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The Effect of Model Minority Myth Salience on White Americans' Perceptions of Black Americans and Their Support for Affirmative Action

Timothy Lee , University of Kansas; and H. Robert Outten* , Trinity College

ABSTRACT. A tenet of the model minority myth (MMM) is that Asian Americans have a greater proclivity toward being successful than other minorities. Informed by racial triangulation theory (Kim, 1999), we examined if exposing White Americans to information consistent with the MMM would increase the likelihood they appraise Blacks as low status and decrease their support for affirmative action policies. Participants either read an article that showed Asians with the highest median household income, followed by Whites and then Blacks (MMM salient condition), or an article that only depicted Whites with a higher median household income than Blacks (MMM not salient condition). To test our predictions, we conducted a one-way Multivariate Analysis of Variance and two one-way Analyses of Variance using a Bonferroni procedure (α level of .025). The omnibus effect of MMM salience on a linear combination of perceived status of Blacks and affirmative action support was significant, Wilk's $\Lambda = 0.98$, $F(2, 619) = 5.71$, $p = .003$, multivariate $\eta^2 = .018$. In terms of the univariate findings, compared to Whites in the MMM not salient condition, Whites in the MMM salient condition were more likely to appraise Blacks as lower status, although this difference did not reach statistical significance, $F(1, 620) = 4.20$, $p = .041$, $\eta^2 = .007$. Finally, those assigned to the MMM salient condition were significantly less supportive of affirmative action, $F(1, 620) = 7.51$, $p = .006$, $\eta^2 = .012$. We discuss the implications of these findings and highlight potential avenues for future research.

Keywords: model minority myth, household income, White Americans, perceived status of Black Americans, affirmative action



Open Data and Open Materials badges earned for transparent research practices. Data and materials are available at <https://osf.io/9fz2p/>

Asian Americans tend to be perceived more favorably than other racial minority groups in America, particularly relative to Black Americans¹. Specifically, Asian Americans are often exalted as the model minority group who manage to be economically and academically successful despite the discrimination they face, thanks to cultural values that stress hard work and

achievement (Kim, 1999; Xu & Lee, 2013). This valorization of Asian Americans can even be seen in the media. For instance, former Fox News host, Bill O'Reilly, during a 2014 television commentary,

¹ We use the term *Black American* rather than *African American* throughout the article because both African American and Black are accepted labels (American Psychological Association, 2010). Moreover, our study materials, which were based on existing materials, used the term *Black American(s)*.

said, “The median income for Asians, close to \$69,000 a year; it’s \$57,000 for Whites, \$33,000 for Blacks—so the question becomes why? And the answer is found in stable homes and in emphasis on education...That is why Asian Americans... are succeeding far more than African Americans and even more than White Americans” (O’Reilly, 2014). Comments like O’Reilly’s are reflective of a belief that, if Black Americans just worked harder and were more family-oriented, like their Asian American counterparts, then Black Americans could be successful too, in spite of centuries of enslavement and institutionalized anti-Black racism (Chow, 2017). It has been argued by some social scientists that the valorization of Asian Americans relative to other racial groups can make it seem as though Black Americans are deserving of their lower status, and in turn delegitimize the need for social policies aimed at redressing historical racial injustices (e.g., Baek & Lee, 2012; Kim, 1999). However, to our knowledge, no published research has experimentally tested this proposition. Given that people are frequently exposed to messages valorizing Asian Americans via the media, it makes sense for social psychologists to examine whether merely being exposed to information consistent with the model minority myth (MMM) can affect people’s current social attitudes. In the current study, we examined if exposure to information suggesting that Asian Americans are economically outperforming both White and Black American households would heighten Whites’ negative perceptions of Black Americans and reduce their support for affirmative action policies.

History of the MMM

Although the notion that Asian Americans have more of a proclivity toward being successful than Black Americans predates the civil rights movement, it was not until the civil rights era that the term *model minority* was first coined. In January 1966, sociologist William Pettersen first used the term in a *New York Times* article where he argued that Japanese culture’s emphasis on family values and hard work had made Japanese Americans economically successful. For this reason, Pettersen (1966) claimed that Japanese Americans were a *model minority* group, rather than a *problem minority* group, like Black Americans. During this time, Black Americans and their allies were engaged in direct actions aimed at ending legalized racial segregation and discrimination against non-Whites. For many White Americans, images of Black

Americans engaging in widespread demonstrations was a jarring sight. Whites’ support for the protests remained extremely low throughout the civil rights movement (Legum, 2017; Theoharis, 2018).

Given the antipathy directed toward Black Americans at the time, it is no surprise that, by the mid-1960s, the MMM was employed more frequently by politicians and the mainstream media to delegitimize the growing push for racial equality. The MMM allowed White Americans to refute one of the central arguments of civil rights activists: that legalized discrimination had made it exceedingly difficult for people of color to thrive in America. In response to claims by Black Americans about being adversely impacted by legalized discrimination, the MMM could be used to assert that Asian Americans too faced discrimination, but because of their work ethic, Asians in America were increasingly becoming socially mobile. For instance, in 1966, Democratic Assistant Secretary of Labor, Daniel Patrick Moynihan, defended his controversial claim that the Black culture’s emphasis on matriarchy is to be blamed for the deterioration of Black American communities by invoking the strong, disciplined Asian American families (Wu, 2014). In the same year, U.S. News & World Report (1966) made a similar claim, stating that, “at a time when it is being proposed that hundreds of billions be spent to uplift Negroes and other minorities, the nation’s 300,000 Chinese Americans are moving ahead on their own—with no help from anyone else.” Thus, the proliferation of the MMM at the height of the civil rights era was not accidental; it provided a convenient cover that served to both legitimize the denigration of Black Americans and minimize the need for policies designed to redress past racial injustices.

The Fallacy of the MMM

In recent decades, the MMM has helped perpetuate the idea that America has become a colorblind society where one’s race does not matter, and merit is the only criterion for success. After all, Asian Americans have prospered through their belief in the American dream and hard work—with little to no external help (Wu, 2013). However, the MMM is flawed because it minimizes the pervasive discrimination that Black Americans still face at the hands of the dominant White culture and its institutions—which not only preferentially treat Whites, but disenfranchise Blacks. For example, in terms of perceived physical appearance, Blacks are often perceived to be significantly less attractive than

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members of other racial groups (e.g., McDermott & Pettijohn II, 2008). Blacks are also consistently more likely to be objectified, dehumanized, and perceived as threatening (Anderson, Holland, Heldreth, & Johnson, 2018; Goff, Eberhardt, Williams, & Jackson, 2008). Between the fiscal years of 2012 to 2016, Black men received sentences that were 19.1% longer than White men for the same federal crimes. This was true even after controlling for peoples' age, education, citizenship, criminal history, and whether or not they pleaded guilty (Schmitt, Reedt, & Blackwell, 2017). A meta-analysis of experiments about hiring discrimination from 1989 through 2015 found that anti-Black racism in hiring is unchanged since at least 1989. Since 1989, Whites have received, on average, 36% more callbacks than Blacks and 24% more callbacks than Latinos (Quillian, Pager, Hexel, & Midtbøen, 2017). For most types of loans, Black borrowers are at a greater risk of receiving higher rate loans and are more likely to be denied loans than Whites, Asians, and Latinos with similar credit scores (Bocian, Ernst, & Li, 2006; Li, 2014). Despite ever-present racial inequality that disproportionately harms Black Americans, many White Americans still subscribe to beliefs consistent with the MMM.

Existing Literature on the MMM

Recent studies have found that most Americans continue to valorize Asian Americans. For example, using data from the General Social Survey, Xu and Lee (2013) examined White Americans' and Black Americans' attitudes toward different racial groups. Overall, Asian Americans, on average, were rated higher on traits consistent with the MMM like work ethic, family commitment, and socioeconomic status. Interestingly, White American respondents were less likely than Black Americans to hold egalitarian attitudes on race, as evidenced by the fact that Whites were much more likely to valorize Asian Americans. Similarly, Chao, Chiu, Chan, Mendoza-Denton, and Kwok (2013) found that Americans associate concepts like hard work and academic success more with Asians than they do Whites or Blacks. In a follow-up study, the same researchers found that reading an Asian American success story (vs. reading a European American success story) strengthened White Americans' belief in the MMM as a shared reality, resulting in greater acceptance of Asian Americans relative to Black Americans. In sum, past studies on the MMM have largely focused on the degree to which people endorse beliefs consistent with it, as well as its implications

for how Whites perceive Asian Americans. What has largely been ignored is whether making Asian success salient affects White Americans' perceptions of Black Americans and their support for policies aimed at redressing historical racial injustices. Our research attempted to fill this gap by experimentally manipulating recent U.S. census data on racial differences in median household income, in an effort to examine the effect that thinking about Asians' higher relative income has on Whites' perceptions of the status of Black Americans and their support for affirmative action policies.

The MMM, Perceptions of Blacks, and Affirmative Action Policies

Racial triangulation theory (Kim, 1999) provides a useful framework by which to understand how exposure to information consistent with the MMM might lead White Americans to perceive Black Americans to be of low status and be less supportive of affirmative action policies. The theory posits that Black Americans are juxtaposed against Asian Americans by White Americans for the purposes of keeping the racial status quo in check. With an emphasis on individual efforts and mobility, the MMM legitimizes the lower social standing of Black Americans, as the success of Asian Americans implies that Blacks are simply not working hard enough. By establishing the prosperity of Asian Americans as a reference point, the racial triangulation paradigm allows White Americans to delegitimize complaints from Black Americans about existing structural inequalities and blame them for their conditions, as well as effectively argue against the need for policies designed to redress historical injustices (e.g., affirmative action) without appearing as irrationally prejudiced.

Thus, in line with racial triangulation theory (Kim, 1999), we argue that mere exposure to information consistent with the MMM, such as current U.S. median household income figures where Asian Americans have a higher median household income than both White Americans and Black Americans, will make White Americans, on average, more likely to view Black Americans as inferior. This is because such information should provide a justification for denigrating Black people (i.e., "if Asians can do it, why can't you people do it"). As racial triangulation theory (Kim, 1999) suggests, Whites can unabashedly emphasize Blacks' apparent poor work ethic and justify the "inferiority" of Black Americans by comparing them with Asian Americans. Furthermore, we argue that

exposure to information consistent with the MMM should also make White Americans, on average, less supportive of affirmative action policies. This is because such policy efforts aimed at redressing past racial injustices should seem more unnecessary given that Asian Americans appear to be excelling in American society. Indeed, White Americans have often used Asian Americans to make a case against affirmative action (see Chang, 2018 for a review).

Overview of the Current Study

In this study, we examined if exposure to information consistent with the MMM affected White Americans' perceptions of Black Americans and their support for affirmative action policies. Specifically, White Americans were randomly assigned to read one of two articles about racial differences in median household income in the United States. One article depicted Asian Americans as having a higher median household income than both White Americans and Black Americans (MMM salient condition). The other article depicted White Americans as having a higher median household income than Black Americans, with no information concerning Asian Americans (MMM not salient condition). After reading one of the articles, participants completed a measure of perceived status of Black Americans, as well as two measures of support for affirmative action policies. The first affirmative action measure assessed support for affirmative action policies that would specifically benefit Black Americans, whereas the second assessed their support for affirmative action policies that would benefit minorities more broadly. The inclusion of two types of support for affirmative action measures was strictly exploratory. White Americans tend to associate affirmative action policies more with Black Americans than they do other minority groups (Feagin & Porter, 1995); as such, we anticipated that Whites' support for affirmative action policies would be affected by being exposed to information consistent with the MMM, regardless of whether affirmative action was framed as benefiting Black Americans or minorities. To summarize, based on racial triangulation theory (Kim, 1999), we predicted that relative to Whites who viewed racial household statistics that excluded Asians (MMM not salient condition), White Americans who viewed racial household income statistics that included Asian Americans (MMM salient condition) would perceive Black Americans to be of significantly lower status, and be less supportive of both affirmative action policies aimed specifically at Black Americans, as well as affirmative action policies targeting minorities more broadly.

Method

Participants

Six hundred forty-one self-identified White Americans residing in the 50 U.S. states and Washington, D.C. ($M_{age} = 41.64$ years, $SD = 12.07$, range = 20–76 years) were recruited via Amazon Mechanical Turk (Buhrmester, Kwang, & Gosling, 2011) and paid U.S. \$1.50.² The sample consisted of 364 women, 274 men, 1 transgender man, and 2 participants who indicated there was no gender option that applied to them. One percent of participants reported having only completed elementary school, 32% had a high school diploma or GED, 18% had obtained an associate degree, 37% had completed a bachelor's degree, and 12% had a master's degree and a PhD or professional degree. With respect to household income, 19% of participants reported that they made less than \$23,999, 28% made between \$24,000 and \$44,999, 25% reported making between \$45,000 and 69,999, 17% made between \$70,000 and \$99,999, and 11% reported a household income exceeding \$100,000.

Procedure and Manipulation

Participants completed an online survey that was created using SurveyGizmo (2019). At the outset of the survey, participants were presented with a consent form, which indicated that our research was approved by Trinity College's Institutional Review Board. Next, participants completed background questions about their gender, age, education level, and household income. Then participants were randomly assigned to either the MMM salient condition or the MMM not salient condition. People in both conditions were presented with a newspaper article about racial differences in median household income in the United States. Both articles contained real median household income figures for White Americans and Black Americans from 1987 to 2016, where noticeable differences in median household income between racial groups were present (see Semega, Fontenot, & Kollar, 2017). For instance, in 2016, White households had a median income of \$65,041 and Black households had a median income of \$39,490. However, in the

² We did not advertise that we were interested in recruiting participants who were White American citizens. Doing so might have introduced demand characteristics. Thus, our survey was open to any adult on Mturk. A total of 805 people completed our study. However, 164 participants were removed for any of the following reasons: (a) they did not identify as White, (b) they were not a U.S. citizen, or (c) they completed the survey outside of the 50 U.S. states and Washington, D.C.

MMM salient condition, real median household income figures of Asian Americans from 1987 to 2016 were also included. Asian households in 2016 had a median income of \$81,431, earning much more than both White and Black households. After reading one of the articles, participants completed measures of the perceived status of Black Americans, support for affirmative action policies aimed at Black Americans, and support for affirmative action policies targeting minorities more broadly. Finally, participants completed an attentional manipulation check where they had to recall which racial group had the highest household income in the article they read. Upon completion of the survey, participants were debriefed.

Dependent Measures

Perceived status of Black Americans. Perceived status of Black Americans was measured with three items adapted from the Perceived Status Scale (Fiske, Cuddy, Glick, & Xu, 2002). The items assessed the degree to which people perceive Black Americans as inferior and low status (i.e., “How well educated are Blacks?”, “How economically successful have Blacks been?”, and “How prestigious are the jobs typically achieved by Blacks?”). The scales ranged from 1 (*not at all*) to 5 (*extremely*). The measure displayed good internal reliability ($\alpha = .86$). Lower scores indicated lower perceived status of Black Americans.

Support for affirmative action for Black Americans. We used Swim and Miller’s (1999) eight-item measure of support for affirmative action policies benefiting Black Americans (e.g., “Blacks should receive racial entitlement such as affirmative action and other forms of compensation due to the past injustices of White America,” “A certain quota of Blacks, even if not all of them are fully qualified, should be admitted to colleges and universities,” and “Blacks have to learn they are entitled to no special consideration and must make it strictly on merit” [reverse scored]). Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). The measure demonstrated excellent internal reliability ($\alpha = .91$). Higher scores reflected greater support for affirmative action programs that would specifically benefit Black Americans.

General support for affirmative action policies. General support for affirmative action policies was measured using eight items adapted from Kravitz and Platania (1993) and Wellman, Liu, and Wilkins (2016). The items assessed support for affirmative action programs that could benefit minority groups

as a whole (e.g., “Affirmative action programs are still needed today to address racial inequality,”, “Businesses should increase their efforts to promote racial diversity in the workplace,” “All in all, I oppose affirmative action plans in industry for minorities” [reverse scored]). Response scales ranged from 1 (*strongly disagree*) to 7 (*strongly agree*). The measure exhibited excellent internal reliability ($\alpha = .95$). Higher scores indicated greater support for affirmative action policies that would benefit minorities as a whole.

Manipulation check. The manipulation check assessed whether participants were paying close attention to the articles they read. Participants were presented with an open-ended manipulation check in which they were asked to recall the racial group that was shown to have the highest median household income in the article they read. For participants in the MMM salient condition, the correct answer was Asian Americans, whereas for those in the MMM not salient condition, the correct answer was White Americans. Nineteen participants provided an incorrect response and were thus excluded from subsequent analyses. This left 622 White Americans for the remaining analyses.

Results

Preliminary Analyses

Factor analysis of items comprising the dependent measures. Before conducting our main analyses, we opted to conduct principal axis factor analysis with an oblimin rotation to be sure that our three dependent measures were separate constructs. First, parallel analysis with 1,000 random samples was used to establish the number of factors to retain (see O’Connor, 2000). The parallel analysis produced three observed eigenvalues greater than the 95th percentile random data eigenvalues (first observed = 9.43, 95% CI of .42; second observed = 1.92, 95% CI of .34; third observed = .90, 95% CI of .28). Therefore, we retained three factors.

According to the principal axis factor analysis, the three factors accounted for 70.49% of the total variance. The first factor accounted for 51.34% of the variance. The second factor accounted for 12.47% of the variance. The third factor accounted for 6.68% of the variance. We followed Costello and Osborne’s (2005) criteria for item-retention. Items with loadings of less than .40 were dropped and items that loaded at .32 or higher on two or more factors were removed. An inspection of the pattern

matrix revealed that only one of the 19 items that comprised our three dependent measures failed to meet the item retention criteria. The one item was, "Once affirmative action programs for Blacks are started, the result is bound to be reverse discrimination against White men," which was an item that comprised our measure of support for affirmative action policies aimed at Black Americans. This item loaded on the first factor at .38. Thus, we removed this item. The remaining 18 items were retained for our main analyses. Factor 1 consisted of eight items representing general support for affirmative action policies (loading, .69 to .95, other item loadings $< .39$). Factor 2 was made up of the three items assessing perceived status of Black Americans (loadings, .79 to .85, other item loadings $< .09$). Factor 3 was comprised of seven items representing support for affirmative action policies specifically for Black Americans (loadings: .47 to .92, other item loadings $< .29$).

Correlational analysis. Next, we calculated intercorrelations among MMM condition (0 = MMM not salient, 1 = MMM salient), perceived status of Black Americans, support for affirmative action for Blacks, general support for affirmative action, participant age, education, and household income. We included age, education, and household income because there was quite a bit of heterogeneity within our sample in terms of each of those demographic characteristics. The intercorrelations, means, and standard deviations are presented in Table 1. In line with our predictions, MMM condition was significantly related to perceived status of Blacks ($r = -.08$, $p = .041$), support for affirmative action for Blacks ($r = -.10$, $p = .010$), and general support for affirmative action ($r = -.11$, $p = .006$). Specifically, viewing household income statistics that included Asian Americans was associated with appraising Blacks to be of significantly lower status, being significantly less supportive of affirmative action policies for Blacks, and being significantly less supportive of affirmative action policies for minorities more broadly. Support for affirmative action specifically for Blacks was highly correlated with general support for affirmative action ($r = .78$, $p < .001$). Also, being younger was significantly negatively related to general support for affirmative action ($r = -.10$, $p = .009$) and household income was significantly positively associated with education ($r = .35$, $p < .001$). No other relationships were statistically significant.

Main Analyses: Effect of MMM Salience on the Dependent Measures

We opted to conduct a one-way Multivariate Analysis of Variance (MANOVA), to examine whether the manipulation of MMM salience had different effects on participants' appraisals of the status of Black Americans and their support for affirmative action policies.³ We employed a one-way MANOVA before conducting one-way Analysis of Variance (ANOVA) because a multivariate approach better accounts for family-wise error.⁴ Also, we decided to drop the measure of support for affirmative action for Blacks from our main analyses. Our rationale for this was that having highly correlated dependent variables can considerably reduce the power of a MANOVA (see Tabachnick & Fidell, 2013 for a discussion). The Black specific measure of affirmative action was highly correlated with the general measure of affirmative action. Furthermore, the results of the factor analysis suggested that some of the items that comprised the

TABLE 1

Variable	1	2	3	4	5	6	7
1. Article type (condition)	—						
2. Perceived status of Blacks	-.08*	—					
3. Support for AA for Blacks	-.10*	-.01	—				
4. General support for AA policies	-.11**	.03	.78**	—			
5. Age	-.01	.01	-.05	-.10**	—		
6. Education	.03	-.04	.07	.04	-.07	—	
7. Household income	-.03	-.04	-.04	-.04	-.00	.35**	—
<i>M</i>	0.50	2.39	2.53	4.44	41.90	3.28	2.73
<i>SD</i>	0.50	0.67	0.98	1.68	12.12	1.06	1.25

Note. AA = affirmative action. Article type coded 0 = MMM not salient and 1 = MMM salient. Education coded 1 = completed elementary school; 2 = completed high school/GED; 3 = held an associate degree; 4 = held a bachelor's degree; 5 = held a graduate degree. Household income coded 1 = $< \$23,999$; 2 = $\$24,000$ to $44,999$; 3 = $\$45,000$ to $69,999$; 4 = $\$70,000$ to $99,999$; 5 = $> \$100,000$.

* $p < .05$. ** $p < .01$.

³ We also ran a one-way Multivariate Analysis of Covariance and two one-way Analyses of Covariance with participant age, education, and household income as covariates. The findings were nearly identical in that the omnibus effect of MMM salience on the linear combination of perceived status of Blacks and general support for affirmative action was statistically significant. Similar to the analyses reported in the paper, both univariate analyses were significant at an α level of .05, and only the model with support for affirmative action as the dependent variable remained statistically significant when the Bonferroni correction (α level of .025) was applied.

⁴ We would like to thank an anonymous reviewer for suggesting this statistical approach.

Black specific measure of affirmative action were somewhat redundant with items that comprised the general measure of affirmative action. In fact, the item that was removed from the Black specific measure loaded highest on the factor consisting of items for the general measure of affirmative action (i.e., factor 1).

Before deciding which MANOVA test statistic to examine, we evaluated Box's Test of Equality of Covariance Matrices to make sure the covariance matrices of the two dependent variables were equal across conditions. We also computed Levene's Test of Equality of Error Variances to assess whether the variances of both dependent measures were equal across conditions. The observed covariance matrices were not significantly different between groups (Box's $M = 1.16$, $p = .763$). The observed variances of the perceived status of Blacks measure, $F(1, 620) = 0.13$, $p = .715$, and the general support for affirmative action measure, $F(1, 620) = 2.05$, $p = .153$, also did not significantly differ between groups. Given that the results of the tests met the assumptions of homogeneity of covariances and variances, we used the Wilk's Λ test statistic to interpret the MANOVA results. The MANOVA was statistically significant, Wilk's $\Lambda = 0.98$, $F(2, 619) = 5.71$, $p = .003$, multivariate $\eta^2 = .018$. These results indicated that there were significant differences between MMM salient and MMM not salient groups on a linear combination of perceived status of Blacks and general support for affirmative action.

Because the MANOVA was significant, we examined the results of the two separate univariate one-way ANOVAs. To guard against Type I error, we applied a traditional Bonferroni procedure to the analyses. Specifically, we tested the significance of both ANOVAs at an α level of .025, rather than the standard .050 cutoff. Compared to White Americans in the MMM not salient condition ($M = 2.45$, $SD = 0.67$), White Americans in the MMM salient condition were more likely to appraise Black Americans as a low status group ($M = 2.34$, $SD = 0.68$), $F(1, 620) = 4.20$, $p = .041$, $\eta^2 = .007$. However, this difference was not statistically significant when using the more appropriate adjusted α level of .025, instead of the traditional .050 cutoff. Finally, compared to participants in the MMM not salient condition ($M = 4.62$, $SD = 1.63$), participants in the MMM salient condition were significantly less supportive of general affirmative action policies ($M = 4.25$, $SD = 1.72$), $F(1, 620) = 7.51$, $p = .006$, $\eta^2 = .012$.

Discussion

Informed by Kim's (1999) racial triangulation theory, we conducted an experiment to examine whether White Americans can use Asian American economic success to (a) denigrate Black Americans and (b) delegitimize attempts at redressing historical injustices through policies like affirmative action. To test these propositions, White participants were either exposed to an article that depicted White Americans as having a higher median household income than Black Americans, with no information concerning Asian Americans (MMM not salient condition), or an article that depicted Asian Americans as having a higher median household income than both White Americans and Black Americans (MMM salient condition). Afterward, all participants completed measures of the perceived status of Black Americans and support for affirmative action policies.

Our findings are somewhat consistent with the crucial argument of racial triangulation theory that the mere addition of Asian Americans to a status-based comparative frame enables White Americans to more freely associate Black Americans with a lower social standing, while also undermining their support for affirmative policies designed to redress historical injustices. Specifically, we found that being exposed to information consistent with the MMM was significantly correlated with perceiving Blacks as low status, less support for affirmative action policies specifically aimed to help Black Americans, as well as decreased support for affirmative action policies aimed at minorities more broadly. The focal univariate ANOVA analysis—that proceeded the multivariate ANOVA analysis—revealed that the effect of MMM salience on perceived status of Blacks and general support for affirmative action policies was statistically significant at a traditional α level cutoff of .05. However, at an adjusted alpha level of .025, only the effect of MMM salience on general support for affirmative action reached statistical significance. Furthermore, the corresponding effect sizes of MMM salience on both outcomes were very small. Given the dearth of experimental research examining the effect of MMM salience on attitudes toward Black Americans and support for affirmative action policies, future studies are needed before any conclusions can be drawn with certainty.

