unanswered questions after visiting their health care provider, or information about a change in diet or exercise habits (Huh et al., 2013). Assessing the information that users request on an OSN provides a better understanding as to why posts with a negative valence were more common in posts that requested support/information.

In rare instances, we identified posts with a positive valence. Even in combination with mixed posts, which include positivity and negativity, there was still a low number of posts that were considered positive. In a study conducted by Ostuland and colleagues (2014), when asked to describe their everyday life, RA patients did not mention anything positive but instead talked about times of fear, embarrassment, and grief. Our findings may be an indication that there are more negative experiences than positive experiences throughout the day for individuals with RA.

STRENGTHS, LIMITATIONS, AND FUTURE DIRECTIONS

As a result of each post being written with a non-identifiable username, it would have been difficult to contact the patients and ask them additional questions. Due to this limitation, we were not able to learn more information about the OSN users. Additional information may have provided a deeper insight of overall demographics of who is using

the OSN. Despite this limitation, the anonymity of an OSN allows patients to comfortably ask questions and describe certain aspects of their illness. This naturalistic environment allows us to see what the patients truly want to discuss, instead of it being filtered to what researchers might want to hear.

Future research can gather demographic data to better understand the generalizability of our findings. Gathering information from OSN users such as age, socioeconomic status, and how long they have been diagnosed with RA would give a better understanding of the users of the OSN. Gathering information about emotional experiences would also be beneficial to determine whether individuals tend to be more positive or negative in their daily lives. For example, users of an OSN could provide multiple daily reports of their general emotions throughout the day for one week. This would allow us to determine whether the users of an OSN tend to be mostly negative or positive throughout the day, how they feel after posting on an OSN, and how they are coping throughout the day, instead of assuming this information from an OSN post.

CONCLUSION

In conclusion, this study found that most initial posts on this RA OSN had a negative emotional valence. Additionally, patients were more likely to ask for support or information in negatively valanced posts. Results from this study provide insight for healthcare professionals regarding the importance of making sure patients are given information in a way they can understand, answering all questions from patients, recognizing what knowledge patients need to cope more effectively, and providing credible resources for them to turn to if necessary.

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Beyond an OSN Post: Looking at Emotional Valence and Request of Support/Information

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What Does Your Musical Instrument Say About You: Analyzing Musical Instrument Preference And the Big 5 Personality Traits

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ABSTRACT

Personality traits have unique abilities to shine through every action, thought, and belief that an individual engages in. These traits, in addition to other influential life experiences, shape all expressions of personality. Past publications in psychomusicology suggest that music listening preferences can be measured and predicted by personality traits. The present study expands on these discoveries by asking the question: What correlations exist between the Big Five personality traits (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Negative Emotionality) and musical instrument listening preferences? 202 participants recruited from Amazon's Mechanical Turk completed a survey on Qualtrics measuring personality traits through the Big Five Inventory-2, as well as musical instrument and genre preferences. First, results revealed that individuals who prefer to listen to traditionally melodic instruments (such as guitar and piano) tend to have higher Agreeableness and Openness to Experience personality scores than those who prefer rhythmic instruments (such as bass and drums). Second, this study found significantly different Extraversion scores among musical instrument preferences. Third, this study found significantly different Extraversion scores among different musical genre preferences. The findings of this study indicate that musical instruments may provide more personality correlations than other musical elements, such as genres.

KEYWORDS: Personality Traits, The Big Five, Musical Genre Preferences, Musical Instrument, Musical Instrument Preferences, Personality Correlates, BFI-2

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What Does Your Musical Instrument Say About You: Analyzing Musical Instrument Preference And the Big 5 Personality Traits

INTRODUCTION

For thousands of years, music has been a fundamental component of society. Music is so integral to listeners' lives that some consider music listening preferences as an identifier or compatibility badge that could serve to indicate one's personality traits or social groups (North & Hargreaves, 1999; Dunn et al., 2012). Rentfrow and Gosling examined this skill and found that strangers were able to make correct guesses about individuals solely based off conversations regarding music. They also found that music preferences were discussed more frequently than any other conversation topic (2006). While the appeal and utilization of music is evident throughout history and psychological literature, what is it about music that allows these correlations to exist?

First, it is necessary to establish what is meant by "musical preferences." North and Hargreaves measured "musical preferences" as they related to various listening situations (1996). Similarly, Kopacz defined "musical preferences" as the auditory musical elements that draw individuals to listen (2005). These studies suggest that there is a great value in researching the influence of music listening tendencies on personality traits outside of instrument playing or music composition. Therefore, this study defines "musical preferences" as preferred listening habits.