With that said, our research does make some notable contributions to the extant literature on the psychological effects of the MMM. First, whereas past research examining the implications of the

MMM has largely been correlational (e.g., Cabrera, 2014; Chao et al., 2013; Parks & Yoo, 2016; Wong, Lai, Nagasawa, & Lin, 1998; Xu & Lee, 2013), our study utilized a novel experimental paradigm to test key tenets of Kim's (1999) racial triangulation theory. Secondly, past studies have tended to focus on the relationship between White Americans' endorsement of beliefs consistent with the MMM and their perceptions of Asian Americans, while ignoring Whites' perceptions of Black Americans. The focus placed on attitudes toward Asian Americans has presumably been because the myth specifically targets Asian Americans and could result in the impression that Asian American success translates into White Americans having to compete for the same resources to achieve upward social mobility (Parks & Yoo, 2016; Wu, 2013). Thus, our research fills a gap in the literature by experimentally testing a crucial facet of racial triangulation theory, namely that the valorization of Asian Americans relative to Black Americans can worsen perceptions of Black Americans and lessen support for policies designed to mitigate the lingering effects of racial injustices.

Limitations and Future Directions

One could argue that the biggest limitation of this research is the magnitude of the effect sizes of MMM salience on the perceived status of Blacks ($\eta^2 = .007$) and general support for affirmative action ($\eta^2 = .012$). According to longstanding statistical standards for interpreting eta squared effect sizes in the social sciences, a factor that accounts for approximately 1% of the variance in a particular outcome is quite small. This can indicate that the differences between groups on particular outcomes are not particularly meaningful in the real world (Maher, Markey, & Ebert-May, 2013; Vacha-Haase & Thompson, 2004).

It is worth noting, however, that many social scientists assert that one of the best ways to understand effect sizes is to consider the variables being studied, not just standard statistical benchmarks (e.g., Prentice & Miller, 1992; Vacha-Haase & Thompson, 2004). As Vacha-Haase and Thompson (2004) have pointed out, "the difference between eta squared effect size for smoking versus not smoking on longevity is around 2%" (p. 478). This is a small effect size when judged entirely through the lens of statistical cutoffs. However, whether or not someone smokes tobacco is generally regarded as a meaningful predictor of longevity in the real world, considering that more than seven million people worldwide

die prematurely each year due to smoking tobacco (World Health Organization, 2019). One of the focal reasons that studies examining the relationship between smoking and life expectancy typically find small effect sizes is that there are a myriad of factors that contribute to life expectancy including exercise, poverty, and exposure to environmental pollutants (Chan, Weinhold, Thomas, Gohlke, & Portier, 2015). Importantly, many of the factors that can help explain people's life expectancy might begin to exert their influence on people's health before they begin smoking.

It is reasonable to assume that similar logic might apply to the interpretation of the effect of MMM salience on White people's attitudes toward Blacks and affirmative action policies. People's racial attitudes begin to form in early childhood and are influenced by various factors including racial socialization and the quality of interracial interactions over one's lifespan. Moderately small to large effect sizes have been found in studies examining White people's knowledge about Black oppression and quality of contact with Blacks, as predictors of their attitudes toward Black people (e.g., Dixon, Durrheim, & Tredoux, 2007; Hughes, Bigler, & Levy, 2007). Thus, it is not too surprising that estimates of the effect of MMM salience on the perceived status of Blacks and general support for affirmative action were small, especially considering that participants were briefly exposed to racial household income statistics. Furthermore, racial attitudes are highly resistant to large shifts over a short time period. A meta-analysis of interventions designed to reduce negative intergroup attitudes found mainly small effect sizes for interventions aimed at improving racial/ethnic attitudes (see Beelmaan & Heinemann, 2014).

In the field of social psychology, minimal manipulations of an independent variable that account for a small portion of the variance of difficult to influence dependent variables have the potential to be meaningful. Especially if those effects are replicable, which would suggest they are not anomalous (see Prentice & Miller, 1992 for a detailed discussion; also see Vacha-Haase & Thompson, 2004). Take for instance recent research examining whether getting White people in Western countries to think about future racial/ethnic demographic projections can heighten their racial animus and support for more conservative policy positions. In these studies, much like our own, participants were briefly exposed to demographic information for a minute or two before completing attitude measures (Craig & Richeson,

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2014; Outten, Lee, Costa-Lopes, Schmitt, & Vala, 2018; Outten, Schmitt, Miller, & Garcia, 2012). Many of the obtained effect sizes ranged from very small to moderate (e.g., Craig & Richeson, 2014). However, what is more relevant is that these effects on valued outcomes are consistently replicable; they do not appear to be serendipitous. Although people are not exposed to racial/ethnic demographic projections on a daily basis, we know that White supremacists are more concerned about future demographic changes than people who are not White supremacists, and these two groups differ in their racial animus and support for more conservative policy positions in ways that are meaningful in the real world. It is also true that, over the last 20 years, as more people have become aware that the relative share of the White population is declining in the West, the number of White supremacist hate groups in countries like the United States has increased substantially (Woodyard, 2019). Furthermore, White supremacists manage to recruit people by using propaganda that highlights that the relative size of White populations in Western nations are declining (Hegyi, 2019). Perhaps it is unlikely that millions of people are recruited annually through the use of such propaganda, but it would be difficult to argue that the small effect sizes in these studies are not meaningful. Researchers keep finding these effects, and people have a good sense of what the real-world implications are.

Given that the current study was the first to our knowledge that has manipulated racial household income statistics to examine their effect on perceptions of Blacks and attitudes toward affirmative action policies, we do not have the luxury of directly comparing our obtained effect sizes with those in other studies. In such instances, it is best to be cautious and rely mainly on existing statistical benchmarks for interpretation, rather than making grandiose claims (Vacha-Haase & Thompson, 2004). With that in mind, at best, the observed effects could suggest that White Americans who tend to think of Asian Americans when thinking of racial differences in status (e.g., household income) are slightly less supportive of affirmative action policies and harbor slightly more negative perceptions of Blacks than those who predominantly think of racial status differences in terms of Black-White comparisons. These effects might also help to explain why some White Americans who want to end affirmative action programs cite Asian American success as a focal reason for why affirmative action should be stopped (Chang, 2018). Additionally, perhaps people could use this

type of information to persuade some members of the general public that American society is just, and that policies like affirmative action are not only outdated, but unfair for those who have succeeded. At worst, the small effect sizes could be indicative of spurious effects. In other words, there might be no meaningful effects of MMM salience on how Whites perceive the status of Black Americans or their support for affirmative action for Blacks. This is precisely why our results should be interpreted cautiously. More studies using this experimental paradigm are sorely needed before definitive conclusions can be drawn regarding the meaningfulness of our results.

A related limitation of this research is that the salience of the MMM was manipulated by either including or excluding median household income figures of Asian Americans in the articles participants read. Although our manipulation used real statistics and the contents of the respective articles were modelled after actual news articles discussing racial differences in household income (e.g., Lam, 2014; The Wall Street Journal, 2013), the MMM encompasses more than just a belief that Asian Americans are economically successful. For example, the MMM is tied to notions about Asian Americans' superior work ethic and academic success relative to other racial groups (Kim, 1999; O'Reilly, 2014). As such, future studies should manipulate racial group differences in work ethic or educational attainment.

A third limitation of this investigation is that we did not examine potential psychological mechanisms underlying the effects found in our study. A potential mediator of the processes we examined could be perceived ingroup threat. According to downward comparison theory (Wills, 1981), outgroup derogation can stem from feeling threatened about an ingroup's relative status position. If people feel threatened because their ingroup appears to be lower in status than a higher status outgroup, one way that people can make themselves feel better is by denigrating other groups that are lower in status than their ingroup. In this case, it is possible that White Americans felt threatened by information consistent with the MMM, as data revealing that Asian Americans are earning more than both Blacks and Whites may suggest that Asian Americans are higher status than White Americans. Perhaps ingroup threat accounts for why Whites assigned to the MMM salient condition were more likely to perceive Blacks as low status and disapprove of affirmative action policies. Thus, it would be advisable for future studies to examine whether appraisals of threat serve as a mediator of the link

between exposure to information consistent with the MMM and perceived status of Black Americans, as well as the link between exposure to information consistent with the MMM and support for affirmative action policies.

Our study focused on how exposure to information consistent with the MMM affected White Americans' attitudes toward Black Americans and policy outcomes associated with Blacks (i.e., affirmative action). This is because Kim's (1999) racial triangulation theory stresses that the valorization of Asian Americans by White Americans can foster negative sentiments toward Black Americans and social policies typically associated with Black Americans. However, it might be the case that White Americans' negative attitudes toward other racial/ethnic groups—like Hispanic Americans and Native Americans—are heightened by making Asian American achievement salient. Thus, another direction for future research would be to test whether exposure to information consistent with the MMM affects attitudes toward other racial minority groups.

Finally, it is worth acknowledging the need for more research that examines if there are efficacious strategies that can improve White Americans' perceptions of Black Americans and their support for affirmative action policies that could benefit them. In our study, regardless of the condition that White participants were assigned to, they tended to perceive Black Americans to be of low status ($M = 2.39$), they expressed fairly low support for affirmative action programs that could benefit Blacks ($M = 2.62$), and they expressed mild support for affirmative action policies that could benefit minorities more broadly ($M = 4.44$). Past studies examining White Americans' racial attitudes and policy attitudes have also found that many Whites perceive Black people and affirmative action policies quite unfavorably (e.g., Bouie, 2013; Priest et al., 2018). Given the dearth of longitudinal research examining ways to improve Whites' intergroup attitudes, it is difficult to know which strategies, if any, might be helpful. For instance, recent research suggests that educating White people about Black people's successes (e.g., exposing them to successful exemplars) might improve their feelings toward Black Americans, at least in the short-term (Gonzalez, Steele, & Baron, 2017). However, making the success of Black Americans salient can also have the unintended consequence of making White people more likely to deny the existence of anti-Black racism—and presumably reduce their support for affirmative action policies. This could be because people tend to interpret the successes of

Black Americans as an indication of what is already possible (Critcher & Risen, 2014). Perhaps a more effective approach would be creating a society where White Americans' early socialization, both at home and in the classroom, includes a more robust teaching of what Black Americans have had to endure in the United States. Salter and Adams (2016) found that critical Black history representations emphasizing historical barriers were more effective at promoting perception of racism and support for anti-racism policy than celebratory Black history representations emphasizing individual achievements. Exposure to the latter was in fact problematic, as it promoted denial of racism and opposition to anti-racist policy (Salter & Adams, 2016). Other studies have found that possessing greater historical knowledge about the Black American experience is associated with being more aware of current systemic racism and feeling more positively toward Black Americans (e.g., Hughes et al., 2007; Nelson, Adams, & Salter, 2013). At this point, we are merely speculating about possible tactics, and all that we can be certain of is that longitudinal studies examining the efficacy of strategies to bolster positive attitudes toward Blacks and policies that might benefit them are needed.

Conclusion

In sum, the results of our study were somewhat mixed. Consistent with predictions derived from racial triangulation theory (Kim, 1999), we found that White Americans' exposure to information consistent with the MMM was significantly correlated with perceiving Black Americans as low status as well as reduced support for affirmative action policies that could benefit Black Americans. However, the results of the univariate ANOVAs—that followed the multivariate ANOVA analysis—showed that only the effect of MMM salience on support for affirmative action policies for minorities was statistically significant. Furthermore, the effect sizes for MMM salience on both perceiving Black Americans as low status and opposition to broad affirmative action policies were quite small when evaluated using traditional benchmarks for interpreting effect sizes in the social sciences. Therefore, the results of this study should be interpreted with a considerable degree of caution. Additional studies examining how exposure to information consistent with the MMM can affect racial attitudes are required to have a better sense of just how reliable these findings are. Given the prevalence of the MMM in American society, it is vital that social psychologists conduct more experimental research on this topic.

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Comparison of Student Health and Well-Being Profiles and Social Media Use

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ABSTRACT. Recently, social media and social networking sites (SNS) have become increasingly accessible and popular, especially among college students. However, it remains unclear as to the effects associated with this increased SNS use on users' health and well-being (e.g., social, mental, physical). As such, the current study examined the well-being of different SNS users across 5 platforms (i.e., Facebook, Snapchat, Instagram, Marco Polo, LinkedIn) among college students ($N = 630$). Participants completed an online questionnaire assessing daily use of these SNS and health-related constructs in social, mental, and physical domains. Results suggest that users of image-based SNS (i.e., Snapchat) showed the most deficits and users of video-based (e.g., Marco Polo) and professional (e.g., LinkedIn) SNS had the best well-being profiles. However, regardless of SNS platform used, increased total daily SNS use was related to worse outcomes. As such, use of certain types of SNS platforms may be more harmful to user well-being than others, although causal directionality remains unclear.

Keywords: social media, social networking, well-being, health, technology

Recently, social media and social networking sites (SNS) have become increasingly accessible and popular, especially among college students. SNS include a variety of platform types ranging from general broadcast services (e.g., Facebook) to messaging services that send content directly to a specific recipient or group (e.g., Marco Polo). Moreover, SNS can be used virtually anywhere, anytime and by anyone, with a recent estimate that every 7 out of 10 Americans use social media regularly (Lenhart, 2018), which is especially high among young adults (i.e., between 18–30 years of age). Indeed, estimates indicate more than 88% of young adults are using SNS, are more likely to use multiple SNS, and are spending as many as 3 hours a day doing so (Lenhart, 2018; Wright et al., 2017). Although SNS offer improved capacities for communication around the world, recent research has highlighted negative effects on individuals' health and behavior (e.g., Huang, 2010; Twenge, Joiner, Rogers, & Martin, 2017).

Given these findings, there is an imperative need to investigate these relationships.

Although daily time spent on social media (e.g., Song et al., 2014; Wright et al., 2017) has been identified as a central factor, little is known about the relationships between specific SNS use (e.g., Facebook, Instagram) and health-related outcomes (e.g., physical, mental, social). Whereas some studies have suggested that SNS use is associated with health outcomes like subjective well-being (e.g., Stead & Bibby, 2017; Tromholt, 2016) or loneliness (e.g., Pittman & Reich, 2016), research has yet to shed light on unique well-being outcomes associated with specific SNS platform use, particularly among college students. As such, the purpose of the current study was to address this research gap by examining a range of health-related and well-being outcomes (e.g., depressive symptoms, loneliness, anxiety) among specific SNS platform (i.e., Facebook, Instagram, Snapchat, Marco Polo, LinkedIn) users in a college student sample.

Social Networking Sites and Health Among Young Adults

Despite the rapid changes in technology and SNS use during the past decade (Lenhart, 2018), it is already well-documented that SNS use, typically operationalized as daily time spent on SNS, is associated with numerous negative health-related outcomes (e.g., Song et al., 2014; Tromholt, 2016). According to Huang's (2010) displacement hypothesis, the availability and accessibility of SNS can seem a more convenient mode of human interaction and take time away from face-to-face interpersonal interactions. Indeed, social interactions through SNS could be more attractive initially but less satisfying and unable to fulfill personal needs due to their potential lack of authenticity, producing health and well-being deficits. As such, spending more time on SNS may foster an illusion that social needs are being met when these interactions may not supply all the benefits afforded by in-person interactions.

In support of this, the loneliness construct provides a strong example. Numerous studies have found a positive relationship between perceived loneliness and time spent on SNS (e.g., Song et al., 2014), especially among college students (e.g., Lou, Yan, Nickerson, & McMorris, 2012; Wright et al., 2017). This is rather perplexing considering that a major purpose of SNS is to connect socially with others, which should reduce perceptions of feeling alone or socially disconnected. However, this positive relationship between SNS use and loneliness lends support to the idea that SNS use may provide a more convenient, but less fulfilling or meaningful, medium for social interaction. Directional causality is still a point of debate (Lou et al., 2012), although it is likely bidirectional as those who are lonely seek out comfortable social interactions online and those who spend more time online are likely to withdraw from more traditional face-to-face interaction (Nowland, Necka, & Cacioppo, 2017).

Other well-being constructs related to SNS use, particularly within the young adult population, include depressive and anxiety symptoms, although studies vary in the strength of the relationship (e.g., Primack et al., 2017; Twenge et al., 2017). For example, in one study of over 500,000 U.S. adolescents (Twenge et al., 2017), those who spent more time on social media were more likely to report depressive symptoms and suicide-related outcomes than those who spent more time interacting with others directly (e.g., in-person social interaction, sports, attending religious services). Moreover, in

a large nationally representative sample of 1,787 U.S. young adults, those who reported using the highest number of social media platforms (7–11) were more likely to present both depressive and anxiety symptomology (Primack et al., 2017).

Finally, well-being (i.e., life satisfaction, mood), perceived stress, and overall health appraisals are related to SNS use. Not surprisingly, those who self-report spending more time on SNS each day typically also report lower well-being than those who spend less daily time on SNS (e.g., Stead & Bibby, 2017; Tromholt, 2016). This may be due to increased time on SNS taking time away from other activities that may engender improved subjective well-being such as exercise, productive pursuits (e.g., work, education), or direct social interactions. Related to anxiety, perceived life stress has been consistently linked to use of SNS (e.g., Vanman, Baker, & Tobin, 2018), and other studies have shown a positive correlation between poor physical health appraisal and symptomology with increased SNS use (e.g., Dibb, 2019). Taken together, these findings suggest major mental, social, and physical health disturbances coinciding with increased daily combined SNS use, and raise the question regarding effects of specific SNS on user health and well-being.

Specific Social Networking Sites and Health

The most recent Pew Research Center statistics on social media use in the United States (Lenhart, 2018) suggest that the most common SNS are Facebook (68%), Instagram (35%), Snapchat (27%), and LinkedIn (25%), which would suggest that daily use of these SNS would have a stronger potential for impact on health and well-being outcomes with discernable main effects. Moreover, categorization of SNS by the primary mode of communication has been helpful in prior investigations where the distinction has been drawn between those SNS platforms that are primarily text-, image-, or video-based (e.g., Pittman & Reich, 2016). Facebook, the most researched of all SNS, is primarily text-based and broadcasted to a wide audience of "friends." Increased Facebook use has been specifically linked to many health-related outcomes including loneliness (e.g., Song et al., 2014), low subjective well-being (e.g., Tromholt, 2016), poor health behaviors (e.g., Dibb, 2019), and high perceived stress (e.g., Vanman et al., 2018), although some studies suggest positive outcomes like emotional support (Ellison, Steinfield, & Lampe, 2007).

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Related to more image-based SNS like Instagram and Snapchat, studies have found contradictory findings with both negative and positive outcomes. For instance, in one study by Pittman and Reich (2016), Instagram and Snapchat use found improved subjective health outcomes for those who use these sites compared to text-based platforms (e.g., Facebook). They argued that this may be due to image based SNS offering a more intimate or “real” forum in which to interact, which produces less loneliness and improved subjective well-being. Behaviors on specific platforms may also make a difference, as Instagram interaction and browsing, in one study, was related to improved well-being compared to those who broadcasted and made social comparisons with others online (Yang, 2016). However, in a longitudinal study, Frison and Eggermont (2017) determined that Instagram browsing predicted subsequent depressive mood, suggesting a causal relationship between Instagram use and poor well-being.

Even less research has been conducted to date on the well-being of users of other professional SNS such as LinkedIn or those that are more video-based such as Marco Polo. However, one study found a clear reduction in depressive symptomology among those who used video chat SNS compared to e-mail, other social media, and instant messaging at a two-year follow-up (Teo, Markwardt, & Hinton, 2019). The researchers argued that this more “real-time” video interaction on SNS fosters a greater sense of connection with others and corresponding health benefits. However, it remains unclear what unique well-being outcomes may be associated with professional and video-based SNS.

Current Study

In sum, the current literature regarding the well-being of users of specific SNS, including college students, is limited in terms of a small quantity and mixed findings. Thus, this study was an exploratory examination of college student health-related and well-being outcomes between: (a) the specific SNS users and the respective daily use of each SNS (specific platform comparisons) and (b) users of these separate platforms compared to nonusers (user and nonuser comparisons). As such, we conducted a study among college students (typically heavy users of SNS), focusing on Facebook, Instagram, Snapchat, Marco Polo, and LinkedIn due to their popularity and contrasting characteristics.

Method

Participants and Procedure

Following institutional review board approval (on March 20, 2018), we investigated health-related and well-being outcome differences between different SNS among students at a large Intermountain West university using a questionnaire administered through an online survey platform (Provo, UT; Qualtrics). A convenience sample was solicited among students taking psychology courses at the university including General Psychology and Health Psychology. Upon providing their informed consent, student participants were offered either course or extra credit, and all participants were entered in a gift card drawing. Data were collected during the month of May 2018, resulting in a total of 630 participants who completed the online survey, which took a median of 11.3 minutes ($M = 64.10$; $SD = 426.72$). The sample was primarily comprised of young adults ages 18 to 23 with a mean age of 21.89 ($SD = 3.39$), where most participants were women (63%), White (82.8%), and single (56.6%).

Measures

Social media. Daily time spent on social media during the past month was assessed using a single item where participants indicated how much combined time they spent on all social media each day during the past month on a sliding scale from 0 to 10 hours. Participants identified SNS they used including Facebook, Instagram, Snapchat, Marco Polo, and LinkedIn (which were selected due to their popularity and contrasting differences within the general and this student population) and how much time they spent each day on each platform. Participants responded to six questions about their attitudes toward social media (Wright et al., 2017; $\alpha = .86$) on a 7-point Likert-type agreement scale (1 = *strongly disagree*, 7 = *strongly agree*) so that greater values indicated a stronger positive attitude toward social media in general.

Physical and mental well-being. Overall subjective health was evaluated using the single-item EuroQol Fifth Dimension (Kind, Brooks, & Rabin, 2005), so participants rated their own health on a Likert-type scale from 0 (*worst physical health*) to 100 (*best physical health*). Affect was captured using an 8-item measure of mood on a 5-point Likert-type scale (1 = *not at all*, 5 = *extremely*) regarding how much a mood adjective described their mood over the past month along positive (i.e., happy, alert, enthusiastic, relaxed; $\alpha = .68$) and negative (i.e., sad, irritable, bored, nervous; $\alpha = .66$) dimensions (see Wright et al., 2017). Acute depressive symptoms during the past week were assessed using the CES-D 5-item measure (Bohannon, Maljanian, &

Goethe, 2005) on a 4-point scale (1 = *rarely or none of the time*, 4 = *most or all of the time*; $\alpha = .76$). Anxiety over the past 3 months was assessed using a 4-item measure on a 5-point frequency Likert-type scale (1 = *never*, 5 = *very often*) from Butz & Yogeeswaran (2011; $\alpha = .85$). Satisfaction with life was captured using the 5-item Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) on a 7-point Likert-type agreement scale (1 = *strongly disagree*, 7 = *strongly agree*; $\alpha = .87$).

Social well-being. Using the same 7-point scale as the Satisfaction With Life Scale, social support measurement included eight items (Wood, Read, Mitchell, & Brand, 2004; $\alpha = .71$) and loneliness during the past month was assessed using the 3-item Short Loneliness Scale (Hughes, Waite, Hawkley, & Cacioppo, 2004) on a 5-point Likert-type frequency scale from 1 (*never*) to 5 (*all of the time*; $\alpha = 0.84$). Social integration (i.e., in-person social interactions) was examined using an 8-item measure adapted from Twenge et al. (2017) on a daily frequency scale ($\alpha = .73$). Finally, a single item examining subjective social standing among their college student peers was asked on a Likert-type scale from 0 (*worst standing in the student community*) to 100 (*best standing in the student community*).

Data Analysis

We reported the results from correlation and independent-samples *t*-test analyses and, given concerns about statistical significance being unsuitable as the sole statistic in reporting relationships, we included Cohen's *d* effect size coefficients, focusing on those that are $\geq .20$ (at least a small effect size).

Results

Participants reported a daily average time spent on all social media of 2.22 hours ($SD = 1.81$) and using an average of 2.64 ($SD = 1.01$) SNS (of the five surveyed). In order of popularity, Facebook was most used ($n = 552$, 91.1%), followed by Instagram ($n = 416$, 68.6%), Snapchat ($n = 391$, 64.5%), LinkedIn ($n = 137$, 22.6%), and then Marco Polo ($n = 102$, 16.8%). A large majority ($n = 513$, 84.7%) of respondents used more than one SNS, although 72 (13%) reported only using Facebook, seven (1.7%) only used Instagram, eight (2%) only used Snapchat, four (2.9%) only used LinkedIn, and two (2%) only used Marco Polo. Among Facebook users, daily average time spent on Facebook was 1.28 hours ($SD = 1.26$) or 55.90% of their total daily social media use time; Instagram users were 1.30 hours ($SD = 1.26$) or 50.58% of their total time; Snapchat users were 1.27 hours ($SD = 1.54$) or 50.20% of their total time; LinkedIn users were 0.37 hours ($SD = 0.41$) or 18.23% of their total time;

and Marco Polo users were 0.42 hours ($SD = 0.46$) or 19.27% of their total time. Finally, women spent significantly more time (hours) on social media daily ($M = 2.49$, $SD = 1.87$) than men ($M = 1.73$, $SD = 1.58$; $p < .001$) and, in particular, more time on Instagram ($M = 1.41$, $SD = 1.33$; $M = 0.93$, $SD = 0.96$; $p < .001$; respectively) and Snapchat ($M = 1.38$, $SD = 1.63$; $M = 0.94$, $SD = 1.24$; $p < .01$; respectively), suggesting greater exposure to social media in general and to image-based SNS than men.

Specific platform comparison analyses. Means, standard deviations, and comparisons between the specific SNS across all study variables using independent-samples *t* tests are presented in Table 1. LinkedIn users were significantly older than all other social media platforms and social media attitudes were the strongest for Instagram users compared to Marco Polo, LinkedIn, and Facebook users. Marco Polo users were significantly less lonely, exhibited fewer depressive symptoms, and had higher life satisfaction than Snapchat users. Finally, LinkedIn users reported feeling a significantly greater sense of social standing among their college student peers than Snapchat, Instagram, and Facebook users. As such, it seems Snapchat users, at least among college students, may be more susceptible to negative health-related outcomes and Marco Polo users may be capitalizing on positive health-related outcomes, compared to users of other social media.

As the next step in our analyses, Table 2 displays the correlations between daily time spent on a specific SNS and the study variables. In general, these results suggest that more daily time spent on social media is associated with more detrimental outcomes (e.g., loneliness, negative mood) and the number of social media platforms used was related to more positive outcomes (e.g., social integration, perceived peer support). Although more daily Facebook and Instagram use was related to lower well-being, greater use of LinkedIn was associated with improved well-being, and increased Snapchat and Marco Polo daily use was not systematically related to any of the health-related variables. Thus, whereas increased daily social media use is associated with negative outcomes, each of the specific platforms demonstrated unique associations.

Users and nonusers difference analyses. Next, we examined users of specific SNS in comparison to all those who did not use that platform in a series of independent-samples *t* tests (see Table 3). Our results of the analyses examining age, number of SNS platforms, and social media attitudes produced some significant ($p < .001$) results. First, compared to nonusers, Instagram and Snapchat users were each younger by about 2 years (both $d = .48$) and LinkedIn users were older by nearly 2 years ($d = .45$).

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TABLE 1

Means, Standard Deviations, and Comparisons Between Social Media Platform Users

Variable	Facebook	Instagram	Snapchat	LinkedIn	Marco Polo	Difference Between Platforms [†]	Cohen's <i>d</i> ^{††}
	<i>M</i> (<i>SD</i>)						
Daily Time Spent on App	1.28 (1.26)**	1.30 (1.26)**	1.27 (1.54)**	0.37 (0.41)	0.42 (0.46)	FB, IG, and SC higher than LI and MP	.99 to .75
Age	21.95 (3.29)	21.38 (3.23)	21.30 (3.01)	23.20 (4.42)*	21.93 (3.29)	LI was higher than all other platforms	.50 to .32
Social Media Attitude	3.32 (1.38)	3.56 (1.35)**	3.51 (1.33)**	3.20 (1.50)	3.19 (1.28)	IG and SC were higher than LI and MP	.28 to .24
Number of SNS	2.74 (0.99)	3.08 (0.79)	3.12 (0.79)	3.34 (1.05)**	3.56 (0.98)**	MP and LI had more than FB, IG, and SC	.83 to .24
Loneliness	2.74 (0.97)	2.72 (0.95)	2.79 (0.95)*	2.68 (1.01)	2.57 (0.93)	SC higher than MP	.23
Social Integration	0.33 (0.19)	0.35 (0.20)	0.35 (0.20)	0.31 (0.18)	0.32 (0.17)		
Peer Support	5.03 (0.87)	5.10 (0.82)	5.08 (0.83)	5.09 (0.80)	5.18 (0.74)		
Subjective Overall Health	77.68(14.82)	78.02(14.92)	77.59(15.25)	77.42(14.96)	79.65(14.06)		
Positive Mood	3.52 (0.66)	3.52 (0.66)	3.51 (0.66)	3.63 (0.65)	3.60 (0.63)		
Negative Mood	2.74 (0.75)	2.75 (0.75)	2.81 (0.77)	2.68 (0.80)	2.71 (0.71)		
Depressive Symptoms	9.09 (3.17)	9.20 (3.18)	9.43 (3.32)*	8.93 (3.16)	8.72 (2.99)	SC higher than MP	.22
Anxiety	2.94 (0.74)	2.95 (0.74)	3.01 (0.74)	2.87 (0.80)	2.86 (0.70)		
Life Satisfaction	5.02 (1.28)	4.98 (1.26)	4.89 (1.29)	5.08 (1.25)	5.18 (1.17)*	MP higher than SC	.24
Subjective Social Standing	57.63(24.14)	56.58(24.76)	55.90(24.52)	62.52(23.96)*	60.93(23.13)	LI higher than SC, IG, and FB	.27 to .20

Note. [†] Only those relationships from the independent-samples *t* tests that are statistically significant are presented in this column. If blank, no statistical difference was observed; ^{††} Effect size (Cohen's *d*) is interpreted as such: *d* > .20 is small, *d* > .50 is medium, *d* > .80 is large; A range of Cohen's *d* values are presented when multiple comparisons are evaluated; SNS = Social media and social networking sites, FB = Facebook, IG = Instagram, SC = Snapchat, LI = LinkedIn, MP = Marco Polo.

p < .05. ***p* < .01.

TABLE 2

Correlations Between Daily Time Spent on Each Social Media Platform and Psychosocial Variable

Variable	Entire Sample <i>n</i> = 606		Facebook <i>n</i> = 552	Instagram <i>n</i> = 416	Snapchat <i>n</i> = 391	LinkedIn <i>n</i> = 137	Marco Polo <i>n</i> = 102
	Daily SNS Time (hr)	Number SNS	Daily Time (hr)	Daily Time (hr)	Daily Time (hr)	Daily Time (hr)	Daily Time (hr)
<i>M</i> (<i>SD</i>)	2.22 (<i>SD</i> = 1.81)	2.64 (<i>SD</i> = 1.01)	1.28 (<i>SD</i> = 1.26)	1.30 (<i>SD</i> = 1.26)	1.27 (<i>SD</i> = 1.54)	0.37 (<i>SD</i> = 0.41)	0.42 (<i>SD</i> = 0.46)
Age	-.11**	-.11**	.03	-.15**	-.09	-.05	.01
Social Media Attitude	.48**	.29**	.22**	.31**	.26**	-.04	.14
Number of SNS	.25**	—	.00	-.02	.05	-.03	.06
Loneliness	.18**	.02	.15**	.14**	.10	-.22*	-.08
Social Integration	-.04	.12**	-.10*	.01	.07	-.07	-.03
Peer Support	-.03	.13**	-.03	-.05	-.01	.15	.15
Subjective Overall Health	-.08	-.03	-.07	-.08	.03	.14	-.04
Positive Mood	-.07	.03	-.09*	-.06	.04	.04	.14
Negative Mood	.18**	.05	.11*	.19**	.05	-.10	.20
Depressive Symptoms	.11**	.05	.10*	.08	-.02	-.20*	.11
Anxiety	.13**	.06	.11**	.15**	.03	-.20*	.10
Life Satisfaction	-.15**	-.03	-.08	-.10*	-.08	.16	.07
Subjective Social Standing	-.10*	.02	.00	-.06	.00	.02	-.02

Note. SNS = Social media and social networking sites.

p* < .05. *p* < .01.

Second, users of three platforms reported using significantly ($p < .001$) more social media platforms than those who did not use that specific platform, including Instagram ($d = 1.89$), Snapchat ($d = 1.78$), and Facebook users ($d = 1.38$). Third, regarding social media attitudes, users of Instagram ($d = .72$), Snapchat ($d = .53$), and Facebook ($d = .52$) reported significantly ($p < .001$) higher (more positive) attitudes regarding the importance of social media in their lives. Whereas some specific SNS users showed mostly beneficial well-being differences (i.e., Instagram, LinkedIn, Marco Polo), others displayed more detrimental well-being differences (i.e., Facebook, Snapchat) compared to nonusers of that specific SNS. Overall, Snapchat users seemed to exhibit the most detrimental outcomes, Facebook users trended toward detrimental outcomes, LinkedIn and Instagram users demonstrated the most beneficial outcomes with Marco Polo users trending toward beneficial outcomes, all compared to the respective SNS nonuser counterparts.

Discussion

The purpose of the current study was to address the current lack of information regarding how well-being and health-related outcomes may be linked to the use of different social media and networking sites (SNS) with an exploratory approach among a college student sample, which is a population known for high use of social media (Lenhart, 2018). Our results generally coincided with previous literature findings regarding outcomes associated with the increased daily use of SNS, but we also discovered unique well-being outcomes associated with the use of these specific SNS. Indeed, although increased daily time spent on social media and certain SNS were generally associated with more negative outcomes overall (e.g., loneliness, depressive symptoms, anxiety), these relationships varied according to different SNS platforms and characteristics. Interestingly, video-based and professional SNS platforms were related to improved well-being, although image-based and text-based SNS were not.

First, not surprisingly, daily use of SNS was positively related to social media attitudes and, regardless of the specific SNS used, was associated with more detrimental outcomes (e.g., loneliness, negative affect, anxiety, depressive symptoms), which coincides with many findings in the general literature (e.g., Song et al., 2014; Twenge et al., 2017; Wright et al., 2017). It may be that daily time spent on social media takes time away from other in-person interactions and is not as fulfilling for one's social health needs (Huang, 2010). However, contrary to findings among other young adult samples (e.g., Primack et al., 2017), the number

of SNS used was related to some positive health-related outcomes including social integration and perceived peer support. Among college students and those who use the Internet extensively, an online "presence" by having multiple SNS accounts may increase perceptions of peer acceptance and provide them with topics to discuss with peers during in-person interactions, particularly ones that help foster social (e.g., Facebook) and professional (e.g., LinkedIn) goals. Thus, social media, in this case, may provide a social foundation whereupon relationships with peers can be built and nurtured.

Second, video-based (i.e., Marco Polo) and more professional (i.e., LinkedIn) SNS demonstrated the strongest links to improved well-being. Indeed, the use of videography may promote feelings of social connection and improved well-being beyond typical text and still-frame images through a more authentic social experience (Teo et al., 2019). Furthermore, Marco Polo delivers a message to a specific recipient rather than a post to a general audience, which may foster additional improved well-being and limit unhealthy social comparisons. In fact, direct communication through social media

TABLE 3

Outcome	User $M(SD)$	Nonuser $M(SD)$	Δ	$t(df)$	d	Better?
Facebook						
Loneliness	2.74 (0.97)	2.51 (0.97)	+.23	1.71(604) [†]	.24	No
Subjective Health	77.68(14.82)	81.19(11.09)	-.35	1.69(604) [†]	.27	No
Instagram						
Social Integration	0.35 (0.20)	0.28 (0.17)	+.07	4.50(604) ^{***}	.38	Yes
Peer Support	5.10 (0.82)	4.88 (0.92)	+.22	3.04(604) ^{**}	.25	Yes
Snapchat						
Loneliness	2.79 (0.95)	2.61 (1.00)	+.18	2.18(604) [*]	.44	No
Social Integration	0.35 (0.20)	0.28 (0.17)	+.07	4.19(604) ^{**}	.38	Yes
Negative Affect	2.81 (0.77)	2.60 (0.72)	+.21	3.28(604) ^{**}	.28	No
Depressive Symptoms	9.43 (3.32)	8.50 (2.82)	+.93	3.65(604) ^{***}	.30	No
Anxiety	3.01 (0.74)	2.79 (0.77)	+.22	3.39(604) ^{**}	.29	No
Life Satisfaction	4.89 (1.29)	5.22 (1.24)	-.33	3.00(603) ^{**}	.26	No
LinkedIn						
Positive Affect	3.63 (0.65)	3.49 (0.67)	+.14	2.10(604) [*]	.21	Yes
Subjective Social Status	62.52(23.96)	55.83(24.48)	+.69	2.83(604) ^{**}	.28	Yes
Marco Polo						
Loneliness	2.57 (0.93)	2.75 (0.98)	-.18	1.71(604) [†]	.20	Yes
Peer Support	5.18 (0.74)	5.00 (0.88)	+.18	1.84(604) [†]	.22	Yes

Note. Δ represents difference in user of platform relative to nonusers; Effect size (Cohen's d) is interpreted as such: $d > .20$ is small, $d > .50$ is medium, $d > .80$ is large.

[†] $p < .10$. ^{*} $p < .05$. ^{**} $p < .01$. ^{***} $p < .001$.

may improve perceived social support, mood, and cognition through a more realistic social interaction instead of fostering unrealistic comparisons through views of others' posts or comments. Similarly, the motivation to engage with someone directly through video or, in the case of LinkedIn, using an SNS for more professional reasons (e.g., locating a job, speaking with a colleague) rather than for social comparisons, may elicit improved well-being because entertainment or comparison motives are not as salient.

On the other hand, the relationships between text-based (i.e., Facebook) and image-based SNS with negative health-related outcomes (especially Snapchat) suggest a unique effect of these specific platforms on user well-being. Compared to users of other SNS, Snapchat users exhibited greater loneliness, depressive symptoms, anxiety, and lower satisfaction with life, in general, suggesting that there may be something unique to the use of Snapchat or to Snapchat users, in general, that may link them to these outcomes. These findings are contrary to the findings of Pittman and Reich (2016) who found less depressive symptomology for image-based SNS users (i.e., Instagram). However, one potential interpretation, consistent with social comparison orientation (Buunk & Gibbons, 2006), is that image-based communications may enable social comparisons more readily and, given that people generally post overly positive or "picture perfect" types of images (Cramer, Song, Drent, 2016; Yang, 2016), this may activate negative emotions and cognitions within the users. Moreover, young women in our sample reported greater exposure to image-based SNS, making gender characteristics likely influential on these results. Indeed, young women are more likely to be held to higher social standards of appearance and achievement (MacNeill & Best, 2015) and, as such, experience more negative reactions to image-based platforms where unrealistic and idealized images of women are portrayed and viewed (Sypeck, Gray, & Ahrens, 2004). It is difficult to know, however, since Instagram, another primarily image-based SNS, was associated with some poor health-related outcomes, but also manifested some positive health relationships (i.e., social integration, peer support) compared to other SNS platforms.

Finally, it is important to note two alternative explanations for these observations. First, Snapchat users were younger than users of all other SNS, suggesting that this may have produced well-being deficits because younger people tend to be more unsure and anxious about their future and less socially stable, especially within college settings (e.g., Sears, 1986). However, Instagram users were significantly younger than other users and did not manifest unilateral negative outcomes. Second, it

is possible that those who have preexisting poor health profiles are drawn to certain SNS such that those who desire entertainment, have poor health, or desire social comparisons to others are drawn to image-based platforms like Snapchat and those who are drawn to video-based SNS (e.g., Marco Polo) may already have superior health.

Potential Limitations and Future Research Directions

Implications of this study should be considered in light of potential limitations. First and foremost, the cross-sectional design of this study limits drawing any causal conclusions. However, our large sample did enable us to detect some clear relationships between well-being and specific SNS use. Second, estimates provided of time spent on each SNS could overlap with time spent using other SNS, which limits our ability to link certain health-related outcomes to specific SNS use. Third, we did not query motivations for SNS use, which can impact well-being (e.g., Yang, 2016) and may be an influential factor. Fourth, SNS usage was determined via a single item with the potential for retrospective self-report bias across a 30-day average estimation, and the relatively large number of *t* tests conducted raises concern for Type I error (false positive), although we focused only on those with at least a small effect size ($d \geq .20$). Finally, we only examined five specific SNS, used a college student sample, and might not have included influential control variables, which may limit generalizability.

Future research should investigate the directionality of the relationship between health and SNS use by well-constructed longitudinal, controlled, and experimental research designs. Different populations should be investigated such as adolescents, older adults, and children who are beginning to use social media to ascertain whether relationships for college students are similar or different for these other populations. Building on the idea that motivations for SNS use are an important factor, examining SNS use motivations and additional SNS platforms across an international domain may yield additional interesting cultural contrasts and similarities. Finally, future studies could examine additional health outcomes, especially objectively measured outcomes (e.g., BMI, blood pressure), which are important health indicators within the college student population (e.g., Wright et al., 2018).

Conclusion

In conclusion, the current study sheds light on the important issue of technology use and health, focusing on differences between types of social media and networking sites across a range of health and well-being outcomes. In sum, the main

conclusions drawn from these findings are that increased daily use of social media has a negative impact on the user well-being, image-based social media (i.e., Snapchat) use is associated with more negative health-related outcomes, and video-based (i.e., Marco Polo) and professional social media (i.e., LinkedIn) use are related to more positive outcomes. As technological advances continue to develop, this area of research inquiry will remain of great importance to researchers and practitioners. As such, it is our desire and hope that future research can build on this to provide additional and valuable understanding of the complicated relationship between technology use and health.

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Belonging and Marital Perception Variances in Emerging Adults With Differing Disability Identities

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ABSTRACT. Emerging adulthood is a developmental period during which adults begin making choices regarding love, work, and partnerships. This experience may be different for those with a disability, depending on how they self-identify. The present study was the first to examine differences in belonging and the importance of marriage in those who self-identify as disabled, those who have a disabling impairment but do not self-identify, and those who do not have a disability. This study examined participants' general sense of belonging, as well as their need to belong, which refers to the feeling that belonging is important. Emerging adults across 32 institutions between the ages of 18 and 29 ($N = 2,016$) completed the Emerging Adults Measured at Multiple Institutions 2 survey including measures of disability identity, sense of belonging, need to belong and the importance of marriage. Results indicate that emerging adults who self-identify as disabled report a lower sense of belonging and a higher need to belong than those without a disability. Additionally, emerging adults with a disabling impairment valued marriage less than those without a disability. These results suggest that disability identity is related to differing levels of confidence in marital relationships, sense of belonging, and need to belong. These findings could be considered by clinicians who work with emerging adults with disabling impairments, who may feel limited in these areas.

Keywords: emerging adulthood, belonging, marriage, EAMMi2



Open Data and Open Materials badges earned for transparent research practices. Data may be accessed from the Journal of Open Psychology Data at <https://doi.org/10.5334/jopd.38>. Materials are available at <https://osf.io/te54b/>.

Emerging adulthood is a developmental period that is not adolescence nor adulthood, but rather a separate period of change and exploration (Arnett, 2000). During this time, emerging adults consolidate aspects of their identity to begin psychosocially establishing their adult self (Arnett, 2000). According to Erikson, Paul, Heider, and Gardner (1959), young adulthood is a time for exploring identity and developing a sense of intimacy with others. Emerging adults' pursuit of identity consolidation and relationships with others have been associated

with increased feelings of belonging and improved quality of life (Arnett, 2000; Blatt & Luyten, 2009; Montgomery, 2005; Schwartz, Côté, & Arnett, 2005).

Few studies have examined how identity formation occurs in emerging adults with disability. According to the World Health Organization (2011), approximately 15% of people worldwide experience some sort of disability, including a disabling impairment or activity limitation. Most research has suggested that emerging adults with disabilities experience a delay in achieving markers

of adult development, including educational, vocational, and social markers (Holmbeck & Devine, 2010; Verhoof, Maurice-Stam, Heymans, & Grootenhuis, 2012). This delay in adult development may be related to limitations which may inhibit independent functioning (Van Naarden Braun, Yeargin-Allsopp, & Lollar, 2006). In addition to developmental limitations, emerging adults with disabilities are at greater risk for discrimination and prejudice in the workplace, poor social adjustment, and internalization of symptoms (Hombeck & Devine, 2010). Similarly, when compared to their nondisabled peers, this group of emerging adults presents higher rates of symptoms of anxiety, depression, withdrawal, and somatic complaints (Dykens, Shah, Sagun, Beck, & King, 2002; Hombeck & Devine, 2010; Lindstrom, Kahn, & Lindsey, 2013).

Rather than focusing on disability as a deficit, psychologists are embracing an emphasis on the role of social and environmental factors in defining disability (American Psychological Association, 2012; Olkin & Pledger, 2003). To examine these social factors, one must consider disability identity, and whether people claim disability status as part of their identity (Shakespeare, 1996). In line with social identity theory, disability identity denotes a recognition and acceptance that one belongs to this social group (Tajfel & Turner, 1979). Previous research has suggested that as many as 74%–82% of emerging adults with a disabling impairment may not self-identify as a person with a disability (Chalk, 2016; Nario-Redmond, Noel, & Fern, 2013). Given that such a substantial portion of emerging adults with a disability do not self-identify as a person with a disability, it is likely that many emerging adults with disability are being excluded from research samples.

The present study explores challenges for those emerging adults with a disability, whether or not they self-identify as disabled. Research has suggested that individuals who experience impairments but do not identify as disabled may be experiencing a level of dissonance, and that identifying with one's disability may provide a level of protection against the stressful effects that the disability may pose (Chalk, 2016). By identifying with the disability, individuals may also be protecting themselves from a lowered self-esteem because their more clearly defined identity may allow for the formation of advocacy groups and more achievable relationships with peers (Chalk, 2016).

Sense of Belonging and Need to Belong

Research has suggested that young adults and adolescents who have an overall higher sense of belonging experience more positive psychological and physical outcomes (Begen & Turner-Cobb, 2015). In undergraduate college students, sense of belonging is positively correlated with academic motivation, self-efficacy, and positive mental health (Freeman, Anderman, & Jansen, 2007; Stebleton, Soria, & Huesman, 2014). In addition, low social isolation is predictive of subjective well-being, especially in emerging adults with disabilities (Yurkevitch, Berslav, & Araten-Bergman, 2015). These positive benefits that are associated with an increased sense of overall belongingness suggest that there may be some protection created by these social interactions.

Unsurprisingly, many researchers have found that emerging adults with disabilities feel as if they generally belong less than their peers (Bramston, Brugerman, & Pretty, 2002; Hall, 2004). This lesser sense of belonging in those with a disability may be related to the increased levels of social rejection that they experience (Chen & Shu, 2012; Salmon, 2013). Although students with disabilities report more difficulty connecting with nondisabled peers, they also report an eased connection with those who also report having a disability, due to their common experiences of being socially isolated and suppressed by stigma (Salmon, 2013). This social isolation may be related to identifying with one's disability, as those who identify as disabled are isolated from their nondisabled peers, potentially as a result of the stigma surrounding disability.

Although those with disabilities do connect with peers of similar disability status, it appears that their opportunities for social connection are more limited than those of nondisabled peers. When seeking social relationships outside the disability community, individuals with a disability report turning to teachers, coaches, and counselors more frequently than their peers (McMahon, Parnes, Keys, & Viola, 2008). Relationships with faculty members on college campuses, as well as involvement in clubs and organizations, provide opportunities to increase sense of belonging, but these are limited to those who pursue higher education (Doubt & McColl, 2003; Jones, Brown, Keys, & Salzer, 2015). The more constricted social network among emerging adults with a disability may be related to the increased difficulty with feelings of belongingness.

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Those who feel that they generally belong on a daily basis often experience a lessened overall need to belong. Need to belong is defined as the need to form and maintain lasting, positive interpersonal relationships (Baumeister & Leary, 1995). Although no studies could be located that have examined need to belong in emerging adults with disabilities, limited findings have suggested an inverse relationship between need to belong and sense of belonging in nondisabled emerging adults (Pillow, Malone, & Hale, 2015). Adults who have a higher need to belong experience lower sense of belonging, lower life and relationship satisfaction, and higher loneliness (Mellor, Stokes, Firth, Hayashi, & Cummings, 2008; Pillow et al., 2015). Because emerging adults who reported having a disability also reported a lower sense of belonging, it was expected that they would also experience a greater need to belong due to the inverse relationship between the two (Pillow et al., 2015).

Importance of Marriage

A decreased sense of belonging, combined with a difficulty in maintaining interpersonal, meaningful relationships, may suggest that the search for a romantic partner or pursuit of a marriage would be more difficult for those who experience some level of disability. Although no studies have specifically addressed this issue in emerging adulthood, some studies have suggested that the marital trends and preferences do differ in those with a disability (Goodall et al., 2018). With an already increased vulnerability to poorer mental health, increased social anxiety, lessened self-efficacy, and a lesser sense of belonging, those with a disability may find it difficult to establish a more intimate relationship, thus potentially influencing the perceived value of marriage.

During this critical time of development, emerging adults begin establishing their preferences regarding love, work, worldviews, and hobbies (Arnett, 2000). At large, no matter one's disability status, emerging adults' view of marriage seems to have shifted, as the median age of first marriage is now approximately 29.2 years for men and 27.1 for women (U.S. Census Bureau, 2017). This delay in marriage may be explained by a variety of factors including nonintact families of origin, parents' attitudes toward marriage, financial concerns, and increased educational aspirations (Cherlin, 2009; Cui, Wickrama, Lorenz, & Conger, 2011; Li, 2014; Muraco & Curran, 2012; Plotnick, 2007; Willoughby, 2010; Willoughby, Carroll, Vitas, &

Hill, 2012; Willoughby, Olson, Carroll, Nelson, & Miller, 2012). Despite limited background research in this area, it was hypothesized that challenges with belonging and social connection experienced by emerging adults with disability may be associated with these individuals' views of marital importance, rendering marriage as less important to those with a disability.