When researchers investigate musical preferences, they often examine their relationships with personality traits. Costa and McCrae developed the "Big Five," one of the most popular concepts in personality psychology (1985). This study found Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Negative Emotionality to be the most fundamental personality traits. Their Five-Factor Model (FFM) of personality was utilized in entirely different contexts as well, such as clinical assessments and psychopathology research (Costa & McCrae, 1992; Costa & Widiger, 1994; Soldz et al., 1993; Trull, 1992). Over the years, their assessment measures have been expanded upon and developed into more generalizable forms (Costa & McCrae, 1992; John et al., 1991; Rammstedt & John, 2007; Soto & John, 2017). Currently, one of the most comprehensive measures of the Big Five personality traits is the Big Five Inventory-2 (Soto & John, 2017).

Research into the psychology of music is also gaining interest. Due to the universality of music, researchers have attempted to identify its roles in many aspects of life. One specialty within psychomusicology examines music preferences based on the auditory features of music, such as rhythm, pitch, bass, and others (Krumhansl, 2000; McCown et al., 1997). However, there are other researchers that organize music by genre and subgenre for analyses (Cattell & Anderson, 1953; Cattell & Saunders, 1954; Rentfrow & Gosling, 2003; Rentfrow & Gosling, 2006). Currently, the most popular method in determining musical listening preferences is the Short Test of Music Preferences (STOMP) from Rentfrow and Gosling's comprehensive study (2003). This measure of music preference asks participants to rate their familiarity and enjoyment of certain genres and subgenres on a 7-point Likert-style scale (1 being "not at all," and 7 being "a great deal"). Based on how highly participants rate their preferences, researchers can determine the degree to which a person enjoys a certain type of music. Findings from this study indicated 4 major types of music: Reflective and Complex (R&C), Intense and Rebellious (I&R), Upbeat and Conventional (U&C), and Energetic and Rhythmic (E&R). They also found that personality traits, such as Openness to Experience, were correlated with R&C, I&R, and U&C styles of music. While effective in analyzing musical genres and their sonic and emotional attributes, the STOMP did not test for musical elements relating to individual musical instruments nor their categorizations as rhythmic or melodic.

The Current Study

The study of personality traits and their associations can be helpful in estimating attitudes, emotional stability, and even health outcomes. Because music is a central component of many cultures, research into music preferences could reveal

more about individuals than their personality scores could. The goal of the present study is to assess the importance of musical instrument preferences in the development of personality, which has been largely ignored in psychomusicological literature. Redirecting efforts to more elemental components of music might provide specific understandings of the functions of musical personality correlates. Also, the present study will not draw a line between experienced musicians and passive music listeners. We believe that a population with varied relationships with music can make the results more generalizable and account for individuals who play an instrument, but do not commit their lives to it. The current study will examine the relationship between a preference of rhythmic or melodic instruments and the Big Five personality traits. For the purposes of this study, rhythmic instruments will be defined as instruments that establish the fundamental groove or beat of the song. Melodic instruments will be defined as instruments that usually produce a melody on top of the beat provided by the rhythm instruments. While some instruments can be both rhythmic and melodic, the present study will limit rhythmic instruments to percussion instruments and bass guitars. Additionally, we will determine the relationship, if any, between certain musical instruments and personality traits. The current study will also replicate Rentfrow and Gosling's methods to see if their results could be found using strictly musical genres, as opposed to their 4-factor model of music (2003).

First, we hypothesized that individuals who prefer rhythmic instruments would be lower in Conscientiousness. Second, individuals who prefer rhythmic instruments would be lower in Agreeableness than those who prefer melodic instruments. These hypotheses are based on the findings of George, Stickle, Rachid, and Wopnford, which claimed that fans of rhythmic musical styles were lower in Conscientiousness and Agreeableness (2007). Third, we hypothesized that individuals who prefer rhythmic instruments would have higher Extraversion scores than those who prefer melod-

ic instruments because previous literature indicates a relationship between Extraversion and preferences for rhythmic musical styles (Langmeyer et al., 2012). Fourth, we hypothesized that individuals who prefer melodic instruments would have higher Openness to Experience scores than those who prefer rhythmic instruments.

METHODS

Participants

The present study recruited 202 participants from Amazon's Mechanical Turk (MTurk), aged 21 to 70 (M=35.14, SD=8.68). This sample included 145 men, 55 women, one other, and one who preferred not to answer. Regarding ethnicity, participants were reported as 69.31% Caucasian, 14.85% Black, 8.42% Asian, 3.47% Native American, 2.97% Hispanic, 0.495% Pacific Islander, 0.495% Other. The only exclusion criteria for recruitment stipulated that participants must reside in the United States of America. All participants, regardless of experience creating music or playing an instrument, were invited to participate. Participants were compensated $1.00 USD for their time.

Procedure

MTurk users who chose to participate in the present study followed a link to Qualtrics, where the survey was operated. On Qualtrics, participants read and approved an informed consent form. Then, participants completed the Big Five Inventory-2 and a brief music preference questionnaire. Afterwards, participants were prompted to answer demographic questions regarding their age, gender, and ethnicity. Upon completion of the Qualtrics survey, participants received a unique passcode to enter on their MTurk tab. After the participants submitted their code, they were thanked for their time, informed they could exit the website, and compensated.