The Present Study

The present study examined the differences in overall sense of belonging, need to belong, and importance of marriage in those who have a disability and those who do not. Additionally, it examined a third group of emerging adults: those who have a disabling impairment but do not self-identify as disabled. As previously mentioned, this third group of individuals is often omitted from research because these individuals do not identify with their disability (Chalk, 2016; Nario-Redmond et al., 2013). By assessing both disability identity and the presence of a disabling impairment, this study aimed to capture how participants identify with their disability.

Based on the existing literature, it was hypothesized that those with no disability would have a greater sense of belonging and lower need to belong than those who have a disability, whether or not they self-identify as disabled. It was also hypothesized that those who have a disability would view marriage as less important (and relatively less important, when compared to hobbies, leisure activities, and career development) than those who do not have a disability. Significant differences were expected between those who do and do not self-identify with their disability, regarding the importance of marriage.

Method

Participants

Data for this project were collected through a multicampus collaborative project investigating dimensions of emerging adulthood (Grahe et al., 2018). A full description of the sample, measures, and data gathering procedures is included in the Open Science Framework (OSF) project page (<https://osf.io/te54b/>). Data were collected by researchers at 32 institutions, including 29 sites in the United States and one each in England, Grenada, and Greece. Each recruitment site received approval from the appropriate institutional review board, and all data collection procedures followed American Psychological Association ethical

standards. The convenience sample was recruited via various methods including university classes, university participant pools, honor society chapters, e-mail, and social media. All surveys were completed online.

The full Emerging Adults Measured at Multiple Institutions 2 (EAMMI2) sample included over 3,200 respondents who were recruited with no mention of disability. It was important to recruit without mentioning disability in order to ensure that those who do not self-identify as disabled would participate in the study. Of the total respondents, only 2,014 reported their level of disability identification; therefore, only those respondents were included in the analyses. If a respondent's self-reported age did not fall within the predetermined age range of emerging adulthood (18–29 years), they were excluded from analysis. The mean age of respondents was 20.26 years ($SD = 2.28$). Most of the sample (73.6%, $n = 1,483$) identified as women, with 25% ($n = 504$) identifying as men, and 1.4% ($n = 29$) indicating another gender identity (i.e., nonbinary). Most participants (60.4%, $n = 1,218$) identified as White/European American, with the remainder identifying as African American (8.1%, $n = 163$), Hispanic (10.5%, $n = 212$), Asian/Pacific Islander (6.8%, $n = 137$), Native American (0.4%, $n = 8$), or other (3.8%, $n = 76$). The remaining participants identified as multiracial (10%, $n = 201$). Most of the sample (94.1%, $n = 1,897$) had attended some college, and most (84.8%, $n = 1,710$) were currently in college. Of the participants, only 6.4% ($n = 129$) stated that they were married, and 85.5% ($n = 1,723$) stated that they were unmarried.

Measures

As part of the online EAMMI2 survey, participants completed measures assessing markers of adulthood, dimensions of emerging adulthood, political views, well-being, self-esteem, perceived esteem, mindfulness, belonging, self-efficacy, social support, social media use, transgressions, personality, disability, somatic symptoms, stress, importance of marriage, and demographics. All participants completed all measures in one survey, which lasted approximately 30 minutes. Measures were presented to each participant in a fixed order. Only the following measures were included in this study.

Need to belong. Participants completed the 10-item Need to Belong Scale by rating items addressing their need to belong to a group (Leary, Kelly, Cottrell, & Schreindorfer, 2013). Participants used a 5-point Likert scale, from 1 (*strongly disagree*)

to 5 (*strongly agree*), to indicate their level of agreement with each of the 10 items. Items included statements such as "I want other people to accept me" and "I have a strong need to belong." Higher scores indicated a greater need to belong.

Sense of belonging. Participants used a 5-point Likert-type scale, from 1 (*not at all*) to 5 (*very much*), to rate their current sense of belonging based on a single item, "I feel like I belong." This one-item assessment was based on the Belonging subscale of the Basic Social Needs Scale (Zadro, Williams, & Richardson, 2004). No reference group was provided so that participants would rate their overall sense of belonging rather than a sense of belonging to a particular group.

Disability identity. Participants first completed a dichotomous item asking whether they identify as disabled, in order to determine their disability identity. Subsequently, participants were asked to state whether they experience a disabling impairment in any of six categories (e.g., physical, sensory, learning psychiatric, chronic health, or other). Participants responded "yes" or "no" to each category of disability and were then categorized into three groups accordingly. The disability identity group refers to those who had a disability and identified as disabled. The disability impairment group includes those who had a disabling impairment but did not identify as disabled. The no disability group includes those who reported no disabling impairment or disability identity. This methodology has been used in recent studies to more clearly differentiate the groups (Chalk, 2016; Nario-Redmond et al., 2013).

Of the participants in this study, 163 (8%) self-identified as a person with a disability, and 1,853 did not self-identify as having a disability (92%). Participants indicated that they experience disabling impairments in the following categories: psychiatric (13.6%, $n = 275$), learning (6.9%, $n = 140$), chronic health (4.3%, $n = 86$), physical (3.9%, $n = 79$), sensory (3.8%, $n = 77$), or other (2.8%, $n = 57$). Some participants (6.8%, $n = 138$) indicated that they experience a disabling impairment in multiple areas. Of those who reported having any disabling impairment ($n = 521$), 31.2% ($n = 163$) self-identified as disabled, and 68.7% ($n = 358$) did not self-identify as disabled. This ratio is consistent with the findings from other samples of emerging adults (e.g., Chalk, 2016).

Importance of marriage. A single-item scale (derived from a longer scale) was used to determine the perceived importance of marriage (Willoughby,

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Hall, & Goff, 2015). The item asked participants to rate how important getting married is to them. Participants rated their responses on a 5-point Likert-type scale ranging from 1 (*not important at all*) to 5 (*very important*).

Relative importance of marriage. To determine the relative importance of marriage, participants were asked to assign percentage values (totaling 100%) to four listed centralities: marriage, parenting, career, and personal/leisure hobbies. The percentage values assigned to "marriage" were compared to the values assigned to other centralities in order to examine the potential differences in the value of marriage, relative to other aspects of human development (Hall & Willoughby, 2016; Willoughby et al., 2015).

Markers of adulthood. Participants self-rated their achievement of selected markers of adulthood using the Markers of Adulthood Scale (Arnett, 1997, 2001). To determine the number of participants who were married or unmarried, researchers examined only the marker pertaining to the individual's marital status. Participants used a 3-point scale (*yes, no, or unsure*) to indicate whether they are married ($N=1,723$).

Results

A one-way Analysis of Variance (ANOVA) revealed a significant difference in sense of belonging based on disability identity, $F(2, 2011) = 31.71$, $h^2 = .031$, $p < .001$. Levene's test revealed that the assumption of homogeneity of variances was violated for sense of belonging, $F(2, 2011) = 10.67$, $p < .001$. Therefore, the Games Howell post hoc test was used. As reflected in the table of means (see Table 1), those who self-identified as disabled reported a lesser sense of belonging than those with no disability ($d = 0.59$, $p < .001$) and those with a disabling impairment ($d = .33$, $p = .001$). Participants with a

disabling impairment reported a lesser sense of belonging compared to those with no disability ($d = .25$, $p < .001$).

A one-way ANOVA also revealed a significant difference in participants' need to belong based on disability identity, $F(2, 2011) = 4.63$, $h^2 = .005$, $p = .01$. Due to unequal sample sizes, the Games Howell post hoc test was used. As reflected in Table 1, those who self-identified as disabled reported a higher need to belong than those with no disability ($d = .55$, $p = .03$). No other group differences were significant.

A one-way ANOVA revealed a significant difference in participants' perception of the importance of marriage, based on disability identity, $F(2, 2009) = 6.95$, $h^2 = .003$, $p = .001$. Games Howell post hoc tests revealed that those who reported having a disabling impairment viewed marriage as being less important, overall, than those who did not have a disability ($d = .22$, $p = .001$). However, there were no significant differences between those who self-identified as disabled and those with no disability.

Last, a one-way ANOVA revealed a significant difference in the relative importance of marriage based on disability identity, $F(2, 2009) = 3.52$, $h^2 = .007$, $p = .03$. Games Howell post hoc tests indicate that those who reported having a disabling impairment viewed marriage as being less important when compared to career, parenting, and hobbies, than those who did not have a disability ($d = .14$, $p = .04$). However, those who self-identified as disabled did not differ significantly in their relative perception of marriage when compared to those with no disability or those who have a disabling impairment.

Discussion

Emerging adults who self-identified as disabled had a lower sense of belonging than those who reported having a disabling impairment and those who did not have a disability. This finding is consistent with the literature; many researchers have suggested that those with a disability experience higher levels of social rejection and isolation from nondisabled peers (Chen & Shu, 2012; Salmon, 2013). For those who self-identify with their disability, this decreased sense of belonging amongst peers could potentially lead them toward more professionally driven relationships with their teachers, coaches, and counselors, which may delay searching for a mate.

Emerging adults who did not have a disability reported a significantly lower need to belong than those who self-identified as disabled. Again, these findings are consistent with the literature because

TABLE 1

Descriptive Statistics for the Full Sample and by Disability Identity

Dependent Variable	Disability Identity ($n = 163$)	Disabling Impairment ($n = 358$)	No Disability ($n = 1493$)	Full Sample ($n = 2014$)
	$M(SD)$	$M(SD)$	$M(SD)$	$M(SD)$
Need to Belong	3.41 (0.77)	3.35 (0.69)	3.26 (0.73)	3.29 (0.72)
Sense of Belonging	3.07 (1.18)	3.42 (1.03)	3.67 (0.96)	3.58 (1.01)
Importance of Marriage	3.63 (1.19)	3.46 (1.14)	3.70 (1.08)	3.65 (1.10)
Relative Importance of Marriage	25.25(18.72)	24.80(20.12)	27.58(19.64)	26.90(19.68)

they suggest that there is an inverse relationship between sense of belonging and need to belong (Pillow et al., 2015). Those who report feeling like they belong among peers find ease in forming and maintaining positive, peer-to-peer interpersonal relationships (Baumeister & Leary, 1995). This increased simplicity in developing interpersonal relationships for those with no disability might yield a less strenuous search for a mate, possibly making the idea of marriage more attractive. However, given the correlational nature of the data, causal interpretations should be considered hypotheses for future research.

Some previous research has suggested that identifying with one's disability may be protective for self-esteem (Chalk, 2016). However, the present study suggests no difference in sense of belonging in emerging adults with a disability based on whether they self-identify as disabled. The findings of Raver, Murchake, and Chalk (2018) suggest that identifying with one's disability is only associated with positive outcomes if one maintains a positive disability identity, a positive view of oneself as a person with a disability (Bolton & Brookings, 1998). It may be that there is no significant difference in belonging based on disability identity, because this identity might have a positive or negative valence for different participants.

Those who identify as disabled report a greater need to belong than those with no disability. A higher need to belong has been linked with lower relationship satisfaction and higher rates of loneliness (Mellor et al., 2008; Pillow et al., 2015). This, combined with the increased levels of social vulnerability, may be related to the delay in achieving markers of adulthood in this group (Arnett, 2000).

Those who reported having a disabling impairment viewed marriage as being less important, overall and relative to career/parenting, than those who did not have a disability, although the effect size is small. Emerging adults with disabling impairments report lower levels of independence than their non-disabled peers, which may be associated with decreased confidence about functioning with a marital partner and decreased interest in pursuing marriage (Van Naarden Braun et al., 2006). This lower perceived value of attaining a marital partnership may also be related to delays in achieving markers of adulthood, including economic instability, in those with a disabling impairment (Arnett, 2000). Furthermore, research has suggested that emerging adults with a disabling impairment experience greater benefits from peer and mentor support, rather than marital partner support (McMahon et

al., 2008). Any of these factors might contribute to the decreased importance of marriage in this group. However, findings should be interpreted with caution because the effect size was modest.

Limitations

This study was one of the first to examine the relationship between disability identity and the importance of marriage. Results suggest differences in sense of belonging, need to belong, and marital preferences between those who identify with their disability and those who do not.

It is important to consider these findings in light of the study's limitations. Due to the large sample size of the EAMMI2, some significant findings had low effect sizes, which are noted throughout the discussion. Given the novel nature of the topic, these findings are important but should be interpreted in light of these effect sizes.

Furthermore, several limitations arise from the nature of the EAMMI2 collaborative project. First, because this study utilized a pre-existing data set, we were not able to select the measures for key variables. For this reason, sense of belonging was assessed using a single-item scale, limiting this variable to a direct measure of self-identified belonging. To more comprehensively assess belonging, researchers should consider using a multi-item scale such as the Basic Social Needs Scale (Zadro, Williams, & Richardson, 2004). By doing so, researchers can examine various aspects of belonging because this assessment includes social acceptance by others, social networks, and levels of social independence. Additionally, due to the limited number of items that could be included in the EAMMI2, this study relies on a single item to assess the perceived importance of marriage. Future studies should use a more comprehensive measure of the centrality of marriage (e.g., Willoughby et al., 2015).

This study is also limited by the lack of diversity in the sample. Most respondents were college students, which is not representative of all emerging adults because participants who are in college have already overcome some barriers to achieving markers of adulthood. Due to the improved nature of college campus disability services, the experience of a college student with a disability or disabling impairment is likely unique, and therefore limits the generalizability of these findings. Additionally, most participants identified as White or European American, thus limiting the generalizability to persons of color. Future studies should take the necessary steps to increase the diversity of the sample by including a more educationally and racially diverse participants with varying disability identities.

Implications

Although this study is limited, the findings shed light on the differing preferences of emerging adults with disabling impairments. Additionally, this study allows researchers to see the significant differences in sense of belongingness across varying disability statuses during emerging adulthood. This study further solidifies that there is a relationship between disability status and belonging. Furthermore, findings suggest differing social goals, attainments, and preferences between emerging adults with differing disability identities.

Because those who identify as disabled feel that they belong less than their nondisabled peers and have a greater need to belong, clinicians should consider the potential benefit of developing social skills to aid in establishing and maintaining social connections with other emerging adults of differing disability statuses. Cognitive-behavioral therapy techniques that target the negative connotations and stigmas surrounding disability could be incorporated by practitioners to empower individuals to develop long-lasting and more intimate relationships with peers. If such clinical practices can increase feelings of belongingness and decrease need to belong, the idea of pursuing a marital relationship may feel more attainable for emerging adults with disabling impairments.

Although these findings are strictly correlational, they show a clear relationship between belongingness, the importance of marriage, and disability identity during emerging adulthood. Results demonstrate that differences exist between those who self-identify as disabled and those who have a disabling impairment, suggesting that future studies should include this differentiation. By developing an understanding of the correlates of identifying with one's disability, clinicians can assist emerging adults with disability to navigate this challenging developmental period.

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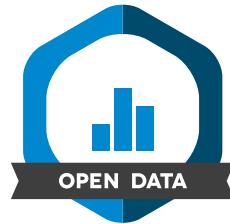
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The Effects of Conversation Arousal Level on Attention Processes

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ABSTRACT. The current study investigated how arousal level during phone conversations affects specific attention processes (i.e., executive, orienting, phasic alertness, and vigilance). Participants engaged in 1 of 3 conversation conditions (i.e., no conversation, low emotional arousal, and high emotional arousal) while completing either a spatial cueing task (Exp. 1) or a Stroop Test (Exp. 2). Neither orienting nor phasic alertness were affected by conversation, but both overall reaction time (RT) and intraindividual variability (vigilance) increased when the conversation was introduced, $t(49) = 5.01, p = .001, r^2 = .34$, and $t(49) = 2.44, p = .009, r^2 = .11$, respectively. Stroop Test RT was significantly increased by conversation when attentional demands were low (congruent), $t(50) = 2.22, p = .031, r^2 = .09$, but not when attention demands were high (incongruent). Level of conversation arousal did not moderate these effects. Our findings suggest that competition for executive attention by the task and by the conversation are dynamic. This has implications for safe cell phone use while performing everyday activities (e.g., driving, work, studying).

Keywords: conversation arousal, attention processes, executive attention, orienting alerting, phasic alerting



Open Data badge earned for transparent research practices. Data available at <https://osf.io/q2xs5/> and <https://osf.io/w2mbp/>.

Over the last several decades, abundant evidence has emerged to suggest that cell phone use interferes with the performance of many everyday tasks. Studies have found that a growing number of driving, pedestrian, and workplace accidents can be attributed to the increasing number of people talking and texting on smartphones (see Caird, Willness, Steel, & Scialfa, 2008; Nasar & Troyer, 2013). However, questions do linger about the specific mechanisms that underlie the detrimental effect of phone conversation on attention processes. This article examines one potential risk factor that has been posited by several authors, that conversations on the phone interfere with attention, which in turn interferes with cognition and behavior in the real

world (see Horrey & Wickens, 2006; Hyman, Boss, Wise, McKenzie, & Caggiano, 2010).

Dating back to James (1890), researchers have conceptualized attention as the ability to process information that is relevant to the task at hand and to ignore irrelevant information. Specific attention processes underlie people's ability to perform different tasks. There are many attentional processes involved in everyday activities, such as driving on a crowded highway, crossing a busy intersection, or operating a dangerous factory machine (Nobre & Kastner, 2014; Pashler, 1998; Posner, 2012). Posner and Petersen's (1990; Petersen & Posner, 2012) network model involves three of these processes: executive attention, orienting, and phasic alertness.

Executive attention may come closest to

James's definition: purposefully selecting important information, and inhibiting responses to competing information. For example, when driving on a highway, these processes enable people to attend to the distance between their car and the car ahead of them while ignoring the herd of cows they are passing.

The orienting network allows people to disengage their attention from one thing (e.g., the car ahead) and shift their attention to something else (e.g., the herd of cows; Posner & Petersen, 1990). Sometimes, people shift their attention voluntarily (endogenous orienting), and sometimes, their attention is automatically shifted by some stimulus (exogenous orienting; Jonides & Yantis, 1988; Posner, 1980). Because automatic shifts can be problematic, executive attention is required to inhibit or at least swiftly correct for unwanted shifts. In the earlier example, when the drivers' attention is exogenously reoriented by the herd of cows, they may endogenously reorient their attention back to the car ahead.

Finally, the alerting system allows the drivers to respond to stimuli quickly. These processes include phasic alertness (i.e., the automatic state of alertness triggered by the sudden appearance of a stimulus, usually lasting seconds at most) and tonic alertness, (i.e., a longer lasting state of arousal that must be maintained by the individual; Posner & Petersen, 1990). When driving, the sudden appearance of brake lights ahead is likely to evoke phasic alertness in drivers automatically. However, drivers will need to work to maintain a state of tonic alertness (sometimes referred to as vigilance) for the long, late-night drive home from work. There is evidence to suggest that these vigilance processes involve both the alerting system and executive control (Petersen & Posner, 2012).

Attention researchers have used a variety of experimental paradigms to isolate each of these processes in the laboratory, and more recently this research has begun to reveal the dynamic and interactive nature of these systems (Petersen & Posner, 2012). The study of how these specific attention networks impact behavior outside of the laboratory presents a greater challenge. It is one thing to examine how cell phone use impedes reaction times (RTs) to brake lights or distance maintenance while driving on an obstacle course or in a driving simulator. It is another to examine how cell phone use might impact executive attention, orienting, or phasic alertness, which in turn might affect RTs to brake lights or distance maintenance while

driving. For example, Harbluk, Noy, Trbovich, and Eizenman (2007) used eye-tracking during a driving task and found some evidence that overt visual orienting (i.e., eye movements) was impacted by a cell phone conversation. However, their paradigm included no direct evidence that orienting attention itself was affected.

Testing the impact of cell phone conversations on specific attention processes involved in real-world contexts (e.g., driving, walking) may not yet be possible. For this reason, we have elected to focus on the effect of cell phone conversations on each attentional process in the laboratory. Our aim with this study was to examine the effect of cell phone use on executive attention, exogenous orienting, phasic alertness, and tonic alertness. We selected these four target-processes because they can be separated from one another using established, well-documented paradigms. We believe this is a necessary preliminary step in the overall process of understanding how cell phone use might influence attention-related components of real-world behaviors.

The Nature of Conversation and Attention

A cell phone can now have many functions besides conversation, such as texting, browsing the internet, and checking messages. Each of these involves specific motor and cognitive processes. To minimize the number of potential confounds, we focused on the conversation function of cell phone use in our experimental design.

The results from numerous studies have established that RT of various processes, such as choice RT time in a car-following situation, braking, and dual-task performance, have been found to be impaired during cell phone conversations (Alm & Nilsson, 1995; Strayer & Johnston, 2001; Strayer, Drews, & Johnston, 2003). This leads to an obvious question: What specific aspects of conversation actually affect people's reactions to their surroundings? One possibility is that the cognitive demands involved in the conversation interfere with the attentional demands involved in walking, biking, and driving. Prior studies have found that increasing cognitive demands impair visual orienting (Harbluk et al., 2007). During discrimination tasks, both hands-free and handheld cell phone conversations affected RTs and attention-related brain activity (García-Larrea, Perchet, Perrin, & Amenedo, 2001). Although conversations slowed responses in simple detection tasks, these costs were even greater for more demanding discrimination

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tasks (Kemker, Stierwalt, LaPointe, & Heald 2009). Their findings suggest that the costs of conversation are most pronounced when the task-related cognitive demands are relatively high (i.e., making quick discriminations).

Although conversations appear to influence cognitive and attention processes, it is not clear which specific aspects of conversation contribute to these costs, and which attention processes are affected by the conversation. For example, does increasing the cognitive difficulty in a conversation increase these cognitive and attentional costs? Difficult conversations have been found to have more adverse effects on driving performance than do simple conversations (Briem & Hedman, 1995). However, their “difficult conversation” condition involved a working memory task and not a naturalistic conversation. More recently, this issue has been examined using a more conversation-like condition, in which participants were interviewed during a driving task (Rakauskas, Gugerty & Ward, 2004). When the difficulty level of the interview questions was manipulated, behaviors such as higher variability in accelerator pedal position and higher variability in driving speed were observed.

It should be noted that evidence has been found to suggest that the costs of engaging in naturalistic conversation may be greater than the costs of performing cognitively demanding tasks (Horrey & Wickens, 2006). This suggests that conversation-related costs are not simply a function of cognitive demand. The level of emotional intensity during cell phone conversations may moderate the amount of interference on driving (Caird et al., 2008). This hypothesis was not supported by Irwin, Fitzgerald, and Berg’s (2000) earlier findings that manipulating conversation intensity had no effect on braking RT. It should be noted that Irwin et al.’s interview questions involved topics about which many people feel strongly (e.g., “What are your views about gun control?” and “What are your views about abortion rights?”). However, their questions were not tailored to the individual participants and might not have evoked arousal in all of their participants.

There is growing evidence that having to regulate emotion can interfere with memory recall, working memory, and executive attention (Bush, Luu, & Posner, 2000; Richards & Gross, 2000; Schmeichel, 2007). However, it is not clear if emotion regulation negatively impacts other attention-related processes (e.g., orienting and alerting). Unfortunately, much of the research above has focused on the impact of emotion-evoking visual

stimuli (e.g., pictures, videos, faces), and not on the effect of emotional arousal evoked by a conversation on cognitive and attention processes. Thus, it is difficult to evaluate the association between the level of emotional intensity during cell phone conversations and specific attention-related processes.

The Current Studies

We conducted two experiments to examine the effect of phone conversation on attention processes. In Experiment 1, we used Posner’s (1980) exogenous spatial cueing task to examine the effect of hands-free phone conversation on orienting and phasic alertness when stimuli suddenly appear in the periphery. We also used intraindividual variability (*SD*) in RTs as a measure of sustained attention during the spatial cueing task (Esterman, Noonan, Rosenberg, & DeGutis, 2013; Stuss, Murphy, Binns, & Alexander, 2003). The presumption is that RTs vary as a function of an individual’s attention fluctuating across the task. Intraindividual variability has been recognized as a marker for vigilance problems in clinical research (MacDonald, Li, & Bäckman, 2009). In Experiment 2, we examined the effect of phone conversations on executive attention during the performance of the color Stroop Test (Stroop, 1935).

We tested two competing hypotheses: First, we reasoned that conversation itself would influence orienting, phasic alertness, and vigilance (Experiment 1), as well as executive attention (Experiment 2), regardless of the amount of arousal. Specifically, we anticipated that any conversation, regardless of arousal level, would (a) interfere with orienting and phasic alertness, reflected in increases in both of these effects in the spatial cueing task; (b) interfere with vigilance, reflected in increased intraindividual variability in both experiments; and (c) interfere with executive attention, reflected in a more pronounced Stroop effect in Experiment 2. Our second hypothesis, based on Caird et al.’s (2008) speculation, predicted that the effect of the phone conversation would increase as the amount of conversational arousal increased. Specifically, we expected that, as the conversational arousal increased, these three effects would all increase linearly.