Measures

Personality traits were assessed using the BFI-2 (Big Five In-

ventry-2), a 60-item survey meant to obtain values for the individual's Big 5 Personality traits (Soto & John, 2017). Sample questions included, "Keeps things neat and tidy," and "Tends to be quiet." Questions were answered on a 5-point Likert-style scale, with responses ranging from 1 ("strongly disagree") to 5 ("strongly agree"). In the current study, Cronbach's αs of the Big Five Personality Traits (Openness to Experience, Conscientiousness, Extraversion, Agreeableness, Negative Emotionality) ranged from 0.7776 to 0.8503.

Musical listening preferences were determined in a direct manner through free-response text boxes. Participants responded to three questions: "Do you prefer rhythmic or melodic instruments," "What is your favorite musical instrument," and "What is your favorite musical genre?"

RESULTS

Responses in the personality questionnaire were coded according to the instructions in Soto and John (2017). Scores closer to 1 indicated a lesser presence of a certain personality trait and scores closer to 5 indicated a greater presence of a personality trait. Responses to the three questions in the musical listening preference questionnaire were grouped into three respective categories for analysis. We performed One-Way ANOVAs for each of the three categories to determine the degree to which musical preferences differed in terms of the Big Five personality traits. The results in **Table 1** depict the average personality scores for those who prefer rhythmic or melodic instruments. As shown in the table, we found significant results regarding the personality traits of Agreeableness ($F(1, 194) = 7.0245$, $p < 0.01$) and Openness to Experience ($F(1, 194) = 5.7923$, $p < 0.05$). Those who preferred rhythmic instruments were observed to be less Agreeable and less Open to Experiences than those who prefer melodic instruments, which supports the second and fourth hypotheses. The responses for six participants had to be discarded in this analysis because they declined to answer or did not appropriately respond. **Table 2** contains the data from a One-Way ANOVA analyzing the relationships between average musical instrument listening preferences and personality traits. Here, the only significant differences between groups were found in the personality trait, Extraversion ($F(10, 177) = 1.9737$, $p < 0.05$). A post hoc test was performed to identify specific significant differences between instruments but found none. This meant that the specific instruments responsible for this significant finding were unable to be identified. Fourteen responses had to be removed from this analysis for the same reasons as before. Lastly, **Table 3** shows the data from a One-Way ANOVA analyzing the personality differences between individuals of differing

Table 1: Means, Standard Deviations, and F-Values of One-Way ANOVAs between Personality Traits and Rhythmic and Melodic Instruments

	Extraversion	Agreeableness	Conscientiousness	Negative Emotionality	Openness to Experience
Rhythmic Instruments	3.07 (0.68)	3.33 (0.61)	3.56 (0.73)	2.66 (0.78)	3.41 (0.66)
Melodic Instruments	3.12 (0.84)	3.62 (0.71)	3.76 (0.83)	2.65 (0.96)	3.70 (0.78)
$F(1,194)$	0.11	7.02**	2.49	0.01	5.79*

Note: *p < 0.05. **p < 0.01. Instrument results are reported in the form "Mean Personality Score (Standard Deviation)."

Table 2: Means, Standard Deviations, and F-Values of One-Way ANOVAs between Personality Traits and Individual Musical Instruments

	Extraversion	Agreeableness	Conscientiousness	Negative Emotionality	Openness to Experience
Guitar	2.99 (0.90)	3.52 (0.73)	3.66 (0.83)	2.78 (0.95)	3.57 (0.82)
Piano	3.23 (0.64)	3.53 (0.69)	3.66 (0.81)	2.54 (0.77)	3.55 (0.74)
Bass	2.24 (0.88)	3.65 (0.62)	3.67 (0.85)	3.27 (1.14)	3.82 (0.79)
Violin	3.56 (1.52)	3.53 (0.91)	4.06 (0.83)	2.58 (1.96)	4.39 (0.55)
Cello	2.72 (1.20)	3.94 (0.61)	2.94 (0.54)	3.11 (0.39)	4.56 (0.24)
Saxophone	3.28 (1.00)	3.59 (0.79)	3.83 (0.80)	2.58 (1.00)	3.5 (0.92)
Organ	3 (0.59)	4.25 (0.71)	3.58 (0.94)	2.79 (0.41)	4.54 (0.53)
Flute	2.38 (0.77)	3.58 (0.94)	3.63 (1.12)	3.96 (1.12)	3.25 (0.59)
Drums	3.30 (0.51)	3.37 (0.68)	3.76 (0.74)	2.41 (0.69)	3.46 (0.58)
Keyboard	3.08 (0.25)	3.67 (0.71)	4 (1.10)	1.94 (1.06)	3.39 (0.57)
Synthesizer	2.04 (0.53)	3.38 (1.00)	3.79 (0.77)	4 (1.18)	4.71 (0.29)
F(10, 177)	1.97*	0.45	0.42	1.86	1.77

Note: *$p < 0.05$. Instrument results are reported in the form "Mean Personality Score (Standard Deviation)."

musical genre preferences. The relationship between musical genre preference and Extraversion ($F(10, 171) = 1.8941$, $p < 0.05$) was the only significant result that came from this analysis of variance. A subsequent post hoc test did not determine any specific differences between groups. This meant that the individual genres responsible for the significant result could not be identified. Eighteen responses had to be removed from this analysis for the same reasons.

DISCUSSION

In addition to being an essential component to cultures around the world, music can be a correlate of personality traits. The present study addressed one question regarding this relationship: What are the correlations between musical instrument listening preferences and the Big Five Personality Traits? This question was analyzed in groups of rhythmic and melodic instruments, as well as at the individual

instrument level. This study also attempted to replicate the findings of Rentfrow and Gosling by using a more direct method to determine musical genre preferences (2003). Neither rhythmic nor melodic instruments were found to be significantly correlated with Conscientiousness. While this does not negate the findings of George, Stickle, Rachid, and Wopnford, it simply suggests that findings regarding rhythmic music preferences and Conscientiousness do not extend to those instruments classically identified as rhythmic (2007). Despite sharing an emphasis on maintaining an orderly, consistent, and metronomic beat, rhythmic instruments might not share personality associations with rhythmic musical styles. This finding sets an important precedent in psychomusicology and can be helpful in informing future hypotheses. It was also hypothesized that those who prefer rhythmic instruments would be higher in Extraversion than those who prefer melodic instruments. The results in this

What Does Your Musical Instrument Say About You: Analyzing Musical Instrument Preference And the Big 5 Personality Traits

Table 3: Means, Standard Deviations, and F-Values of One-Way ANOVAs between Personality Traits and Musical Genres

	Extraversion	Agreeableness	Conscientiousness	Negative Emotionality	Openness to Experience
Rock	3.03 (0.83)	3.63 (0.78)	3.80 (0.77)	2.56 (0.99)	3.74 (0.80)
Pop	3.25 (0.78)	3.48 (0.67)	3.50 (0.86)	2.74 (0.76)	3.59 (0.71)
Hip Hop	3.53 (0.65)	3.63 (0.69)	3.77 (0.88)	2.45 (0.76)	3.62 (0.68)
Classical	3.11 (0.45)	3.39 (0.55)	3.54 (0.57)	2.81 (0.51)	3.29 (0.53)
Jazz	3.20 (0.83)	3.60 (0.75)	3.90 (0.88)	2.50 (1.03)	3.56 (0.88)
Alternative	2.63 (1.04)	3.93 (0.69)	3.77 (0.99)	2.76 (1.36)	4.24 (0.69)
Rap	3.08 (0.18)	3.17 (0.48)	3.36 (0.58)	2.66 (0.39)	3.25 (0.50)
Metal	2.39 (1.13)	3.43 (0.79)	4.08 (0.80)	2.68 (1.16)	3.51 (1.10)
Electronic	2.85 (0.58)	2.98 (0.29)	3.5 (0.79)	3.43 (0.85)	3.73 (0.82)
Folk	3.23 (0.31)	3.46 (0.92)	3.58 (0.93)	2.52 (0.86)	3.27 (0.61)
Country	2.96 (0.61)	3.58 (0.45)	4.31 (0.93)	1.85 (1.03)	3.25 (0.49)
$F(10, 171)$	1.89*	1.20	1.06	1.00	1.77

Note: *$p < 0.05$. Genre results are reported in the form "Mean Personality Score (Standard Deviation)."

paper do not support this hypothesis, as neither rhythmic instruments nor melodic instruments were significantly related to Extraversion. This finding does not negate Rentfrow and Gosling's finding that those who prefer E&R types of music were more Extraverted (2003). Alternatively, it suggests that rhythmic instruments likely are not the factors that facilitate their observed correlation. These findings might be observed due to an insufficient sample size, as previous studies have drawn results from populations of over 1,000 participants. However, individual musical instrument preferences had significantly different group means in the Extraversion trait. This finding might be observed because certain instruments are more socially prominent than others. Those who are more Extraverted might prefer instruments that are commonly at the forefront during songs and performances, while those who are less Extraverted might identify with the instruments in the background.

The current study also found that those who preferred rhyth-

mic instruments were lower in Agreeableness and Openness to Experience than those who preferred melodic instruments. This could be a result of rhythmic instruments having more pronounced timbres and fewer beat arrangements than melodic instruments. These musical elements could be associated with more disagreeable or tradition-oriented personality characteristics. These two results support earlier hypotheses and provide evidence that some findings regarding musical preferences can be generalized and expanded to groupings of instruments. The generalizability of previous findings regarding genre preferences is important for the future of psychomusicology research because it might attest to the centrality of musical instruments in certain genres. For example, a future study can investigate the correlation between the personality traits of those whose favorite music genre is classical and whose favorite instrument is piano.