In both experiments, we randomly assigned undergraduate participants to engage in one of three cell phone conversation conditions: (a) no conversation, (b) a low arousal interview, and (c) a high arousal interview. During the conversation, the participants simultaneously performed one of

the two attention tasks. The first two conversation conditions were similar to the conditions used by both Irwin et al. (2000) and Dula, Martin, Fox, and Leonard (2011). However, our high arousal condition critically differed from the earlier studies. We based the conversation on a list of topics each participant had previously identified as being very upsetting, allowing us to manipulate the conversational arousal intensity with an issue that was personally relevant for each participant. This approach has long been used to evoke emotionally charged conversations in marital and family systems research (Levenson & Gottman, 1983).

Experiment 1

In Experiment 1, we examined the impact of cell phone conversation on performance during a variant of Posner's (1980) exogenous spatial cueing task. For a review of the large body of literature involving this task, readers are referred to several excellent reviews (see Chica, Martín-Arévalo, Botta, & Lupiáñez, 2014; Wright & Ward, 1998). This task involves several attention processes, and any of these could be impacted by the conversation. Posner's paradigm allowed us to assess the participant's ability to detect and respond to stimuli suddenly appearing in the periphery (i.e., orienting). It also allowed us to examine the degree to which the participant becomes alert for impending events after a visual cue is presented (i.e., phasic alertness; Fernandez-Duque & Posner, 1997). Finally, we used intraindividual standard deviation in RT as a measure of fluctuations in each participant's tonic alertness (vigilance; Stuss et al., 2003). This paradigm allowed us to test Caird et al.'s (2008) hypothesis about the effect for varying the level of conversational arousal with each of these attention processes (i.e., increasing the level of conversational arousal would increase the degree of impairment). We also tested the competing notion that any conversation, regardless of the arousal level, might affect orienting, phasic alertness, or vigilance.

Method

Participants. We recruited 54 undergraduate participants ($M_{\text{age}} = 19.4$, $SD = 0.8$) from introductory psychology classes. After we randomly assigned them equally to one of the three conversation conditions, one participant in the control condition withdrew from the study. The data from a second control participant was omitted due to excessively long RTs throughout the task. This left a final sample of 52 participants (36 women and 16 men).

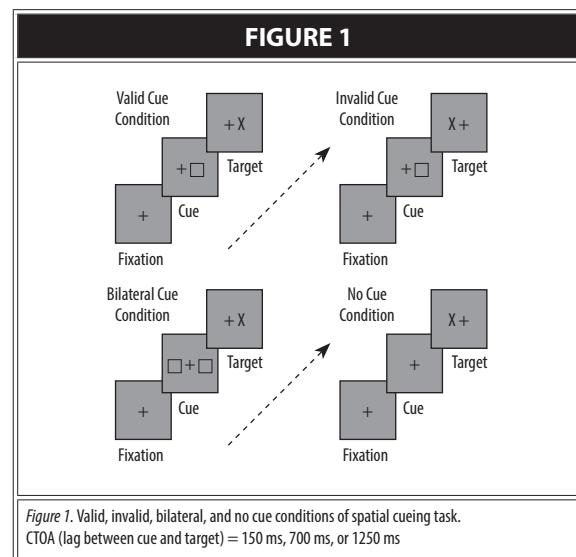
All participants received extra credit in their class in exchange for participating in the study and were treated in accordance to the ethical standards of the American Psychological Association (APA). Our protocol was approved by the SUNY Cortland Institutional Review Board (IRB).

Instruments.

Prescreening. Before arriving for the experimental session, the participants had completed a battery of prescreening surveys, most of which were not used for this study. However, we included two open-ended questions: (a) "Please name three people, places, or things that usually bring you pleasure or make you happy when you think about them" and (b) "Please name three people, places, or things that usually make you upset or angry when you think about them." The first question served as a filler item, and their responses were discarded. The participants' responses to the second question provided personal information about topics that might evoke emotional arousal in the high arousal interview condition.

Vision screening. A Snellen visual acuity chart was used to conduct a brief visual acuity screening (Snellen, 1862). All participants had normal or corrected normal visual acuity.

Spatial cueing task. This experimental paradigm has been widely used for several decades by attention and neuroscience researchers to examine visual orienting (Posner, 1980). During each trial of this task, three types of stimuli, fixation, cue, and target were presented (see Figure 1). The fixation stimuli consisted of a "+" presented in the center of the display. The cue stimulus consisted of a yellow



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box, presented to either the left or right of the fixation or two boxes presented to the left and right of the fixation (bilateral cues). The target stimulus consisted of the letter "X" presented to either the left or right of the fixation. This test measures RTs in various cueing conditions, and we observed strong split-half reliability for overall RTs ($r_{SB} = .95$). The spatial cueing task was performed on a Dell Optiplex GX240, (1.8-GHz Pentium 4 processor), with a Dell™ 20.1" Active Matrix TFT LCD display (1600 x 1200). The participants were fitted with a wireless Jabra BT135 Bluetooth earpiece that was connected to an LG EnV2 VX9100M cellular phone. The interviewer used a desk phone in the adjacent room during the cell phone conversation with the participant. The spatial cueing task was performed with E-Prime v1.1 (copyright 2002, Psychology Software Tools, Inc.). A chin rest was used to minimize lateral head movements.

Procedure. During each trial of the spatial cueing task, a fixation point was presented in the center of the screen. After 900 ms, a cue was presented on the left or right side of the screen, or both the left and right side of the screen simultaneously (neutral cue). When the target appeared, the participants responded by hitting the space bar as quickly as possible. The lag between the cue and target presentations, referred to as the stimulus onset asynchronicity (SOA), was also varied (150 ms, 700 ms, or 1250 ms), with an equal number of trials for each SOA. During no-cue trials, only the fixation stimulus remained visible during the variable cue/target lag. This experimental task included four cueing conditions: (a) *valid cues*, in which the target and cue appeared on the same side of the display (30% of trials); (b) *invalid cues*, in which the target and cue appeared on the opposite side of the display (30% of trials); (c) neutral cues (30% of trials); and (d) no cue (10% of trials). Targets were presented in each hemifield (left and right) in 50% of the trials for each condition. The order of SOA, cue validity, and target location were randomized within and across participants. The individual's ability to shift attention rapidly from the invalidly cued location to the target location (orienting effect) was reflected in the RT difference between validly and invalidly cued targets ($RT_{Invalid} - RT_{Valid}$). The degree to which individuals become alert when a cue suddenly appears regardless of its location (phasic alertness) was reflected in the difference between targets following neutral

cues and no-cue targets ($RT_{no\ cue} - RT_{neutral}$). The intraindividual standard deviation in RT was used to measure the individual's ability to maintain attention consistently across the task (Stuss et al., 2003). RT reflects how quickly the individual is able to respond to targets while performing the task. The experimental task consisted of two blocks of 126 trials and took a mean of 8.5 minutes to complete.

Before beginning the actual trials, each participant performed a minimum of 25 practice trials. Then, the interviewer moved to the adjacent room to initiate the cell phone call. After making the connection, the interviewer instructed the participant to begin the actual task. Participants were assigned to one of three conversation conditions: (a) no conversation (control); (b) low arousal conversation; and (c) high arousal conversation. In the low arousal condition, the interviewer asked participants a series of general "getting-to-know-you" type questions (see Appendix A for a copy of survey questions). The high arousal participants were interviewed about a previously identified personally upsetting topic (see Appendix B). Because the goal was to make the conversation as arousing as possible, the interviewers were trained to probe the participants on the topic, with the goal of evoking an emotional response during the conversation. In keeping with our IRB-approved protocol, topics that had been identified by the participant but were considered to be highly sensitive in nature (e.g., sexual assault, child abuse, criminal convictions) were not discussed during the interview. Our interviewers were also trained to shift the subject of discussion if they believed that the participant was becoming overly upset, although this did not occur. In both the low and high arousal conditions, the interview began immediately after the instruction to begin the task was given.

Design and analysis. The between groups experimental design involved the conversation (none, low arousal, and high arousal) as the independent variable. We used a series of planned contrasts to test two hypothetical patterns of interference on four dependent variables: (a) overall reaction time (RT), (b) mean orienting effect ($RT_{invalid\ cues} - RT_{valid\ cues}$), (c) mean phasic arousal ($RT_{no\ cue} - RT_{neutral\ cue}$), and (d) intraindividual standard deviation (a measure of vigilance across the task). We adopted this approach because contrast analysis provides a more efficient and powerful

approach to evaluating hypotheses about specific patterns of change than would omnibus F tests with post hoc pairwise comparisons (Furr & Rosenthal; 2003; Rosenthal, Rosnow, & Rubin, 2000; Wiens & Nilsson, 2017). The first contrast predicted a linear amount of interference as the arousal was increased. The second contrast tested a nonlinear trend, in which any conversation, regardless of the amount of arousal, interfered with the performance. These predicted patterns are depicted in Figure 2, with the contrast weights assigned accordingly. Whereas the first contrast speculated that the interference would increase across the three conditions, the second contrast predicted that the two conversations would differ from the no-conversation, but not from one another. A one-sample t test was then used to determine if each contrast was significantly different from zero, as would be predicted by the null hypothesis. In cases in which neither contrast was significant, traditional overall F tests and post hoc tests were used to determine if the conversation had *any* effect on the respective dependent variables that were not predicted by the two hypotheses.

Results

Preliminary analyses were conducted using related-groups t tests (1-tailed) to test for the expected orienting ($RT_{invalid\ 150ms} - RT_{valid\ 150ms}$) and phasic alerting ($RT_{no\ cue} - RT_{neutral}$) effects. As expected, both the orienting and alerting effects were significant, $t(51) = 1.83$, $p = .034$, $r^2 = .06$ and $t(51) = 4.31$, $p = .001$, $r^2 = .27$, respectively (see Table 1). The planned contrast predicting a linear increase in overall RT was not significant, but the contrast predicting a nonlinear increase in RT was both significant and strong, $t(49) = 5.01$, $p = .001$, $r^2 = .34$ (see Figure 3). This suggests that any conversation slowed responses to targets. When we tested the same contrasts with the orienting or phasic alerting effects, neither model predicted significant cell phone conversation interference (all p 's $> .05$). Furthermore, post hoc one-way Analyses of Variance (ANOVAs) revealed no significant or large conversation effects on either of these dependent variables, $F(2, 49) = 1.86$, $p = .166$, $\eta^2 = .04$ and $F(2, 49) = 1.66$, $p = .201$, $\eta^2 = .03$, respectively. Finally, the planned contrast predicting a linear effect on intraindividual variability (SD) was not significant, but the contrast predicting a nonlinear effect was found to be both significant and moderately strong, $t(49) = 2.44$, $p = .009$, $r^2 = .11$ (see Figure 4).

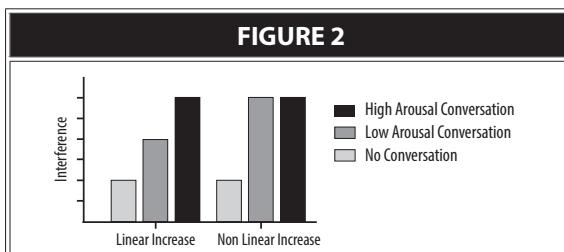


Figure 2. The pattern of interference predicted by each planned contrast (Linear vs. Nonlinear effects). Linear contrast predicted a linear amount of interference as the arousal was increased. Nonlinear contrast found that, regardless of the amount of arousal, any conversation interfered with the performance. The two conversations will differ from the no-conversation, but not from one another.

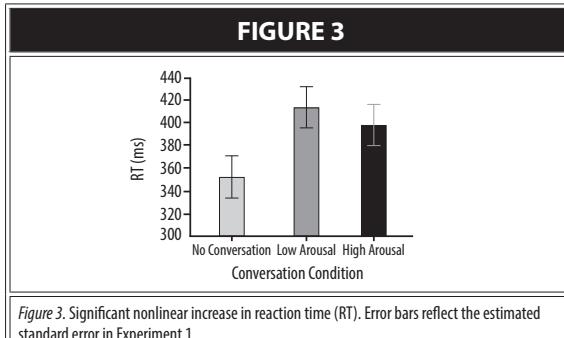
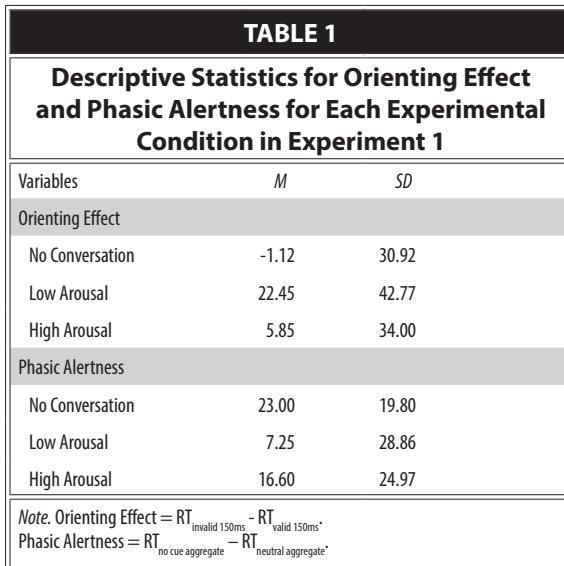


Figure 3. Significant nonlinear increase in reaction time (RT). Error bars reflect the estimated standard error in Experiment 1.

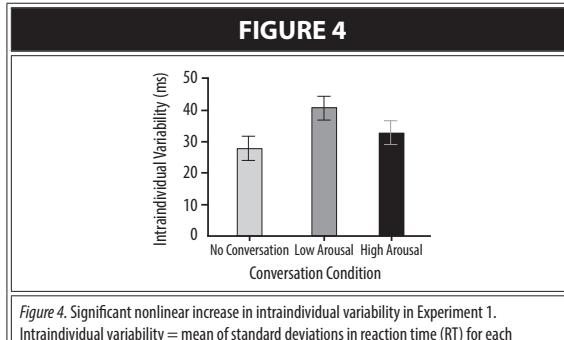


Figure 4. Significant nonlinear increase in intraindividual variability in Experiment 1. Intraindividual variability = mean of standard deviations in reaction time (RT) for each participant. Error bars reflect the estimated standard error.

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Discussion

In line with earlier findings (Alm & Nilsson, 1995; Strayer & Johnston, 2001; Strayer et al., 2003), our results revealed that conversation negatively influenced RT. However, the emotional arousal level evoked by the conversation did not affect RT, as reflected in the significant nonlinear contrast. This finding does not support Caird et al.'s, (2008) speculation that the level of emotional intensity during conversations moderates the attention process.

The results that neither exogenous orienting nor phasic alerting were impacted by conversation suggests that these two automatic attention processes are not the main factors that slowed responses. The fact that conversation did affect intraindividual variability suggests that the participants' ability to remain vigilant throughout the task was negatively impacted. This raises an interesting question. Unlike phasic alertness, sustaining attention does involve purposeful control, and may involve executive processes (Petersen & Posner 2012). The degree of conversation interference on executive control was further investigated in Experiment 2.

Experiment 2

In Experiment 2, participants performed a version of the color Stroop Test (Stroop, 1935). This task often is used to examine executive attention processes related to responding to one type of stimulus information (color) while ignoring another type of stimulus information (word; Posner, 2012). In this task, participants are shown a series of color names (i.e., "RED," "BLUE," and "GREEN"). In some cases, the words are displayed in the related color (e.g., the word "RED" is written in red). In other cases, the words are displayed in a different color (e.g., the word "RED" is written in green). Participants are instructed to *name* the color and not to *read* the word. Conflicts between the word and color often result in an increased number of errors, and RTs tend to be longer when the word and color are incongruent. Poor performance on this task has been associated with impairments in executive processing, including selective attention (MacLeod, 1991; Petersen & Posner, 2012; Strauss, Sherman, & Spreen, 2006).

Participants were assigned to the same three conversation conditions used in Experiment 1 (i.e., no conversation, low arousal, and high arousal). We used planned contrasts to test the two competing hypotheses tested in Experiment 1: (a) that

participants in the two conversation conditions would perform more poorly on the Stroop Test than would the participants in the control condition, regardless of the arousal condition, and (b) conversation-related costs would be greater in the high arousal condition than in the low arousal condition.

Method

Participants. We recruited 54 undergraduate students ($M_{age} = 19.05$, $SD = 0.85$) to participate in Experiment 2. One participant who had been randomly assigned to the low arousal conversation group was unable to perform the Stroop Test, leaving a final sample of 53 participants (39 women and 14 men)¹. All participants received extra credit in their class in exchange for participating in the study and were treated in accordance with the ethical standards of the APA and our university's IRB. All participants were determined to have normal or corrected-normal vision.

Instruments. We used the same prescreening survey, Snellen test, computer system, and cell phone with Bluetooth earpiece described in Experiment 1. The Stroop color/word test (Stroop, 1935) has been widely used to study selective attention in attention and neuroscience research, as well as clinical practice. During each trial, a stimulus word (i.e., "RED," "BLUE," or "GREEN") was presented in the center of the display. In 33% of the trials, the color names and the actual stimulus color were congruent, and in 67% of the trials, the color names and the actual colors were incongruent. We observed strong split-half reliability for both RT ($r_{SB} = .96$) and accuracy (percentage of correct responses; $r_{SB} = .81$). Our version of the Stroop Test was created and presented using E-Prime v1.1 (copyright 2002, Psychology Software Tools, Inc.). Because the Stroop Test did not involve stimulus presentations to the two visual fields, head orientation was not considered to be a concern. Consequently, we did not stabilize the head with a chin rest. Given the level of difficulty presented by the Stroop Test, especially when the task was performed concurrently with an interview, we decided to minimize the time-on-task. Consequently, the actual task involved only 63 trials (not including practice trials).

Procedure. Participants were instructed to identify the color of the stimulus word by pressing

¹ The decision to omit this participant's data was based on poor performance after several sets of practice trials, not on performance during the low arousal conversation.

a red key for a word displayed in red, a blue key for blue words, and a green key for green words. The word was displayed until the participant pressed a key, or until 5 seconds had lapsed, in which case the trial was not counted. Participants completed a minimum of 25 practice trials before beginning the actual experiment. Participants repeated the practice trials until they were able to achieve an 80% accuracy level. During the actual experiment, the order of words and colors were randomized across participants.

After the practice trials, the participant was informed that the interviewer would move to the next room to call the participant's cell phone. The participant was told that the interviewer might or might not begin a conversation with the participant. Regardless of whether or not a conversation took place, the participant's primary task would be to perform the computer test. Once the participant understood these instructions and was able to perform the practice trials, the interviewer left the lab and made the phone call from the adjacent room. As soon as a connection was established, the interviewer instructed the participant to begin the actual Stroop Test. In the low and high arousal conditions, the interviewer waited 10 seconds after instructing the participant to begin the task (see Experiment 1 for a description of interview conditions).

Design and analysis. Our overall experimental design consisted of a 3 (conversation type) \times 2 (color congruence) mixed factorial design. It has long been understood that RT and accuracy of response represent distinct, sometimes competing aspects of performance (MacLeod, 1991; Pachella & Pew, 1968). Therefore, our dependent variables of interest consisted of the Stroop effect on RT ($RT_{incongruent} - RT_{congruent}$), the Stroop effect on accuracy (percentage correct_{congruent} – percentage correct_{incongruent}), as well as the overall RT and overall accuracy. Our dependent variables of interest consisted of the Stroop effect on RT ($RT_{incongruent} - RT_{congruent}$), the overall RT, the Stroop effect on accuracy (percentage correct_{congruent} – percentage correct_{incongruent}), and overall accuracy. As in Experiment 1, we employed planned contrasts predicting linear and nonlinear increases in the Stroop effect and overall RT, and linear and nonlinear declines in accuracy across the conversation conditions. When neither planned contrasts were found to be significant, overall *F* tests with post hoc comparisons were used to test for unpredicted effects.

Results

Preliminary analyses revealed that the Stroop effect was significant for both RT and accuracy, $t(52) = 4.36, p = .001, r^2 = .27$ and $t(52) = 2.90, p = .005, r^2 = .14$, respectively. The planned contrast predicting a linear increase in overall RTs across conversation conditions was not significant, but the contrast predicting a nonlinear increase was significant and moderately large, $t(50) = 2.22, p = .031, r^2 = .09$. Interestingly, the contrast predicting a linear conversation impact on the Stroop effect was significant $t(50) = 2.46, p = .017, r^2 = .11$ (see Figure 5). The contrast predicting a nonlinear effect was not significant. The Stroop effect declined as the degree of arousal increased. It should be noted that increases in the Stroop effect ($RT_{incongruent} - RT_{congruent}$) could be a function of either faster responses to congruent stimuli, longer responses to incongruent stimuli, or both. To test for this, we ran the same contrasts (i.e., linear and nonlinear) as post hoc tests (with Bonferroni corrections for Type I error) with the congruent and incongruent word/color pairings. Although the contrast predicting a linear increase in RTs during the congruent condition was not significant, the nonlinear contrast was both significant and moderately large, $t(50) = 2.85, p_{Bonferroni} = .025, r^2 = .14$ (see Figure 6). Neither contrast predicting changes in RT in the incongruent condition were significant.

FIGURE 5

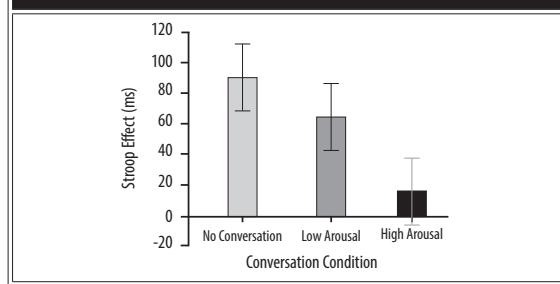


Figure 5. Significant linear decline in Stroop effect ($RT_{incongruent} - RT_{congruent}$) in Experiment 2. Error bars reflect estimated standard errors.

FIGURE 6

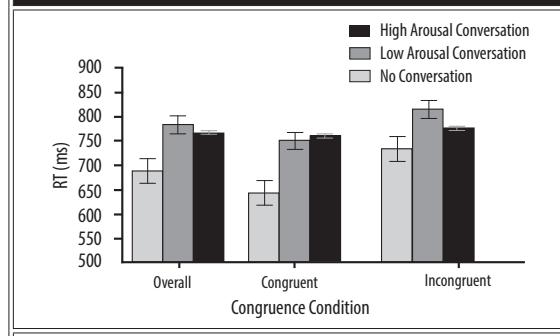


Figure 6. Overall, Congruent, and Incongruent reaction times (RTs) for three conversation conditions in post hoc analyses in Experiment 2. Error bars reflect estimated standard errors.

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Finally, we examined potential conversation effects on accuracy. To this end, we tested contrasts predicting linear and nonlinear declines in the Stroop effect on accuracy. Neither contrast was found to be significant. Furthermore, when we conducted post hoc ANOVAs to test for differences in the Stroop effect on accuracy and on overall accuracy, no significant conversation effects were found (all p 's $> .115$).

Discussion

In Experiment 2, we examined the conversation-related costs on executive attention. Correctly responding during the incongruent condition has been associated with increased executive processing as compared to responses during the congruent condition (Strauss et al., 2006). At the same time, the demands of regulating emotion have been found previously to limit cognitive resources (Bush et al., 2000; Richards & Gross, 2000; Schmeichel, 2007). In light of this, Caird et al.'s (2008) hypothesis would predict that increasing the demands of regulating emotion during the high arousal condition would add additional interference with the executive demands in the incongruent condition. However, our results suggest that any conversation affects the RT, regardless of the amount of arousal. This is inconsistent with Caird et al.'s (2008) hypothesis that increasing conversational arousal would increase the interference of cell phone conversations (as reflected in the linear contrast).

General Discussion

In Experiment 1, the task performed by the participants required orienting to spatial cues, phasic alertness, and vigilance, but few executive attention demands. We found that neither orienting nor phasic alerting attention were affected by conversation or conversational arousal level. However, both the overall RT and intraindividual variability (associated with vigilance) increased when the conversation was introduced. We suspect that the vigilance impairments associated with the conversation contributed to the increased RTs.

Experiment 2 focused on conversational effects on executive attention. We observed a conversational effect on executive attention, but this effect appeared to be limited to the congruent condition. One explanation for this phenomenon has to do with nonequivalent demands placed on the executive attention network by the two Stroop conditions. In the congruent condition, there is no color/word conflict. The incongruent condition, however, involves a conflict between

color and word. It is believed that resolving this conflict depends in part on inhibition of the semantic processing of the word (Cohen, Dunbar, & McClelland, 1990; MacLeod, 1991; Posner & Snyder, 1975). The inhibition of the incongruent semantic properties of the word also may result in the inhibition of conversation interference. The fact that the conversation effects were limited to the low-demand condition of this task are in line with the observed conversation effects in Experiment 1, which also involved low attentional demands. Admittedly, this explanation is highly speculative, and we would encourage future researchers to explore this further. If true, however, this would suggest that executive attention processes are relatively dynamic, self-adjusting to the competing attentional demands of the task and distractors in the environment (in this case conversation). This explanation is in line with arguments made by Lavie (1995).

We can imagine how this phenomenon might be similar to the real-life scenario of studying in a crowded café. When the study material is relatively simple, a student may tend to be easily distracted by the noise in the environment. However, when the material becomes more cognitively challenging, the student may tend to tune out the noise and muster more attention to focus on the study. The same may be true when one is studying and listening to music at the same time. As processing the study material becomes more demanding, the person is forced to focus on the material more and may become oblivious to the music. The development of approaches to studying attention processes (e.g., executive attention control, orienting, phasic alertness) outside of the laboratory would enable researchers to test this speculation about the dynamic nature of attention in daily life in the real world.