The results of the present study have implications for the importance of musical instrument listening preferences,

their personality correlations, and their centrality to certain musical genres. It is helpful to consider the instruments that facilitate the connections between personality traits and music preferences. For example, one should reflect on the roles of rhythmic instruments when forming conclusions about the personality traits of those who prefer Rhythm & Blues. By recognizing the number and significance of the personality correlates of musical instruments, researchers might be able to better understand the root of personality associations in musical genre listening preferences.

Findings from the present study have the potential to support future studies. Now that there are preliminary results supporting musical instrument and personality correlations, future studies can create a rigorous, STOMP-like method of determining musical instrument preferences. We can also analyze the results from the current study from an ethnomusicological standpoint. The ethnomusicological method of organizing instruments would account for a more diverse range of instruments and their use in songs as both rhythmic and melodic. Additionally, future studies should investigate the degree to which musical performance and composition skills influenced the correlations found in the present findings. The importance of certain musical instruments within genres should be further studied. For example, analyzing drum samples in the electronic beats of rap and hip hop might identify similar personality associations. Future studies should also diversify the findings from this study by using the personality traits reflective of the culture of interest.

Although the current study had some significant results, future studies can improve on the validities and reliabilities of these findings by addressing their limitations. First, the present study had a limited sample, drawing only participants from the United States of America who were over eighteen years old and had MTurk accounts. Future studies should obtain a more diverse population, as the demographics in the present study are not reflective of the entire United States of America. Additionally, future international studies should be careful to consider whether the Big Five Personality Traits accurately represent the basic personality traits found in the culture and language that they are researching (Benet-Martínez & John, 1998). Lastly, with more time, greater funding, and a larger sample size, some of those musical instrument preferences that only had a few responses could be better represented.

CONCLUSION

Due to the abundant interactions that many people have with musical instruments, it is necessary that research in psychomusicology expands to more specific aspects of music than simply genre. The present study addressed this lack of musical instrument research by investigating the personality correlates of musical instrument preferences. The current study found that those who prefer traditionally rhythmic instruments were lower in Agreeableness and Openness to Experience than those who prefer traditionally melodic instruments. Additionally, the results of this study suggest that Extraversion may play a role in musical instrument preferences. The current study also found more personality associations with musical instrument preferences than genre preferences. These findings reflect the importance of instruments in certain musical genres and their role in developing a unique connection with personality traits.

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Skeptics and Believers: Examining the Role of Extroversion and Skepticism in Paranormal Beliefs

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ABSTRACT

Prior research has identified inconsistencies in relations between extroversion and paranormal beliefs, particularly in the context of a direct association between skepticism and paranormal beliefs. Thus, the current study investigates the role of skepticism and extroversion on the paranormal beliefs of individuals. Participants were 384 students from an accredited postsecondary minority institution enrolled in a Skepticism and Pseudoscience Psychology class. All participants completed a set of online questionnaires that examined their personality traits (i.e., extroversion and neuroticism), skepticism, and paranormal beliefs. A 2x2 analysis of variance indicated that extroverted individuals exhibited greater belief in the paranormal than their less extroverted counterparts. No association was found between skepticism and paranormal beliefs. However, for less extroverted individuals, belief in the paranormal was higher for those with high skepticism relative to those with low skepticism. The limitations and implications of these findings are discussed.

KEYWORDS: ESP, Extroversion, Paranormal Beliefs, Skepticism

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Skeptics and Believers: Examining the Role of Extroversion and Skepticism in Paranormal Beliefs

INTRODUCTION

Paranormal or supernatural beliefs have been pervasive in society since the late 90's (Campbell, Nelson & Sparks, 1997). Despite scientific advancements, such beliefs and activities persist as popular interest in newspaper articles, books, television programs, and movies (Molle & Bader, 2013; Scheidt, 1973). There is also a psychological axiom that 'beliefs' are held because they serve significant psychodynamic needs of an individual (Irwin, 1993). Therefore, by uncovering the psychological aspects linked to paranormal beliefs, we hope to better understand how these belief systems work.

The most basic operationalization of paranormal beliefs has been the assessing belief in extrasensory perception (ESP). In this context, Thalbourne (1981) and Thalbourne and Haraldsson (1980) found that a high tendency for belief in extrasensory perception (ESP) exists among believers who are slightly more extroverted than their less-extroverted counterparts. However, Tobacyk's (1983) findings report that global paranormal beliefs (or the belief in psi, ESP, witchcraft, superstitions, precognition, etc.) are positively correlated with greater social alienation of individuals. Still, other studies suggest that there is no correlation between extroversion and paranormal beliefs. To illustrate, Lester and Monaghan (1995) explored the personality correlates of paranormal beliefs but found no significant relations. More recently, Williams et al. (2007) examined individual differences in paranormal beliefs in a sample of adolescents aged 13 to 16 and found that paranormal beliefs were independent of extroversion. Thus, empirical literature demonstrates discrepancies in the associations between extroversion and paranormal beliefs.