Our hypothesis regarding the effect of conversational arousal was not supported. However, other aspects of the conversation may influence attention. For example, we could imagine that the complexity of the conversation might present additional attentional demands. A conversation that involved cognitively challenging topics (e.g., science, work, philosophy) might be more distracting than a conversation that was relatively light in nature. Alternatively, a conversation that was relatively free-flowing, jumping from topic to topic might require more cognitive demands than a more focused conversation that involved fewer shifts in topics. Future research should examine the effect of these conversational issues on attention.

In this study, we focused on one theoretical

perspective (Posner & Petersen, 1990) to select four specific attention processes to examine (i.e., orienting, phasic alerting, vigilance, and executive attention). It is possible that other attention processes may be differentially impacted by conversation arousal. Future researchers may utilize competing theoretical perspectives to examine the impact of conversation on attention (e.g., Lavie & Tsal's perceptual load theory, 1994; Salvucci and Taatgen's threaded cognition theory, 2008; Wegner's ironic process theory, 1994). It is also important to note that we selected widely used, somewhat brief measures of these attention processes. Other assessments (e.g., flanker tasks, stop-go tasks, endogenous orienting tasks) might reveal additional attention processes that are vulnerable to conversational interference. We would encourage replications with these measures.

We employed a widely used approach to eliciting conversation arousal from clinical research (i.e., using self-identified troublesome topics). However, we did not include a manipulation check. Nor did we include physiological measures of their effects on the participants. Follow-up studies with electroencephalogram measures of emotion-centers in the brain and electrodermal response measures of stress and arousal during the task might provide additional insights into the interplay between attention and conversational arousal. Participants in the current study were young adults in college. These conversational demands may increase later in life when the ability to multitask becomes more difficult (see Zanto & Gazzaley, 2017). The student population at the time of data collection was relatively homogenous (roughly 87% white, non-hispanic)². Although we did not collect these data from our participants, we suspect our sample was similarly homogenous. Our sample did include both males and females, but power constraints precluded our testing for gender differences. Therefore, we encourage future researchers to examine the generalizability of our findings. Finally, we used experimental tasks in a controlled laboratory setting. Ultimately, the ecological validity of these findings should be replicated under real-world conditions.

Conclusions

We found that conversation did not seem to affect the ability to orient attention or to respond quickly to suddenly appearing stimuli (phasic alertness), but it does seem to influence the ability to maintain

attention (vigilance). Interestingly, as demands on executive attention are increased, interference by the conversation is minimized. Finally, the level of conversation arousal had little or no effect on executive attention or vigilance. Our findings suggest that competition for attentional resources by the demands of the task and by the conversation are relatively complicated and dynamic. In light of this, we would recommend that more effective workplace rules and driving laws governing cell phone use would need to be more nuanced, taking into account the demands of the task or road conditions.

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Appendix A**Low Arousal Questions**

Instructions: I'm going to ask you several questions to get to know you a little better.

1. How would you describe yourself?
2. How do you think others would describe you?
3. When is your birthday?
4. What year are you as of this semester?
5. How satisfied are you with your college experience so far?
6. Have you chosen a major?
7. What is your major? OR What major are you thinking of choosing?
8. What do you like best about college so far?
9. What are your plans after college?
10. Are you involved in any sports? If so, what ones?
11. Are you involved in any clubs or extracurricular activities? If so, what ones?
12. Are you in a sorority/fraternity?
13. What is your current living situation? How satisfied are you with your current living situation?
14. Did you bring a car to campus?
15. Do you have any siblings? If so, what are their ages? How close are you to them?
16. Did you live with your biological parents as a child and teenager?
17. Do you have any pets at home? If so, what kind?
18. How important is it to you to live near your parents after finishing college?
19. What was your family's religion when you were growing up, if any?
Have you stuck with that religion?
20. Where were you born?
21. Where did you grow up?
22. How would you describe the community where you grew up?

Appendix B**High Arousal Questions**

Instructions: When you completed the prescreening surveys, you mentioned that the topic of (insert topic selected from prescreening for discussion) makes you upset, and I would like to talk to you about that. (Note: Interview uses the following questions to generate discussion. Participants are allowed and encouraged to elaborate as much as they want.)

1. Can you tell me why you get upset when you think about (this topic)?
2. Do you tend to avoid discussing (this topic) with others?
3. How upset would you say you get when other people start discussing (this topic)?
4. Do most of your friends or family members tend to have the same negative feelings toward (this topic)?
5. Have you considered the opposing side of your argument about (this topic)?
6. Do you find yourself getting defensive when (this topic) is brought up?
7. Would you consider yourself very set in your beliefs or perhaps even stubborn about (this topic)?
8. What sort of negative feelings do you experience when you think about (this topic)? Frustration? Anger? Sadness? Grief?
9. Do you ever feel that your negative reactions to (this topic) are extreme or irrational?
10. Can you describe a situation in which you became particularly annoyed or upset when you thought about or discussed (this topic)?

Contexts of Communication Apprehension and Their Relation to Self-Esteem

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ABSTRACT. With extensive research having illustrated the lack of self-esteem nourishing attributes that individuals with communication apprehension exhibit, the present investigation evaluated the strength of correlations between general and context-specific forms of communication apprehension and self-esteem. College students ($N = 40$; $M_{age} = 19.48$) completed measures that assessed their general and context-specific communication apprehension as well as their self-esteem. General and context-specific forms of communication apprehension were all predicted to be strongly and negatively correlated with self-esteem, and the correlation between interpersonal communication apprehension and self-esteem was predicted to be the strongest out of all contexts of communication apprehension. A linear regression showed a significant relation between general communication apprehension and self-esteem ($R = .61$, $R^2_{adj} = .36$, $p < .001$). Multicollinearity in the multiple regression prevented the intended test for differences in strength of correlations between contexts of communication apprehension and self-esteem. Bivariate correlations signaled that all contexts of communication apprehension are considerably correlated with self-esteem, with the small group context as the most closely related to self-esteem ($r = -.59$, $r^2 = .35$, $p < .001$), and the meeting context as the least closely related ($r = -.42$, $r^2 = .18$, $p = .007$). The present findings illustrate the strong relation between general communication apprehension and self-esteem even among individuals with higher-than-normative levels of communication apprehension and suggest that those with acute communication apprehension might experience similar effects on self-esteem across context-specific forms of communication apprehension.

Keywords: communication apprehension, self-esteem, context-specific communication apprehension, competence, independence, connectivity

Communication apprehension refers to distressing feelings associated with actual or anticipated situations that require communication (McCroskey, 1984). Communication apprehension can be general (inducing the same degree of distress across all

contexts) as well as context-specific. Context-specific communication apprehension refers to accentuated feelings of distress associated with a particular situation that requires communication (e.g., interpersonal or public speaking communication; McCroskey, 1984). The comprehensive body



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of evidence delineated below has shown that communication-apprehensive individuals develop a wide array of dysfunctional traits and attitudes that reduce their sense of competence, connectivity, and independence within many aspects of their lives. Conjunctively, empirically based theories on *self-esteem*—sociometer and self-determination theory—have proposed that competent, connection-seeking, and independent qualities are vital nourishers for individuals' self-esteem.

Communication Apprehension and Competence

Communication-apprehensive individuals exhibit behaviors and psychological tendencies that impair their ability to navigate through various domains of their life competently. Research has found that those with higher communication apprehension possess higher self-attributed communication deficits, as they indicate having lower communication self-efficacy (Hassall, Arquero, Joyce, & Gonzalez, 2013) as well as communication competence (Croucher, 2013; Donovan & MacIntyre, 2004). In social contexts, McCroskey and Richmond (1977) found that communication-apprehensive individuals tend to disclose cynical and dishonest information about themselves, suggesting they are often less shrewd and competent about their social unfolding. Those with acuter communication apprehension also exhibit diminished adaptability, as those higher in apprehension indicate having lower tolerance for context ambiguity (Arquero, Polvillo, Hassall, & Joyce, 2017). As well, highly apprehensive individuals, relative to slightly apprehensive counterparts, experience more difficulties conforming to complex social settings (like a college campus; McCroskey & Sheahan, 1978). Communication-apprehensive individuals also deal with impaired competencies related to their professional attitudes, behaviors, and endeavors. Meyer-Griffith, Reardon, and Hartley (2009) showed that, when choosing potential careers, highly apprehensive individuals exhibit significantly higher decision-making confusion, inner conflict, and lack of commitment than moderately and slightly apprehensive individuals. They also showed that communication apprehension correlates positively and substantially with decision-making confusion, inner conflict, and lack of commitment. Beatty (1987) further showed that communication apprehension is detrimentally influential for competent public speaking efforts, as he found that, when given the option to, highly apprehensive individuals are more likely to avoid public speaking than slightly apprehensive ones.

The polarizing relationship of competence- and incompetence-related attributes with communication apprehension has also been empirically validated. Studies have shown that communication apprehension is inversely correlated with positive dispositions such as willingness to lead, appreciation for multiculturalism, and aptitude for adaptability (Blume, Baldwin, & Ryan, 2013), as well as with constructive personality traits such as emotional maturity and character (McCroskey, Daly, & Sorensen, 1976). Conversely, communication apprehension correlates positively with maladaptive personality traits such as neuroticism and dogmatism (McCroskey et al., 1976). Also, others' perceptions about one's competence can be compromised by communication apprehension, as it has been found that, when evaluated by their peers, highly apprehensive individuals are viewed as substantially less competent and composed than their slightly apprehensive peers (McCroskey & Richmond, 1976). Collectively, the above findings illustrate how dysfunctional qualities distinctive of those with communication apprehension preclude, both explicitly and implicitly, their ability to carry out tasks successfully, overcome difficulties, and develop foundational traits for their competencies across life domains.

Communication Apprehension and Connectivity

Communication is a primary medium for connectivity. Thus, it is no surprise that research has substantiated the lack of connectivity that communication-apprehensive individuals often experience. Studies have shown communication apprehension correlates negatively with connectedness toward classroom peers (Carlson et al., 2006), collaborative learning preferences (Arquero et al., 2017), and loneliness in general (Zakah & Duran, 1985), thus indicating its close correspondence with social detachment feelings. McCroskey and Sheahan (1978) also found that, relative to slightly apprehensive counterparts, highly apprehensive individuals develop fewer and weaker relationships with peers and faculty in a college setting, thus suggesting that developing different forms of social capital can also be challenging for those with acute communication apprehension. When interacting, McCroskey and Richmond (1977) found that highly apprehensive individuals are significantly less inclined to disclose information about themselves than slightly apprehensive counterparts, a factor which can limit the development of

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relationships commonly nourished through mutual disclosure of interests, opinions, and preferences (e.g., friendships and romantic relationships). Individuals' communication apprehension also influences their decisions and nonverbal behavior in ways that lead them away from situations where interaction is likely (e.g., choosing a secluded house to live in, or choosing a seat far away from everyone in the classroom; McCroskey, 1976). Highly apprehensive individuals also exhibit such isolating tendencies through their occupational preferences, as they are acutely and consistently inclined to desire and choose occupations that require substantially less interaction than those desired and chosen by slightly apprehensive individuals (Daly & McCroskey, 1975). Further research has shown that communication apprehension is negatively associated with general willingness to communicate (Croucher, 2013) and with the desire to seek extracurricular interaction with academic lectures (Martin & Myers, 2006), thus further validating the strong connection between communication apprehension and an inhibited drive for interaction of various natures. Indeed, the reticent and detaching disposition continuously espoused by those with communication apprehension echoes their profound lack of connectivity.

As well, communication apprehension can help weaken internal and external factors that play a crucial role in the dynamics of relationship, affinity, and connectivity formation. When evaluated by peers, McCroskey and Richmond (1976) found that highly apprehensive individuals are viewed as substantially less sociable and extraverted than slightly apprehensive counterparts, a potentially harmful factor for the social life of communication-apprehensive individuals as they may be less likely to be approached by their peers if they are perceived as being less willing and eager to socialize. McCroskey, Richmond, Daly, and Cox (1975) showed that communication apprehension is associated with unfavorable social-attraction ratings from the opposite sex and that highly apprehensive individuals too tend to have more uncaring and disapproving views toward other people than slightly apprehensive counterparts. Such reciprocity of negative opinions between those with communication apprehension and those who are around them can further aid distance and block multidimensionality of relationships between these parties, thus diminishing the connectivity for those with communication apprehension.

Communication Apprehension and Independence

Communication-apprehensive individuals also experience a diminished sense of independence. Self-determination theory defines independence as the ability to be the only causal agent in one's life (Deci & Ryan, 2008). If guided by this definition and analyzing the previously mentioned research highlighting the handicapping attributes that communication apprehension can bring about for individuals' competence and connectivity, we can recognize that communication apprehension and other precluding factors engendered by it often play a decisive role in individuals' behavior, reasoning, and decision-making, consequently lessening their ability to be self-governed. Research has further shown that communication-apprehensive individuals deal with a limited sense of interaction sharpness, as they often feel an accentuated fear of embarrassment within various social situations (Withers & Vernon, 2006), as well as accentuated anxieties towards tasks involving formal communication (Beatty, 1987). Communication-apprehensive individuals also employ maladaptive coping strategies that can help preclude their distress management rather than aid it. Shi, Brinthaupt, and McCree (2015) showed that reinforcing self-talk is negatively associated with communication apprehension and that self-critical self-talk is positively associated with communication apprehension. However, they also showed that highly apprehensive individuals engage in more frequent self-critical self-talk than slightly apprehensive counterparts when trying to manage their distress toward public speaking. In essence, the combined evidence indicates that communication apprehension often leads those who experience it to live lives in which they always cope with distressing feelings and dysfunctional idiosyncrasies that limit their scope of possibility and potentiality.

Self-Esteem and Sociometer Theory

Self-esteem refers to individuals' overall evaluation of their value (Leary & Baumeister, 2000). According to sociometer theory, self-esteem is a social instrument of measurement that evaluates individuals' degree of connection and integration with society and other individuals (Leary & Baumeister, 2000). Corroborating this theory, Gruenfelder-Steiger, Harris, and Fend (2016) showed that peers act as a source of information regarding the self and that peers are central to

the development of self-esteem and self-image in adolescence. Furthermore, Luciano and Orth (2017) also showed that romantic transitions of contrasting nature impact self-esteem in opposing ways: Although beginning a romantic relationship has a positive effect on self-esteem, separating from a romantic relationship has a negative effect on self-esteem.

Correlational studies have also suggested that conformity to social expectations and norms is associated with higher self-esteem, and deviance from these is associated with lower self-esteem. Donnellan, Trzesniewski, Robins, Moffitt, and Caspi (2005) showed that self-esteem is significantly and negatively correlated with socially deviant behaviors (e.g., aggression and delinquency) and that these correlations hold across age groups and research designs. A study examining the relationship between adolescents' body satisfaction relative to social expectations and their self-esteem also found a strong positive correlation between the two (van den Berg, Mond, Eisenberg, Ackard, & Neumark-Sztainer, 2010). Although a large portion of the discussed research on sociometer theory is correlational and thus is only limited to inferences of association, the overall evidence corroborates the premises of sociometer theory relating higher self-esteem to a more profound sense of connectedness to society and individuals.

Self-Esteem and Self-Determination Theory

According to self-determination theory, individuals fulfill their true self-esteem when they act in deterministic ways (Deci & Ryan, 2008). Self-determination theory complements the premises of sociometer theory in that it also proposes that individuals have an inherent need to feel connected with others, and it further proposes that individuals have other inherent needs that will fulfill their self-esteem. That is, individuals achieve their highest self-esteem when they meet three innate psychological needs and satisfy them to their highest level: competence (mastering skills and overcoming obstacles), connectedness (establishment and maintenance of relationships), and autonomy (being the only causal mediator in one's life; Deci & Ryan, 2008).

A corroborating work of this theory evaluated the link between low self-esteem and psychiatric illness, and demonstrated the potent relationship between low self-esteem and internal handicapping factors for one's self-sufficiency such as

depression (Sowislo & Orth, 2013). On the other hand, an investigation concerned with self-esteem and its beneficial effect on anxiety demonstrated that higher self-esteem helps diminish anxiety-arousal common in response to threatening stimuli (Greenberg et al., 1992), thus helping individuals become more independent from internal factors that could obscure their judgment in threatening situations. The mastering of situations that might have induced social anxiety in the past has also been shown to enhance self-esteem meaningfully in the future (Nordstrom, Goguen, & Hiester, 2014). In academic contexts as well, academic competence is strongly correlated with self-esteem from early ages (Rahmani, 2011), and performance in subjects like math and literature can be predicted from individuals' academic self-concept (Ghazvini, 2011). Collectively, the supporting evidence for self-determination theory suggests that the inhibition of factors frustrating deterministic behaviors can have a positive impact on the development of self-esteem, and the nourishment of these hindering factors can yield a negative effect on the development of self-esteem.

Present Study

The lack of competence, connectedness, and independence that communication-apprehensive individuals exhibit and the centrality of these attributes to self-esteem suggests a negative relationship between communication apprehension and self-esteem. An early inquiry found a strong correlation between general communication apprehension and self-esteem that held across cohorts of the general adult population (McCroskey, Richmond, Daly, & Falcione, 1977). To our knowledge, however, correlations between specific dimensions of communication apprehension and self-esteem as well as the strength of these correlations, if any, have not yet been examined. Previous research has shown that contexts of communication apprehension bear distinctive correlations with factors such as loneliness (Zakahi & Duran, 1985), suggesting that context-specific forms of communication apprehension bear different consequences for people's psyche. Therefore, the aims of the present study were: (a) to reevaluate the correlation between general communication apprehension and general self-esteem in a contemporary sample, (b) to explore potential correlations between context-specific forms of communication apprehension and general self-esteem, and (c) to explore whether a specific context of communication apprehension was more strongly correlated with general self-esteem than others.

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Hypotheses

It was first hypothesized that the correlation between general communication apprehension and general self-esteem would be negative and statistically significant. This prediction was based on the initial findings outlined by McCroskey et al. (1977). Second, it was hypothesized that correlations between contexts of communication apprehension assessed in this study—interpersonal, small group, meeting, and public speaking—and general self-esteem would also be negative and statistically significant. The rationale for this prediction followed that those who exhibit higher context-specific communication apprehension may likely develop: (a) a weaker sense of connectivity due to the detaching and cagey tendencies that they may adopt in that specific context, (b) a diminished sense of autonomy due to the limitations that their apprehension may impose for their context-specific endeavors, and (c) a diminished sense of competence due to the impairments that their context-specific apprehension will likely impose on their ability to carry out relevant context-specific tasks successfully. As the paucity of these attributes become increasingly evident in individuals exhibiting higher context-specific forms of communication apprehension, a decline in their self-esteem may become increasingly apparent as well. It was further hypothesized that interpersonal communication apprehension would be most strongly correlated with general self-esteem out of all contexts of communication apprehension assessed in this study. The rationale for this prediction followed that those who exhibit higher interpersonal communication apprehension may likely experience increasing challenges developing interpersonal connections. Thus, this intensified lack of interpersonal connectivity may contribute to an accentuated decline in their self-esteem due to a diminished sense of connection with the primary component of society, the individual.

Method

Participants

A target sample size of at least 30 participants was calculated by performing a power analysis for a bivariate correlation. An online correlation power calculator was used (Kohn, 2017), which accounted for the alpha (.05) and power (.80) levels, and an expected correlation coefficient of $r = -.54$ with a corresponding effect size of $r^2 = .29$. This correlation coefficient was obtained from a similar study, which found a statistically significant negative correlation

between general communication apprehension and general self-esteem (McCroskey et al., 1977). A total of 40 participants were recruited ($M_{age} = 19.48$, $SD = 2.83$, age range: 18–34). Twenty-eight participants identified as women ($M_{age} = 19.04$, $SD = 1.71$, age range: 18–26) and 12 as men ($M_{age} = 20.50$, $SD = 4.42$, age range: 18–34). This sample was from a small liberal arts institution with a roughly 80% European American student body. Participants were recruited from introductory psychology classes through a research participant pool system called SONA. Participants needed to be at least 18 years of age and have no previous history of psychiatric illnesses.

Measures

Communication apprehension. Participants completed the Personal Report of Communication Apprehension (McCroskey, Beatty, Kearney, & Plax, 1985), a 24-item Likert-type scale that assesses communication apprehension in general and in four major contexts: interpersonal, small group, meeting, and public speaking contexts of communication. Six items in the scale represent every major context. When filling out the measure, individuals record the extent to which every statement applies to their feelings toward oral communication (1 = *strongly agree*, 2 = *agree*, 3 = *undecided*, 4 = *disagree*, 5 = *strongly disagree*). This measure includes statements such as, “I dislike participating in group discussions,” “I have no fear of speaking up in conversations,” and “I feel relaxed while giving a speech.” A Cronbach’s α of .96 was found in this study, and further reports ranging from .93 to .95 (McCroskey et al., 1985) for all 24 items of the scale were indicators of its excellent internal consistency. Reports of test-retest reliability coefficients greater than .80 have also indicated it is stable over time (Rubin, Graham, & Mignerey, 1990). Concerning its validity, this measure correlates significantly with anxiety measures like the Spielberger State Anxiety Measure ($r = .69$; McCroskey & Beatty, 1984) and assertiveness measures like the Rathus Assertiveness Schedule ($r = -.70$; McCroskey et al., 1985). Its context-specific subscales also predict anxiety in related contexts (McCroskey & Beatty, 1984), and these findings have been replicated for the public speaking context (Beatty, 1987, 1988; Beatty, Belfantz, & Kuwabara, 1989; Beatty & Friedland, 1990). Studies have also shown that the public speaking subscale score predicts withdrawal, avoidance, and length of dialogue (Beatty, 1987; Beatty, Forst, & Stewart, 1986).

Self-esteem. Participants completed the Rosenberg Self-Esteem Scale (Rosenberg, 1979), a 10-item Likert-type scale that measures general self-esteem. This measure includes statements such as, "On the whole, I am satisfied with myself" and "At times I think I am no good at all," to which individuals record the number that best represents their opinion toward every item-statement (1 = *strongly agree*, 2 = *agree*, 3 = *disagree*, 4 = *strongly disagree*). A Cronbach's α of .92 found in this study and further reports ranging from .88 (Gray-Little, Williams, & Hancock, 1997) to .91 (Sinclair et al., 2010) for all 10 items showed the overall adequate internal consistency of this scale. Reports of test-retest reliability coefficients of .88 over two weeks (Rosenberg, 1979) and of .77 over two years (Donnellan, Kenny, Trzesniewski, Lucas, & Conger, 2012) also indicated its satisfactory stability. The validity of this scale is also well-corroborated. Zeigler-Hill (2010) showed it correlates strongly with Self-Liking ($r = .90$) and Self-Competence scales ($r = .71$) as well as with the State Self-Esteem Scale ($r = .71$), and studies showed it correlates with the Coppersmith Self-Esteem Inventory ($r = .52$; Francis & Wilcox, 1995) and the Single-Item Self-Esteem Scale ($r = .69$; Robins, Hendin, & Trzesniewski, 2001). Further, Orth, Robins, and Widaman (2012) showed this scale also predicts future depression ($\beta = -.20$), negative affect ($\beta = -.13$), and physical health ($\beta = -.11$). This measure also correlates negatively with neuroticism ($r = -.50$; Robins, Tracy, Trzesniewski, Potter, & Gosling, 2001) and depression ($r = -.62$; Lovibond & Lovibond, 1995).

Procedure

Before conducting the study, Shepherd University's institutional review board approval was obtained. Presentation of consent and debriefing forms, as well as completion of all measures, were done online. Participants were first presented with informed consent information. After providing consent, participants completed the communication apprehension scale, followed by the self-esteem scale. Once finished with both measures and demographic questions, participants were debriefed on the nature and purpose of the study. There was no time limit or other restriction during the completion of the measures.

Results

Analyses

Two preliminary comparisons were conducted. The first one involved a series of independent-samples t tests to compare participants' average

general apprehension score, as well as their average context-specific apprehension subscores, to those from U.S. college students nationwide (McCroskey, 1982). The second one involved a repeated-measure Analysis of Variance (ANOVA) to compare participants' average context-specific apprehension subscores to each other to test for average differences. A simple linear regression was conducted to test this study's first hypothesis, which involved participants' general apprehension scores as the predictor variable and their self-esteem scores as the criterion variable. A linear multiple regression was conducted to test this study's second hypothesis, which involved participants' context-specific apprehension subscores as predictor variables and self-esteem scores as the criterion variable. Further analyses involved examination of the semipartial correlation coefficients from each of the four correlations between context-specific forms of communication apprehension and self-esteem. These denote the strength of each correlation. Alpha levels for all analyses were set to .05.