Another postulation is that paranormal believers may perceive more meaningful patterns in ambiguous information such as semantic or visual stimuli than their skeptical counterparts (Blackmore & Toscano, 1985; Brugger et al., 1993; Giannotti et al., 2001). Brugger et al. (1993) explored the effects of belief in ESP on the attribution of meaningful-ness to random patterns. They found a positive correlation between the propensity to see meaningful patterns (in the given random display) and the subject's belief in ESP. This susceptibility of believers was attributed to their 'yes-saying' tendency and confirmation bias (Wiseman, Greening & Smith, 2003). The results of these studies hint at the possibility that the believers may be overly sensitive to social information and thus may only require a small amount of information to activate their social information processing agency. Another potential explanation is that the belief in the paranormal may lead individuals to misinterpret normal events as paranormal occurrences and perceive human characteristics when none exist (Blackmore & Moore, 1994; Jones & Russell, 1980).

Given that personality factors may be important both as potentially confounding variables and independent predictors of ESP, Thalbourne and Haraldsson (1980) examined the differences in personality factors of believers and non-believers with respect to ESP. They suggest that believers tend to be more extroverted and more conservative than non-believers who may be inclined towards introversion and intellectual skepticism. To elaborate, it is possible that those who are socially withdrawn may shy away from paranormal beliefs for fear they may be ostracized from their already more limited social support networks. Additionally, Farag and Elias (2016) demonstrated a positive relation between extroversion and trait professional skepticism (a psychological construct; ability to detect fraud and maintain an independent attitude) of graduating students.

Overall, the literature on the relations between paranormal beliefs and the personality trait of extroversion is mixed, with some studies suggesting positive relations between belief in ESP and extroversion (Irwin, 1993; Thalbourne, 1981; Thalbourne & Haraldsson, 1980), some indicating negative associations (Milford & Tobacyk, 1985), while others indicating no associations at all (Lester & Monaghan, 1995; Williams et al., 2007). Additionally, there is a dearth of literature

examining a direct relationship between paranormal beliefs and skepticism. Thus, the current study aims to add to the existing pool of literature by investigating extroversion and skepticism as potential correlates or psychological mechanisms that may be underlying the paranormal beliefs. The results of this study may provide a better understanding of the basis of paranormal beliefs and how factors of psychological nature potentially play a role in fostering and making these beliefs a common feature of the thinking and behavior of individuals in society.

This study addresses the following three hypotheses:

Hypothesis 1: More extroverted individuals are likely to exhibit greater belief in the paranormal than less-extroverted individuals.

Hypothesis 2: Less-skeptical individuals are more likely to exhibit paranormal beliefs than more skeptical individuals.

Hypothesis 3: Extroverted individuals with low skepticism are more likely to believe in the paranormal than their more skeptical counterparts.

METHODS
Participants

The sample included 384 students from an accredited post-secondary minority institution (University of California, Riverside) (N = 384; 75% females; M_{age} = 20.5 years; age range: 18-22 years), who were enrolled in psychology courses in the Winter and Summer of 2008 and Skepticism and Pseudoscience Psychology class in Spring, 2008. The sample was ethnically diverse. All participants agreed to participate in this research as it was a part of their course requirement (extra credit opportunity), and informed consent was obtained from all participants. 152 participants were excluded from the total sample due to incomplete survey responses and scales that were subsequently added to the battery of assessments, yielding a final sample of 232.

Procedure

IRB approval was obtained for conducting the study. All participants were subjected to online questionnaires that measured their extroversion, skepticism, and paranormal beliefs. The questionnaires accounted for the diversity in the sample and were utilized during several studies performed on campus. The questionnaires were accessed via an online portal, and there were no time limitations for completing them. The participants responded using their personal computers and from a location of their choice. The data coding and analysis were conducted using the SPSS software. All analyses were controlled for participants' gender, race/ethnicity, and SES.

MATERIALS
Sociodemographic information

Participants self-reported their demographics (name, age, gender, ethnicity, and SES).

Extroversion

Extroversion was assessed using an online version of the 8-item Extroversion scale drawn from the full 44-item Big Five Inventory (BFI; John, Donahue & Kentle, 1991). Participants rated how much they agreed with each item (e.g., is outgoing, sociable) on a 5-point Likert scale from (1) strongly disagree to (5) strongly agree.

Skepticism

Skepticism was assessed using a 6-item Skepticism, Gullibility, and Trust Scale (SGT; Burgess, 2002). This scale distinguishes between general assessment of trust, gullibility and skepticism, and these assessments of self in personal relationships. A 3-point Likert scale (ranging from strongly disagree, not sure, to strongly agree) indicated the ratings of participants on the skepticism dimension.