Preliminary Comparisons

Independent-samples t tests were conducted to compare participants' average scores for general and context-specific communication apprehension to corresponding average scores from college students nationwide. This was to assess whether the sample's average communication apprehension levels conformed to normative ones. Participants' average general apprehension score ($M = 72.50$, $SD = 19.57$; McCroskey, 1982) was significantly higher than the national average ($M = 65.60$, $SD = 15.30$), $t(40038) = 2.85$, $p = .004$, $d = 0.45$. Participants' average context-specific apprehension subscores were also significantly higher than the national average for the public speaking, $t(40038) = 2.70$,

FIGURE 1

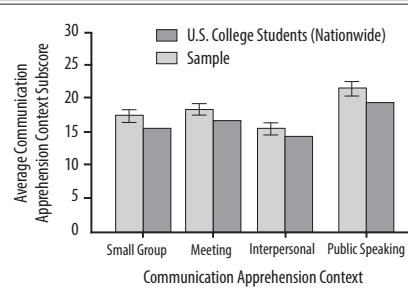


Figure 1. Graph showing this study's sample and national average subscores for the four contexts of communication apprehension. Error bars indicate standard error of the mean. Standard error of the mean values (not visible on the graph) for nationwide average subscores are 0.02 for small group, meeting, and interpersonal communication apprehension, and 0.03 for public speaking communication apprehension.

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$p = .007$, $d = 0.43$, meeting, $t(40038) = 2.82$, $p = .005$, $d = 0.45$, and small group contexts, $t(40038) = 2.57$, $p = .01$, $d = 0.41$. Participants' average interpersonal context subscore did not differ significantly from the national average, $t(40038) = 1.94$, $p = .05$, $d = 0.31$. See Figure 1. These findings indicated that the sample's average levels of general and context-specific communication apprehension (except for the interpersonal context) were considerably higher than what is generally found in college students nationwide. These parameters suggested limitations for generalization inferences of further findings. On the positive side, however, these also suggested that further findings conveyed novel insight into the relation between dimensions of communication apprehension and general self-esteem in more apprehensive groups.

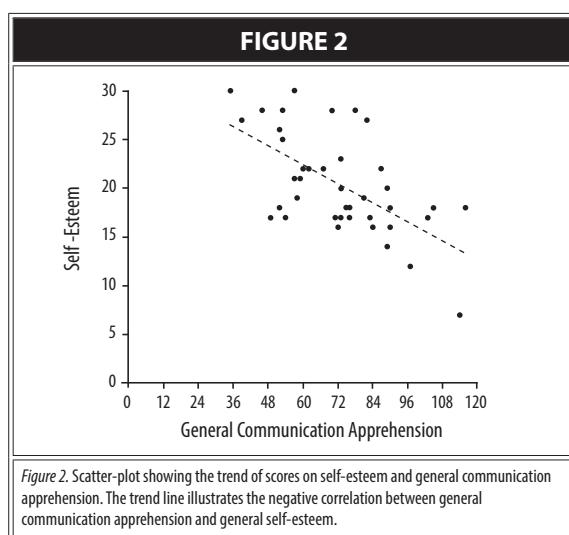
A repeated-measures ANOVA was conducted to assess differences in participants' subscores for the four contexts of communication apprehension. This analysis revealed a significant main effect of context, $F(3, 117) = 18.54$, $p < .001$, $\eta^2 = .32$,

indicating that communication apprehension level varied significantly from context to context. Post hoc pairwise comparisons with Bonferroni corrections revealed that participants' average public speaking subscore ($M = 21.48$, $SD = 6.21$) was significantly higher than their average small group ($M = 17.35$, $SD = 5.70$; $p < .001$), interpersonal ($M = 15.40$, $SD = 5.78$; $p < .001$), and meeting subscores ($M = 18.28$, $SD = 5.74$; $p = .01$). This analysis also revealed that participants' average interpersonal subscore was significantly lower than their average meeting subscore ($p = .003$), and that there were no significant differences between their average small group and meeting subscores ($p = 1.0$) or between their average small group and interpersonal subscores ($p = .05$; See Table 1). These findings indicated that context of communication had a considerable impact on the level of communication apprehension participants felt; public speaking was the most distress-inducing context, interpersonal communication was the least distress-inducing context.

TABLE 1
Estimated Mean Differences Among Contexts Of Communication Apprehension Subscores

Context	Small Group		Meeting		Interpersonal		Public Speaking	
	M diff.	SE	M diff.	SE	M diff.	SE	M diff.	SE
Small Group			0.93	0.69	-1.95	0.70	4.13***	0.89
Meeting	-0.93	0.69			-2.88**	0.76	3.20*	0.95
Interpersonal	1.95	0.70	2.88**	0.76			6.08***	0.96
Public Speaking	-4.13***	0.89	-3.20*	0.95	-6.08***	0.96		

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



Study Aim 1

It was first hypothesized that general communication apprehension ($M = 72.50$, $SD = 19.57$) would be negatively and significantly correlated with general self-esteem ($M = 20.40$, $SD = 5.17$). As expected, the linear regression showed that general communication apprehension accounted for a significant amount of variance in general self-esteem (38%; 36% adjusted), $R = .61$, $R^2_{adj} = .36$, $F(1, 38) = 23.02$, $p < .001$, $f^2 = .61$. These results indicated that 36% of the variance in general self-esteem was explained by general communication apprehension alone, which was revealing. As general communication apprehension increased, general self-esteem decreased (see Figure 2), indicating that general communication apprehension was a potent predictor of self-esteem, $\beta = -.61$, $t(38) = -4.80$, $p < .001$.

Study Aim 2

Second, it was hypothesized that each context of communication apprehension assessed (interpersonal, small group, meeting, and public speaking) would be significantly and negatively correlated with general self-esteem, and it was further hypothesized that the interpersonal context would be most notably correlated with general self-esteem

out of the four contexts of communication apprehension. The overall model of the multiple regression accounted for a significant amount of variance in general self-esteem, $R = .65$, $R^2_{adj} = .35$, $F(4, 35) = 6.31$, $p = .001$, $f^2 = .72$, but none of the individual predictor variables were significant. Combined, the lack of the predictive significance of the individual contexts of communication apprehension for self-esteem, and the significant intercorrelations extant among these contexts (see Table 2) suggested multicollinearity among predictor variables. A collinearity analysis was conducted to evaluate the degree of multicollinearity. Tolerance values higher than 0.10 and variance inflation factors lower than 4 for all predictor variables (see Table 3) suggested a low concern for multicollinearity within the regression (Belsley, Kuh, & Welsch, 2004). Eigenvalues close to 0 and a condition number close to 15, however, indicated a multicollinearity issue (see Table 4; Belsley et al., 2004). The significance of the overall model suggested that the combination of the contexts-specific types of communication apprehension predict general self-esteem substantially. The multicollinearity among these contexts, however, made it unclear whether it was a specific context or the shared variance among all contexts that drove this association.

Individually, the small group context held the strongest correlation with general self-esteem ($r = -.59$, $r^2 = .35$, $p < .001$), followed by the interpersonal ($r = -.54$, $r^2 = .29$, $p < .001$), public speaking ($r = -.51$, $r^2 = .26$, $p = .001$), and meeting contexts ($r = -.42$, $r^2 = .18$, $p = .007$). In the regression model, the small group ($\beta = -.37$, $p = .09$, $sr^2 = .05$), interpersonal, ($\beta = -.24$, $p = .21$, $sr^2 = .03$), and public speaking contexts ($\beta = -.24$, $p = .14$, $sr^2 = .04$) followed the predicted direction of the association with self-esteem. However, the meeting context did not follow the predicted direction of association ($\beta = .12$, $p = .54$, $sr^2 = .01$) even though the correlation between this context and general self-esteem did. With multicollinearity in mind, a *tentative* inference was that all four communication apprehension contexts correlate considerably with general self-esteem. As for their individual correlative strength, the small group context of communication apprehension may be more closely associated with self-esteem, and the meeting context may be (more confidently suggested) the least correlated with self-esteem.

TABLE 2

Linear Multiple Regression Of Context-Specific Communication Apprehension and General Self-Esteem

Variables	Correlation Results (r)				Regression Results		
	Self-Esteem	Small Group	Meeting	Interpersonal	B	β	sr^2 (unique)
Small Group	-.59***					-0.34	-.37 .05
Meeting		-.42**	.71***			0.11	.12 .01
Interpersonal			-.54***	.70***	.65***		-0.22 -.24 .03
Public Speaking				.56***	.50**	.49**	-0.20 -.24 .04
							Intercept = 31.88
$R^2 = .42$	$R^2_{adj} = .35$	$R = .65**$		$S_{est} = 4.16$			

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

TABLE 3

Multicollinearity Test for the Multiple Regression of Context-Specific Communication Apprehension and Self-Esteem: Tolerance and Variance Inflation Factor Indices

Variables	Tolerance		VIF
Small Group	0.37		2.70
Meeting	0.44		2.28
Interpersonal	0.46		2.18
Public Speaking	0.66		1.52

Note. VIF = Variance Inflation Factor.

TABLE 4

Collinearity Diagnostics From Multiple Regression of Context-Specific Communication Apprehension and Self-Esteem

Model	Dimen-	Eigen	Condition	Variance Proportions					
				Value	Index	(constant)	Small Group	Meeting	Interper-
1	1	4.83	1.00	.00	.00	.00	.00	.00	.00
	2	0.07	8.28	.38	.03	.02	.27	.09	
	3	0.04	11.31	.44	.00	.09	.00	.83	
	4	0.04	11.66	.13	.14	.37	.69	.00	
	5	0.03	13.88	.05	.82	.52	.04	.08	

Note. Condition index with the largest value (bold) denotes the condition number.

Discussion

The present study sought to reexamine the relationship between general communication apprehension and general self-esteem, assess potential correlations between specific contexts of communication apprehension and general self-esteem, and assess whether a specific context of communication apprehension was more strongly correlated with general self-esteem than others. The first hypothesis was supported by the results, which indicated a substantial and negative association between general communication apprehension and self-esteem. With this study's unique sample in mind, these findings indicate that general communication apprehension is a potent predictor of self-esteem even among samples with higher-than-normal levels of apprehension. Although multicollinearity in the multiple regression analysis prevented our intended test for subsequent hypotheses, a comparison of correlation coefficients and effect sizes of individual correlations between contexts of communication apprehension and general self-esteem tentatively indicated that all contexts of communication apprehension were closely and negatively associated with self-esteem. These comparisons also tentatively suggested that, although the small group context may be more notably associated with self-esteem, the meeting context may be the least correlated with self-esteem out of all contexts of communication apprehension. Perhaps more distinct correlative differences among these contexts could have been observed if the sample had included a more even distribution of communication apprehension levels.

Multicollinearity among contexts of communication apprehension is not unprecedented, and some hypotheses have been formulated regarding the source of this occurrence. After encountering multicollinearity when testing these variables in another culture, Renshaw (2010) partially attributed this occurrence to potentially divergent interpretations of several contexts of communication that may be engendered by idiosyncratic social dynamics of particular cultures. However, the occurrence of multicollinearity in the study, as well as in previous research testing these variables in the American culture (Zakahi & Duran, 1985), suggests this occurrence may not be culturally bound. Renshaw (2010) also attributed multicollinearity among these variables to conceptual discrepancies in a translated version of the Personal Report of Communication Apprehension scale and suggested the necessity of revisions to the original measure. Nevertheless, several works have validated the

conceptual structure and construct validity of this scale as a measure of context-specific communication apprehension (Booth-Butterfield & Gould, 1986; Levine & McCroskey, 1990).

Multicollinearity often indicates that variables assessed may be redundant. However, the collinearity diagnostics evaluated in this study indicated contradicting degrees of concern for multicollinearity among contexts of communication apprehension, suggesting a lack of consistent evidence confirming the redundancy of these variables. A plausible explanation for the multicollinearity occurrence in this study could be that the association between general communication apprehension and self-esteem was driven by the shared variance across contexts of communication apprehension and not the unique variance. Although this could conceivably suggest that communication apprehension may not vary substantially across context, this study and other research works have found significant variations in levels of communication apprehension across contexts (Booth-Butterfield & Gould, 1986; McCroskey, 1984), thus contradicting the previous notion. If level of communication apprehension does vary across context, then it is perhaps the effect of each context of communication apprehension for self-esteem that does not change substantially. Considering the highly apprehensive sample of this study, it could also be that the observed multicollinearity among contexts of communication apprehension is idiosyncratic of highly apprehensive groups, and thus perhaps the effects of context-specific forms of communication apprehension for self-esteem are only relatively unvarying among individuals with acute communication apprehension. Plausibly, the effects of context-specific forms of communication apprehension for self-esteem may be more distinguishable among those with lower communication apprehension.

Limitations and Future Directions

The correlational basis of this study prevented inferences of causation from our findings. Generalizations for groups of specific socioeconomic, racial, ethnic, and cultural backgrounds were difficult to make in this study as no information was collected regarding these and other demographics. Unique characteristics of this study's sample also prevented the extension of the findings to more diverse populations, as this study's sample was comprised of college students averaging 19 years of age and with a large proportion of them identifying

as women (70% of the sample). This study's sample also belonged to a younger generation than the nationwide college student cohort from McCroskey (1982), and so possible generational differences could have impacted the observed apprehension differences. For instance, today's college students have increased exposure to alternative modes of communication that do not require face to face or oral communication across contexts (e.g., e-mail, texting, social media), which could be conducive to a higher sense of oral communication apprehension. However, research has found that face to face communication prevails as the preferred communication medium across the latest three generations (i.e., generations X, Y, and Z; Lester, Standifer, Schultz, & Windsor, 2012; Seemiller, 2017) and that there is high intergenerational convergence in many contextual communication practices and preferences (Woodward & Vongsawadi, 2017). These similitudes suggest that the current sample may indeed have had particularly high apprehension, not only in relation to norms of earlier cohorts but in relation to today's norms as well. As such, this study's acutely communication-apprehensive sample also limited the extension of the findings to young adult population groups with higher apprehension levels than are generally found in young adults. Further, the observed multicollinearity might also plausibly be idiosyncratic of highly apprehensive persons. Overall, the scope of generalization for these findings overarches a somewhat younger, mostly feminine, and considerably more communication-apprehensive cohort of the general population.

Future directions for this research could be assessing differences in communication apprehension across individuals with low, moderate, and high self-esteem, testing relations between contexts of communication apprehension and self-esteem in less apprehensive samples, and implementing discrete measures to assess each context of communication apprehension. An alternative method of measurement could be to assess communication apprehension through psychophysiological signs of distress. For example, Beatty and Behnke (1991) evaluated the effect of public speaking apprehension on heart-rate level and found that the average heart-rate of highly apprehensive individuals was substantially higher than slightly apprehensive ones when their performance held low stakes. Future research could use heart-rate and other psychophysiological-distress indices to assess communication apprehension for other contexts.

Implications

The present findings provide meaningful implications for our understanding of communication apprehension and its detrimental impact on psychological well-being. The multicollinearity among contexts of communication apprehension also tentatively indicates that their effects on the self-esteem of highly apprehensive individuals may be of relatively equal strength, although their effects on self-esteem could plausibly differ more among less apprehensive persons. These findings also amplify the group range that was formerly established for the relation between general communication apprehension and self-esteem (McCroskey et al., 1977), as these suggest that this relationship is strong even among highly apprehensive individuals. This study's findings also have practical value for organizational and counseling domains. Employers, for instance, could use self-esteem level as an index of general communication apprehension when considering individuals for positions with substantial communication demands. For therapeutic efforts, counselors could consider the impact of communication apprehension on self-esteem and implement treatment methods to work on their patients' communication competencies as implicit means to nourish their self-esteem.

Conclusions

This study showed the presence of the strong relationship between general communication apprehension and self-esteem in a contemporary sample of highly apprehensive individuals, delineated issues and explanations surrounding multicollinearity across contexts of communication apprehension, and expounded on implications from this occurrence in connection with this study's highly apprehensive sample. Future research may want to assess relations between context-specific forms of communication apprehension and self-esteem in less apprehensive groups, as this study found evidence tentatively suggesting that these dimensions may have similar effects on self-esteem, but primarily examined those with higher apprehension. Although correlational findings do not imply causality, communication-apprehensive individuals could still focus on improving their communication competencies because doing so could help inhibit their apprehension and could also positively impact their self-esteem. Simultaneously, nourishing one's self-esteem may just as well help inhibit one's communication apprehension.

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It's for Their Health: Encouraging Autonomy During Emerging Adulthood

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ABSTRACT. Improving health behaviors, especially among emerging adults, is no easy task. The present research sought to develop an intervention to improve health behavior by harnessing emerging adults' desire for autonomy. Ninety-one participants between the ages of 18 and 25 years ($M = 19.36$ years) were randomly assigned to a control condition ($n = 43$) or an experimental condition ($n = 48$) in which they described ways in which they, rather than others, were in control of their health. We hypothesized that, compared to those in the control condition, those in the experimental condition would feel more in control of their health and make healthier food and drink choices when presented with a variety of options. Results indicated that postintervention internal health locus of control scores did not differ between those in the experimental and control conditions. However, there was an effect of the intervention on snack choice such that those in the experimental condition selected significantly fewer unhealthy snacks than those in the control condition, $t(89) = -2.02$, $p = .046$. These results suggest that encouraging emerging adults to think about ways in which they are in control of their health may translate into healthier food-related behaviors.

Keywords: emerging adulthood, health, health behaviors, autonomy, control

Indicators of poor health such as sedentary behavior, fast food consumption, obesity, and tobacco use tend to increase as adolescents transition into adulthood (Harris, Gordon-Larsen, Chantala, & Udry, 2006). Moreover, poor health behaviors during adolescence can increase the risk of chronic disease in adulthood (Daw, Margolis, & Wright, 2017; Kwan, Cairney, Faulkner, & Pullenayegum, 2012; Tabak, Piyal, Celen, Karakoc, & Ozan, 2009). Although there is some debate as to the exact ages that define adolescence, it is commonly thought to encompass ages 10 to 24 (Sawyer, Azzopardi, Wickremarathne, & Patton, 2018). This developmental period may be one of the best times to implement interventions to improve health and establish healthy habits that

may persist across the lifespan. There are four primary reasons for this.

First, adolescence is a time period during which individuals are often given more freedom and independence; this may translate into more free time, access to spending money, and decision-making power (Bryan et al., 2016). For example, adolescents may be more likely to stop at a fast food restaurant on their way home from school compared with younger children. Second, relative to younger children, adolescents have the cognitive capacity to understand health information that is presented to them (Icenogle et al., 2019). This is due to their developing ability to consider future possibilities rather than solely what is happening in the current moment (Steinberg, 2002). For

example, adolescents can better comprehend the long-term consequences of smoking and unhealthy eating relative to younger children (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2002). Third, adolescence is a time during which identity formation occurs, of which health values are a crucial component (Kroger, 2004). Lastly, the adolescent brain is developmentally plastic; it is malleable depending on life experiences (Steinberg, 2014). As such, it is important to establish healthy behaviors during adolescence while the brain is still plastic, before the adult brain becomes increasingly rigid. In sum, adolescence may be a critical period for establishing healthy behaviors because of adolescents' increased freedom, cognitive ability to comprehend health concepts, formation of identity and behaviors, and brain plasticity.

In particular, emerging adulthood—a time in adolescence that spans ages 18 to 25—may be key to establishing healthy behaviors because it is a period in the lifespan during which the most identity exploration is likely to occur (Arnett, 2000). Moreover, common themes that are characteristic of emerging adulthood are accepting responsibility for oneself and making independent decisions (Arnett, 1997). Emerging adulthood is a time during which individuals often focus on developing into self-sufficient people, and the choices they make and habits they form have enduring ramifications for the rest of their lives (Arnett, 2000). As such, emerging adulthood may be an ideal time for implementing interventions to improve health behaviors.

Although adolescence in general and emerging adulthood in particular may be a key time for health behavior interventions, some interventions targeted at this population have yielded inconsistent success. For example, in a meta-analysis of more than 60 programs designed to prevent obesity in children and adolescents, only approximately 1 out of 5 programs yielded significant effects; moreover, the average effect in preventing weight gain was relatively small with $r = .04$ (Stice, Shaw, & Marti, 2006). This may be due to a variety of factors including the duration of the intervention, the age of the participants, or the specific health behaviors that were targeted (Stice et al., 2006). Effective interventions may be fairly time-intensive and require an average duration of 40 hours (Stice et al., 2006). In addition, the particular behavior that is targeted by the intervention may influence effectiveness; effects tended to be larger for interventions focused on preventing obesity rather than focusing on other

areas of health such as preventing eating disorders or increasing physical activity (Stice et al., 2006). Finally, how information is delivered in the intervention may influence effectiveness. For example, evidence regarding the relationship between obesity prevention programs and the prevalence of eating disorders among adolescents indicates that certain modes of delivering health information can be disadvantageous because adolescents may misinterpret obesity prevention messages by eliminating supposed "bad" or "unhealthy" foods, which may lead to the presence of an eating disorder (Sim, Lebow, & Billings, 2013). This suggests that the design, target, and messages promoted in the intervention are all important considerations in the development of health behavior interventions.

Although recent research has shed light on what *not* to do when advising adolescents about their health (e.g., using weight-based language; Golden, Schneider, & Wood, 2016), less research is available to suggest effective ways to guide them toward improving their health. In a report on improving the health behaviors of adolescents, the World Health Organization (2018) suggested that future research should consider how health-related interventions foster adolescents' needs for autonomy, empowerment, engagement, and positive development. This is consistent with the literature from developmental psychology, which suggests that the specific period of emerging adulthood is when individuals typically grapple with tasks such as making independent decisions, taking responsibility for oneself, and developing self-sufficiency (Arnett, 2000).

Taken together, three main messages emerge in this area of research: (a) Emerging adulthood is a crucial period for establishing health behaviors given the sensitive period and the potential for future health implications; (b) the methods by which health interventions are implemented are important in addition to the content; and (c) the aforementioned implementation method of health interventions should consider emerging adults' developmental needs for autonomy and empowerment. Thus, it is important for researchers and health professionals to ask the following question: How can the developmental need for autonomy and empowerment be acknowledged and utilized in successful health interventions for emerging adults? Although research specific to emerging adults is limited, research about general adolescent behavior and reactions to autonomy—or lack thereof—sheds some light on the topic.

Past work has suggested that adolescents react negatively to external criticism. In one study, healthy adolescents' brains were scanned as they listened to recordings of their mothers criticizing them (Lee, Siegle, Dahl, Hooley, & Silk, 2015). In this context, researchers found that adolescents showed increased activity in brain areas that are often associated with "processing negative feedback, physical/social pain and negative emotions" (Lee et al., 2015, p. 907), indicating a negative response. Another study examined the relationship between parental criticism and somatic symptoms (e.g., headaches, vomiting, or nausea without a medical diagnosis) among parent-adolescent dyads (Horwitz et al., 2015). The results suggested that parental criticism is a contributing factor to adolescent somatic symptoms, likely because parental criticism disrupts adolescents' stress responses (Horwitz et al., 2015). Taken together, these studies suggest that adolescents tend to react negatively to external criticism.

By contrast, recent research has suggested that adolescents react positively to autonomy-boosting environments that foster the development of emotional autonomy. For example, one adolescent health intervention harnessed common adolescent values (e.g., autonomy and social justice) by presenting preadolescents in the experimental condition with an article about the food industry (Bryan et al., 2016). The article depicted the food industry as manipulative by making junk food addictive and advertising to children who do not know how to distinguish between what is healthy or unhealthy. It went on to say that people could take a stand against the manipulative food manufacturing industry by engaging in healthy eating behaviors. By framing health behaviors as a way to assert autonomy—the latter of which is a hallmark task of adolescence (Allen, Hauser, Bell, & O'Connor, 1994)—the intervention was successful in improving the health profile of snacks and drinks that adolescents chose in an unrelated social context one day postintervention (Bryan et al., 2016). This implies that health behaviors may be one way by which adolescents exert feelings of autonomy (Bryan et al., 2016).

The polarity between the reactions of the adolescents in the studies discussed above—adolescents' negative emotions evoked by hearing parental criticism and adolescents' increase in healthy behaviors when told that behavioral choice was a way to assert autonomy—suggests that adolescents may react negatively to external advice and criticism, but positively to autonomy-boosting

environments. The dichotomy can be understood by applying the concept of locus of control, which is the belief in the extent to which individuals can control their life outcomes (Rotter, 1966). Individuals with an internal locus of control believe they are in control of their life outcomes; individuals with an external locus of control believe outside forces are in control of their life outcomes (Rotter, 1966). In applying the concept of locus of control to the situations mentioned above, adolescents reacted negatively to a situation in which they had an external locus of control (i.e., their mothers were criticizing them) and reacted positively to a situation in which they had an internal locus of control (i.e., they had an opportunity to make autonomous choices about their health). Applying locus of control to adolescent behaviors and reactions prompts the following question: Are effective health interventions those that encourage adolescents to adopt an internal locus of control? To explore whether locus of control can be used to understand adolescent health behaviors and create an effective adolescent health intervention, locus of control specific to the domain of health can be examined.

Health locus of control (HLOC) is defined by individuals' beliefs about who or what is in control of their health (Tabak et al., 2009). Similar to general locus of control (Rotter, 1966), HLOC can be classified into components including internal, powerful others, and chance HLOC (Wallston, Wallston, & DeVellis, 1978). One correlational study examined the relationship between adolescents' health behaviors and their HLOC scores and found a positive association between internal HLOC and healthy behaviors, such as milk-drinking behavior (Tabak et al., 2009). Further, there was an inverse association between internal HLOC and risky health behaviors, such as eating fried foods (Tabak et al., 2009). Although promising, these findings were cross-sectional; thus, it is unclear whether HLOC and healthy behaviors are causally related.