Paranormal Beliefs

Paranormal beliefs were assessed using the 25-item Paranor-

Table 1. *ANOVA Table*

Predictor	*df*	SS	Mean Squares	*F*-value	λ	Power
Extroversion	1	798.259	798.259	4.242*	4.242	.518
Skepticism	1	12.705	12.705	.068	.068	.058
Extroversion*Skepticism	1	910.843	910.843	4.840*	4.840	.578
Residual	92	17312.182	188.176			

*p < .05. Note. df indicates degrees of freedom; SS indicates sum of squares; λ indicates Lambda values.

mal Belief Scale (Tobacyk & Milford, 1983). Participants rated how much they agreed with each item (e.g., *witches do exist*) on a 5-point Likert scale (ranging from [1] strongly disagree to [5] strongly agree).

RESULTS

To test the hypotheses, a 2 (Extroversion: high vs. low) X 2 (Skepticism: high vs. low)

ANOVA was conducted on the Paranormal Belief Scores. Results are reported in **Table 1**.

Individuals scoring high on extroversion indicated greater belief in paranormal ($M = 70.2$) than those who scored lower ($M = 67.9$, $F (1,92) = 4.24$, $p = .04$). Individuals scoring high on skepticism ($M = 69.2$) did not indicate any greater belief in paranormal than those who scored lower ($M = 68.7$, $F (1,92) = 0.68$, $p = 0.79$).

Further analysis revealed an interaction of extroversion and skepticism on paranormal beliefs, $F (1,92) = 4.84$, $p = .03$ (Table 1). To probe this interaction, pairwise comparisons were conducted at an alpha level of $p = 0.05$. For extroverted individuals with low skepticism, there was no reliable difference in their paranormal beliefs ($M = 75.1$) relative to extroverted individuals with high skepticism ($M = 69.2$, $F(1,46) = 1.49$, $p = 0.22$). However, for less-extroverted individuals, there was a reliable difference in their paranormal beliefs. Belief in the paranormal was higher for those with high skepticism ($M = 69.6$) relative to less-extroverted individuals with low skepticism ($M = 62.2$, $F(1,46) = 4.10$, $p = 0.04$, see **Figure 1, next page**). Skepticism did not predict a reliable difference in the paranormal beliefs of those who were more extroverted ($M = 69.27$) relative to those who were less-extroverted ($M = 69.6$, $F(1,36) = 0.57$, $p = 0.45$).

DISCUSSION

Despite no objective evidence for the existence of the paranormal phenomena, many people continue to believe in it (Markovsky & Thye, 2001). Marks (1986) claims that factors of psychological nature may foster the paranormal beliefs of individuals and make them a common feature of their thinking and behavior. Building on this, the current study investigated the role of extroversion and skepticism in the paranormal beliefs of individuals. Consistent with hypothesis 1, the results indicate that extroverted individuals exhibit a greater belief in the paranormal than their less extroverted counterparts. The results did not support hypothesis 2, as the individuals with high skepticism did not indicate any greater belief in the paranormal than their less-skeptic counterparts. Hypothesis 3 was partially supported, as the interaction of extroversion and skepticism on the paranormal beliefs indicate that less-extroverted individuals with high skepticism believe more in the paranormal than their less-skeptic counterparts.

Although partially supportive of Marks' (1986) claims the

Figure 1. *Interaction of extroversion and skepticism*
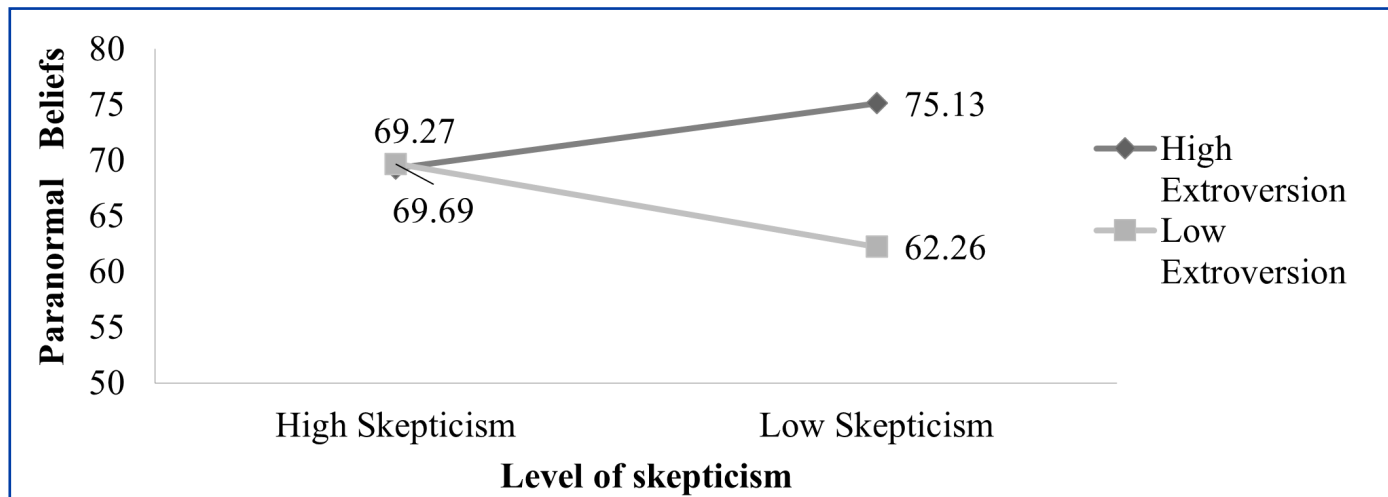
results of the present study are significant in several ways. Besides adding to the existing pool of knowledge about the psychological correlates of paranormal beliefs, the study results provide evidence that traits like extroversion and skepticism may make individuals more prone to believing in the paranormal. Secondly, the positive association between extroversion and paranormal beliefs is consistent with the findings of other researchers, thus strengthening the credibility of this relationship (Irwin, 1993; Thalbourne, 1981; Thalbourne & Haraldsson, 1980). Thirdly, the lack of association between skepticism and paranormal beliefs suggests that all skeptics may not uniformly hold implicit beliefs in the supernatural phenomena. Some non-analytical skeptics may be prone to biases that further predispose them to having such beliefs. Intuitively, skeptics may comprise of a heterogeneous group of individuals, some of whom are disbelievers, some who may evince cognitive biases that may predispose them to supernatural beliefs, and others who may implicitly endorse the actual, culturally shared supernatural/paranormal beliefs (Lindeman, Svedholm-Häkkinen & Riekki, 2016). More importantly, the results demonstrate that in addition to the level of extroversion, an individual's beliefs in the paranormal are dependent on his/her level of skepticism. In this sense, the notion of extroversion under-

lying paranormal beliefs seems no longer tenable. However, it may also be that the expressions of paranormal beliefs are used by individuals to address their particular contextual needs, or that people may be attributing the ambiguous processes to paranormality. Another possibility is that, compared to skeptics, believers may possess much tighter construct systems in which any change at their core level may imply a significantly greater upheaval in their belief systems (Marks, 1986).

Owing to the possible limitations, the present study's results are tentative. First, the participants were University of California, Riverside students who took psychology and pseudoscience courses. The sample size was reduced from 300 to 232 during data analysis due to incomplete survey responses and scales that were subsequently added to the battery of assessments. Additionally, a higher percentage of women in the sample suggests that the results may be best describing women's beliefs in the paranormal and that the results may be different for men. However, women showing a stronger belief in the paranormal has been a general trend consistent with the findings of prior research (Irwin, 1985; Randall, 1990).

Much empirical work is yet to be done on this topic. Future

theoretical refinements in the understanding of paranormal beliefs may benefit from the findings of this study. Future investigations should corroborate these results and explore factors like an individual's underlying cognitive processes, such as inferential confusion, confirmation bias, and meta-cognitive beliefs (Irwin, Dagnall & Drinkwater, 2012; Musch & Ehrenberg, 2002); perceptual mechanisms that detect patterns and agency (Van Elk, 2013); and the individual's experience of childhood trauma (Irwin, 1994). Examining the cognitive processes may allow for drawing similarities between paranormal beliefs and delusions. Perceptual mechanisms and perceptual sensitivity may inform whether paranormal believers may be more biased towards detecting agency or just jumping to conclusions based only on limited evidence. Finally, examining childhood trauma in terms of children's home lives with alcoholic or abusive parents may help explain if trauma evokes a need for a sense of control over life events and makes them generally susceptible to paranormal beliefs via "providing an impression of at least intellectual mastery over threatening situations and anomalous or otherwise incomprehensible events" (Irwin, Dagnall & Drinkwater, 2012).

The broad scope of paranormal beliefs further calls for closer scrutiny. Nonetheless, the results of the given study are fundamental as they are the first to suggest that in addition to the level of extroversion, an individual's beliefs in the paranormal are dependent on his/her level of skepticism. Knowing the extent to which believers and non-believers differ on personality dimensions may be crucial and act as an impetus for future research efforts that pertain to understand the mechanisms that may contribute to the maintenance of paranormal beliefs.

Overall, the scientific study of paranormal beliefs seems legitimate, irrespective of the non-resolution of the debate about the reality of the existence of the paranormal phenomena. The evident impact of paranormal beliefs upon an individual's life signals the importance of pursuing a better understanding of psychological functions, personality correlates, and other aspects related to such beliefs. Additional research on the beliefs and disbeliefs in the paranormal may shed light on the psychological factors involved in being a believer or a skeptic potentially helping to further clear people's misconceptions about the reality behind such beliefs.

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