To investigate this phenomenon and address gaps specified by the World Health Organization (2018), the present experiment was designed to target internal HLOC and investigate its effects on health behavior. More specifically, the current research examined whether a health behavior intervention that encouraged emerging adults to have an internal HLOC—one in which individuals believe they are in control of their health via the behavioral choices they make—can not only alter their HLOC scores (i.e., improve internal HLOC), but also influence their health behavior related to

food and beverage intake. We built upon previous work (Bryan et al., 2016) by targeting emerging adults rather than preadolescents, removing social desirability from participants' food choice, and using self-reflection to promote feelings of control and autonomy rather than mere reactions to external stimuli. Based on research suggesting that HLOC and health behaviors are correlated, as well as theoretical considerations suggesting that emerging adulthood is the prime time to conduct health interventions, we hypothesized that a novel intervention targeting HLOC would increase internal HLOC and lead to healthy food and beverage choice relative to a control group. Additional sensitivity and secondary analyses investigated whether results differed for food choice separate from beverage choice, as well as whether other components of HLOC (i.e., powerful others and chance) were impacted by the intervention. Because these latter analyses were not central to our research question, we did not have a priori hypotheses regarding them.

Method

Participants

Ninety-one emerging adults—ages 18 through 25 ($M = 19.36$ years, $SD = 1.31$)—who were proficient in reading and writing English participated in this study. Other eligibility criteria included being free of chronic diseases or dietary restrictions (e.g., food allergies, food intolerances, or strong food preferences) so as not to interfere with the behavioral outcome of the study (i.e., food and drink choice). Participants were recruited from Chapman University, primarily through introductory psychology courses or other psychology courses that offered extra credit for research participation. Participants ($N = 91$) received one research credit in exchange for their hour of participation. Most participants were White (60%); other participants were Asian (17.6%), Native Hawaiian/Pacific Islander (1.1%), or more than one race (13.2%). A small percentage of participants (7.7%) preferred not to disclose their race. Most participants were women (83.5%) and the rest were men (16.5%).

Procedures

Before conducting the study, approval was given by the Institutional Review Board at Chapman University (1617H111). The study was composed of two parts: a 15-minute online questionnaire completed approximately two weeks prior to a 45-minute laboratory visit. The purpose of the previsit online survey was to collect demographic

information and a baseline measure of participants' internal HLOC scores. The laboratory visit included a health behavior intervention via a 10-minute writing task, several questionnaires, and a choice of snacks. There were two primary outcomes of interest: Participants' postintervention internal HLOC scores served as the psychological outcome and participants' postintervention snack choice served as the behavioral outcome. Total participation—including the 15-minute online survey and the 45-minute laboratory visit—did not exceed one hour.

Upon signing up for a laboratory visit time slot, participants were sent a link to the previsit online survey. During the online survey, participants indicated their consent to participate in the study. Next, they provided demographic information including their age, gender, race/ethnicity, level of education, and English language proficiency. Then, participants completed one form of the Multidimensional Health Locus of Control (MHLC) scale, which provided a baseline measure of their internal HLOC score (i.e., our baseline score of interest), powerful others HLOC score, and chance HLOC score. Next, participants were prompted to answer questions about their daily habits (e.g., sleep, physical activity, eating, studying, working, and volunteering), which served as filler questions in order to disguise the primary psychological outcome. Upon completion of the online survey, participants were reminded about their scheduled laboratory visit and were instructed to avoid eating for two hours prior to their scheduled appointment.

Approximately two weeks following completion of the online questionnaire, participants visited the laboratory. Participants were first instructed to take 10–15 minutes to respond to a writing prompt on a computer. The computer randomly assigned participants to either an experimental condition where they wrote about a time during which they took control of their health decisions or a neutral control condition where they wrote about their day since waking up that morning. Next, participants filled out a different MHLC form to assess their internal (as well as powerful others and chance) HLOC scores postintervention. Upon completion of the MHLC scale, participants were instructed to enter a different laboratory room so that the experimenter could set up the next part of the study. In the other room, a variety of healthy and unhealthy snacks were available (i.e., nuts, chips, fresh fruit, cookies, water, and soda). As a cover story, participants were told that there were extra snacks from a recent laboratory party and that they

were welcome to eat whatever they wanted. Participants were also asked to take at least one item in the interest of keeping procedures consistent among all participants because some participants had already taken snack items. Next, participants were asked to return to the original computer room to fill out a series of filler questions on the computer. Participants were then given their compensation and told that they would receive debriefing materials via e-mail once data collection was complete.

Experimental Manipulation

Participants were randomly assigned to either an experimental condition ($n = 48$), which asked them to write about a time during which they—rather than others—had taken control of their health, or a neutral control condition ($n = 43$), which asked them to write about their day since waking. The experimental condition was designed to prompt participants to think about how much control they take over their health and invoke feelings about whether they are satisfied or not with the control they have over their health. Participants randomly assigned to the experimental condition were shown the following prompt derived from theoretical conceptualizations of internal HLOC (Wallston et al., 1978):

Please take the next 10–15 minutes to write about 3–5 times when you took control of your health. Examples include skipping dessert at a restaurant even though your friends ordered it, setting your alarm 30 minutes earlier so that you could go for a run before class, choosing to go to sleep earlier instead of staying up to watch TV, or anything else you can think of. Describe the events leading up to your decision, and consider the benefits that resulted from your decision. The events that you write about can be from the past, present, or future. If you can't think of a time when you have taken control of your health in the past, write about the steps that you might take to do so in the future. Also consider the barriers that you face when you try to take control of your health and how you overcome them. Lastly, consider how being in control of your health makes you feel. How might you have felt if you made an alternative decision that did not involve taking charge of your health? Don't worry about using perfect grammar or spelling, but try to write continuously for at least 10 minutes.

Participants in the control condition engaged in a neutral writing task that did not invoke emotion or thoughts about one's health behaviors (similar tasks have been used by past researchers such as Layous, Nelson, & Lyubomirsky, 2013):

Please take the next 10–15 minutes to write about your day since you woke up this morning. You can include details such as what you did after you woke up, the places you went, the people you saw, the activities in which you participated, or anything else you can think of. Try to include as many details as possible from as much of the day as possible. Don't worry about using perfect grammar or spelling, but try to write continuously for at least 10 minutes.

Manipulation Check

Immediately following the writing intervention, participants responded to several manipulation check questions designed to measure whether the intervention had successfully motivated those in the experimental condition to feel more in control of their health compared to those in the control condition. Participants were asked to indicate their agreement with the following statements on a sliding scale ranging from 1 (*completely disagree*) to 100 (*completely agree*): "I feel in control of my health," "I feel in control of my activities and decisions," "My activities today were positive," "My activities today were negative," "My activities today were typical of my usual routine," and "I am able to manage my life."

Materials

The psychological outcome of the study was determined by responses on the MHLC scale (two different forms were used in the present research). The MHLC scale measures beliefs about participants' control over their health (Wallston et al., 1978). To our knowledge, this scale, developed in the mid-20th century, is the only measure of HLOC that is used in health psychology research to date. Each form of the MHLC scale assesses three subscales comprised of six items each: internal (i.e., the belief that one's health is in her or his own control), powerful others (i.e., the belief that one's health is in the control of powerful others in their lives), and chance (i.e., the belief that one's health is controlled by luck or fate; Wallston et al., 1978). Each statement is rated with a 6-item Likert-type scale ranging from *strongly agree* to *strongly disagree*. Cronbach's α s for the internal HLOC

subscale suggest acceptable internal consistency both preintervention ($\alpha = .71$) and postintervention ($\alpha = .72$). Our primary analyses examined the internal HLOC subscale due to its alignment with the popular value of autonomy among emerging adults. Secondary analyses examined effects of the intervention on powerful others ($\alpha = .50\text{--}.66$) and chance ($\alpha = .67\text{--}.74$).

Following the experimental manipulation, participants were presented with a variety of healthy snacks (i.e., fresh fruit [apples and tangerines], nuts, and water) and unhealthy snacks (i.e., cookies, chips, and soda). Each snack was individually packaged, and multiple packages of each item were available. The behavioral outcome of the study was determined by recording the number and type of healthy and unhealthy snacks that participants chose postintervention. Prior to each participant's visit to the laboratory, the experimenter counted and recorded how many of each snack were displayed. The number of each snack was counted a second time after participants finished the study. To determine the snack choice outcomes, participants' snack selections were first classified as healthy versus unhealthy and then snack choices were calculated in two different ways: one based on the total quantity of healthy or unhealthy snacks and one based on the total type of healthy or unhealthy snacks. For the quantity calculation, the total number of all snacks selected by participants was considered. For example, if a participant selected two apples and one bag of chips, then snack quantity was coded as two healthy snacks and one unhealthy snack. For the type calculation, participants who took more than one of the exact same snack did not have additional identical snacks counted. For example, if a participant selected two apples and one bag of chips, then snack type was coded as one healthy type of snack and one unhealthy type of snack.

Statistical Analyses

Primary analyses involved independent-samples *t* tests to evaluate differences between the experimental and control conditions in the manipulation check items, internal HLOC scores, snack choice quantity, and snack choice type. Using G*Power 3.1 (Faul, Erdfelder, Lan, & Buchner, 2007), we conducted a priori power analyses for an independent samples *t* test. With a relatively small effect size ($d = .3$) and power of .80, a sample size of 352 would have been required. Given that this research project was led by an undergraduate student with time and resource constraints, the desired sample size was not achieved.

In addition to the independent-samples *t* tests, we conducted a mixed Analysis of Variance to determine whether condition interacted with time (pre, post) to impact internal HLOC scores. Sensitivity analyses were also conducted to see if food items in the unhealthy and healthy snack choice outcomes (rather than food and beverages combined) altered findings. These sensitivity analyses used independent-samples *t* tests. Secondary analyses explored whether the intervention impacted the MHLC subscales of powerful others and chance HLOC with independent-samples *t* tests. Analyses were conducted in SPSS with $\alpha = .05$, two-tailed.

Results

Those in the experimental condition ($M = 83.42$, $SD = 11.96$) did not report feeling significantly more in control of their health than those in the control condition ($M = 82.19$, $SD = 15.39$), $t(89) = .43$, $p = .67$, $d = 0.09$. Similarly, there were no significant differences between those in the experimental and control condition for the other manipulation check items.

Internal Health Locus of Control Scores

There was not a significant difference in postintervention internal HLOC scores between those in the experimental condition ($M = 4.39$, $SD = 0.62$) and those in the control condition ($M = 4.45$, $SD = 0.61$), $t(89) = -.44$, $p = .66$, $d = -0.09$, nor was there a significant interaction between time (pre- to postintervention assessment of internal HLOC) and condition, $F(1, 89) = 0.41$, $p = .52$, $\eta_p^2 = .005$. These results suggest that the intervention did not affect participants' self-reported internal HLOC.

Snack Choice Quantity

There was a statistically significant effect of the intervention on the quantity of unhealthy snacks selected such that those in the experimental condition ($M = 0.35$, $SD = 0.57$) selected significantly fewer unhealthy snacks than those in the control condition ($M = 0.63$, $SD = 0.73$), $t(89) = -2.02$, $p < .05$, $d = -0.43$ (see Figure 1a). There was not a significant effect of the intervention on quantity of healthy snacks selected between those in the experimental condition ($M = 1.40$, $SD = 0.94$) and those in the control condition ($M = 1.09$, $SD = 1.02$), $t(89) = 1.48$, $p = .14$, $d = 0.32$ (see Figure 1b). These data suggest that, although the intervention did not affect the quantity of healthy food and drinks selected by participants, it did successfully motivate participants in the experimental condition to select fewer unhealthy food and drinks than participants in the control condition.

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Snack Choice Type

Participants in the experimental condition ($M = 0.35, SD = 0.57$) were not significantly more likely to select unhealthy types of snacks compared with participants in the control condition ($M = 0.60, SD = 0.66$), $t(89) = -1.95, p = .054, d = -0.41$ (see Figure 2a). However, those in the experimental condition ($M = 1.29, SD = 0.82$) were significantly more likely to select healthy types of snacks than those in the control condition ($M = 0.93, SD = 0.74$), $t(89) = 2.20, p = .03, d = 0.46$ (see Figure 2b). These findings suggest that the intervention successfully motivated participants in the experimental condition to select healthier types of food and drinks more often compared with participants in the control condition.

Sensitivity Analyses

To investigate whether there was a discrepancy between participants' food and drink choices and whether they were healthy or unhealthy, and also to account for those participants who came to the laboratory visit with a personal water bottle, a sensitivity analysis that excluded beverages was conducted. When only including food in the analysis (i.e., excluding water and soda from the quantity

of items selected), there was not a statistically significant difference between the experimental ($M = 0.88, SD = 0.82$) and the control condition ($M = 0.70, SD = 0.86$) on healthy food choices, $t(89) = 1.01, p = .32, d = 0.22$. Moreover, those in the experimental condition ($M = 0.33, SD = 0.52$) did not select fewer unhealthy food items than those in the control condition ($M = 0.56, SD = 0.63$), $t(89) = -1.87, p = .07, d = -0.40$. Thus, participants in the experimental and control conditions did not differ significantly in the number of healthy food items or unhealthy food items that they took. Notably, effect size estimates for food only items were slightly weaker than effect size estimates for food and beverage items combined, suggesting that beverages are an important piece to consider.

Secondary Analyses

To examine whether the intervention had an effect on the other subscales of the MHLC scale, we conducted secondary analyses with powerful others and chance HLOC. Analyses suggest that there was no significant postintervention difference between the experimental ($M = 3.32, SD = 0.58$) and control groups ($M = 3.20, SD = 0.58$) on the powerful others subscale, $t(89) = .88, p = .38, d = 0.19$. Moreover, there was not a significant interaction between condition and time (i.e., pre- to postintervention) on the powerful others subscale, $F(1, 89) = 2.76, p = .10, \eta_p^2 = .03$. This suggests that following the intervention, those in the experimental condition were no more likely than those in the control condition to report feeling as though others were in control of their health outcomes.

There were statistically significant differences between the experimental and control groups on the postintervention chance subscale of the MHLC, such that those in the experimental condition ($M = 3.19, SD = 0.62$) scored higher than those in the control condition ($M = 2.74, SD = 0.74$), $t(89) = 3.10, p = .003, d = 0.65$. There was also a significant interaction between condition and time for the chance subscale of the MHLC questionnaire, $F(1, 89) = 6.34, p = .01, \eta_p^2 = .07$. Although those in the experimental and control conditions scored approximately equally on the preintervention chance subscale (as would be expected with random assignment), those in the experimental condition were more likely to report feeling as though chance factors controlled their health outcomes postintervention than those in the control condition.

FIGURE 1

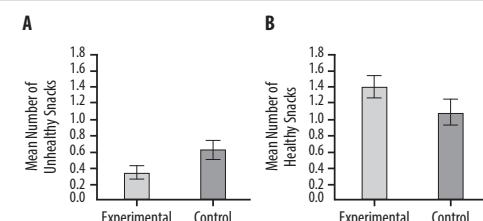


Figure 1a. The mean number of unhealthy snacks that participants selected in the experimental and control groups. Error bars represent standard error of the mean.

Figure 1b. The mean number of healthy snacks that participants selected in the experimental and control groups. Error bars represent standard error of the mean.

FIGURE 2

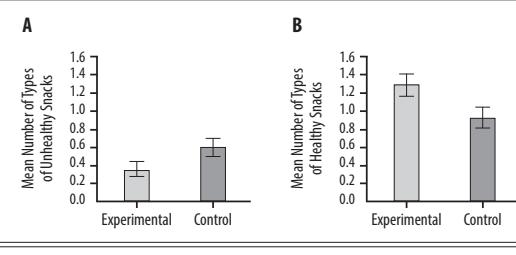


Figure 2a. The number of types of unhealthy snacks that participants in the experimental and control groups selected. Error bars represent standard error of the mean.

Figure 2b. The number of types of healthy snacks that participants in the experimental and control groups selected. Error bars represent standard error of the mean.

Discussion

This study sought to investigate whether encouraging emerging adults to consider ways in which they—rather than others—are in control of their health can motivate them to make healthier choices, particularly related to food intake. Findings suggest that the intervention motivated participants to choose healthier types of food and fewer unhealthy items. In other words, emerging adults who were prompted to write about autonomous experiences from their past, present, or future were more likely to eat less unhealthy food (i.e., chips, cookies, and soda) relative to emerging adults in a control condition.

However, the intervention did not affect participants' self-reported internal HLOC scores. There are several potential explanations for this. For example, the relatively small sample size might not have been adequately powered to detect changes in HLOC scores. It is also possible that HLOC is not something of which participants are consciously aware. Lastly, given the lack of research attempting to manipulate HLOC, it is possible that HLOC is more trait-like than state-like, making it difficult to manipulate this quality through a one-time, relatively short intervention. To our knowledge, this is the first study to attempt to modify HLOC, thus it is unclear in the existing literature whether it is feasible or realistic to manipulate HLOC. There are also several possibilities that may explain the counterintuitive findings that participants in the experimental condition—which was designed to boost internal HLOC—reported higher levels of chance HLOC than participants in the control condition. These may include the amount of attention that participants paid to the scales and participant comprehension of the scale items.

Nonetheless, these results contribute to the growing body of research about the relationship between HLOC and health behaviors. These results are also in line with past research. For example, the present findings are consistent with a study comprised of a nationally representative German sample in which adults who scored higher on the internal HLOC scale reported engaging in more health-related behaviors (Grotz, Hapke, Lampert, & Baumeister, 2011). Moreover, a meta-analysis of 76 studies with adults—some of which were cross-sectional—showed that stronger internal HLOC orientations were associated with two health-promoting behaviors, specifically exercise and diet (Cheng, Cheung, & Lo, 2016). Interestingly, internal HLOC orientations were not significantly

associated with health-compromising behaviors such as smoking or drinking alcohol (Cheng et al., 2016). In addition, internal HLOC orientations were associated with mental and physical quality of life, as well as lower levels of anxiety and depression (Cheng et al., 2016). Although this previous research supports associations between HLOC and better health, it speaks solely to the correlational relationship between HLOC and health. The current study, however, sought to investigate a causal relationship between the two factors.

A study by Bryan et al. (2016) was one of the first studies to utilize an experimental design to examine the role of autonomy in encouraging health behaviors among adolescents. Their findings suggested promising results: young adolescents chose significantly healthier foods and drinks when researchers framed healthy eating as a way to assert the universal adolescent value of autonomy in a social context (Bryan et al., 2016). The current research expanded upon previous findings by testing the theory with emerging adults, who tend to be the oldest and most autonomy-focused adolescents. Further, it eliminated the social appeal factor because participants in the current research selected and consumed their food and drinks in a private context, rather than surrounded by peers. The current research also differs from the study by Bryan et al. (2016) by using a self-reflective writing prompt, rather than a response to a persuasively written article.

Implications

Findings from the current research suggest that the desire for autonomy may be a tool in motivating emerging adults to exhibit healthy behaviors, particularly those related to food choice. Although this area of research is relatively new and requires additional research, these results may inform the development of future health interventions targeted at this population, which is important due to the inconsistent and relatively small effects of previous health interventions (Stice et al., 2006). More specifically, utilizing the desire for autonomy may increase the effectiveness of a variety of health interventions, including large-scale school or community health programs (e.g., Bryan et al., 2016) or even the practices or recommendations of individual healthcare providers (Dickey & Deatrick, 2000; Kim & White, 2018).

Although there was a significant effect of the intervention on participants' food and drink choices, the mechanism by which the intervention

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affected such choices remains unclear. We predicted that internal locus of control would foster healthy behavioral choices, but the null findings for self-reported internal HLOC suggest that other mechanisms are at work. It could be that the experimental rather than control condition drew participants' attention to their health such that they were primed to make healthy choices (cf. Papies, Potjes, Keesman, Schwinghammer, & van Koningsbruggen, 2014). It could also be that the experimental condition was more emotionally arousing than the control condition; emotions are known to influence health-related behaviors and decisions (Ferrer & Mendes, 2018). Finally, whereas the control condition focused participants' attention on the immediate past, the experimental condition encouraged participants to focus on either past, present, or future actions. Evidence has suggested that the time perspective a person uses may be associated with health-related behaviors (Henson, Carey, Carey, & Maisto, 2006), which could have come into play in the current study. Future research should examine whether the improved behavior choices can be replicated and should closely examine the mechanism by which this change may occur.

Strengths and Limitations

To our knowledge, this study was the first to experimentally test whether encouraging emerging adults to think about ways in which they are in control of their health could motivate healthier behaviors. The experimental design of this study was an asset because several studies in the existing literature utilize cross-sectional designs or before-after designs rather than comparing randomly assigned treatment and control groups (Grotz et al., 2011; Salam, Das, Lassi, & Bhutta, 2016). Although there were no significant effects of the intervention on self-reported internal HLOC scores, there were significant effects on participants' food and drink choices. As such, one strength of this study was the ability to target a measurable health behavior that has important implications for subsequent health (although the underlying mechanism remains to be determined).

Another strength of this study is that the intervention was relatively simple; it required minimal time and few resources. As such, it could easily be implemented into school curricula or school-related health programs without the need for ample time or resources, making it an accessible and feasible option. Unlike other health behavior

interventions, the one used in the current research contains self-reflection rather than direct instruction or advice, which may be important among adolescents who tend to react negatively to criticism from authority figures (Lee et al., 2015) or who may misconstrue traditional health or nutritional advice (Golden et al., 2016).

This study has several limitations. First, the small sample size ($N = 91$) might have limited the statistical power needed to detect differences in participants' self-reported internal HLOC scores. The reliability for the HLOC subscales was also relatively weak. Additionally, the uneven distribution of female ($n = 76$) and male ($n = 15$) participants might have affected results, considering the potentially different responses that women and men may have to health interventions. Results of one meta-analysis of health interventions suggests a larger effect size for female-only samples than mixed-sex or male-only samples (Stice et al., 2006). In addition, most participants were White, and small numbers of people from other racial/ethnic backgrounds prevented comparisons across subgroups. Moreover, this design did not measure food and drink choice at different time points following the intervention. Because follow-up data was not collected in the short- or long-term, it is unclear how long the effects of this intervention might last.

It is also important to acknowledge that neither the internal HLOC scores nor the manipulation check items differed significantly by condition, which is to say that participants who were asked to think and write about being in control of their health did not report feeling more autonomous. There are several possible explanations for this phenomenon, including but not limited to the reliability of self-report questionnaires and the discrepancy between participants' behavior and their self-report responses. Alternatively, it is possible that the experimental writing task drew participants' attention to their health, regardless of whether or not it induced feelings of autonomy, self-control, or empowerment.

It is also possible that participants could have intentionally made unhealthy choices, either due to or in spite of an increased sense of autonomy. Future research that examines the potential causal relationship between increased autonomy and behavioral choices could shed light on whether it is desirable for emerging adults to have an increased sense of autonomy in the health domain. An additional, related limitation is the potential differentiation in how participants appraised the

various food and drink options available in the laboratory. For example, although the food and drink options were selected as options that could easily be classified as healthy or unhealthy by the researchers, it is possible that participants' criteria regarding what is healthy were different. Factors such as attitudes toward food, perceived desirability, and caloric load of the available foods may have impacted participants' choices. Future research could ask participants to evaluate their attitudes toward the food and drinks available in the laboratory prior to making a snack choice.

Lastly, it is important to consider the possibility that participants in the experimental condition were simply primed to think about their health, leading to healthier food choices, while participants in the control condition were not. Participants in the experimental condition were asked to write about times during which they had taken control of their health and were encouraged to write about the feelings and emotions related to those instances. By contrast, participants in the neutral control condition were asked to write about their day, and were instructed to avoid writing about emotions or feelings. To eliminate this limitation, future research may include a similar study with three conditions: a writing task about times during which participants have taken control of their health, one about times during which they have not had control of their health, and a neutral control condition in which participants do not write about their health at all. These limitations warrant additional research.

Future Research

The results of this study suggest the need for future research regarding ways in which encouraging individuals to have an internal HLOC or bringing attention to their health choices may motivate health behaviors. First, future research may examine whether encouraging emerging adults to have an internal HLOC may motivate other health-related behaviors such as sleep, exercise, or stress management. Other health domains that may be particularly relevant for emerging adults—and therefore domains in which autonomy interventions may be useful—include sexual health, micronutrient supplementation, substance abuse, and vaccination (Salam et al., 2016). Future research should also explore whether encouraging individuals to have an internal HLOC may motivate health behaviors among other age groups, such as children or older adults, as well as whether interventions are equally effective for both men and women and for people

from diverse racial/ethnic backgrounds. Moreover, while the intervention in this study was a relatively brief (i.e., 10-minute) one-time writing task, future studies may examine whether a repeated or longer intervention may yield stronger or longer-lasting effects.

Lastly, additional research is needed to explore the mechanism by which the intervention in the current study encouraged participants to make healthier food and drink choices. Future studies with additional conditions are necessary to discern whether the intervention motivated participants to feel autonomous or simply directed participants' attention to their health. This may include an exploration into other relevant theories such as Self-Determination Theory—the basic tenet of which is that one's motivation is related to the degree to which it is autonomous or externally regulated—which has shown associations with beneficial health outcomes in the context of interventions that encourage autonomy and intrinsic motivation (Silva et al., 2010).

Concluding Remarks

In sum, the current research involved a novel approach to improving the health of emerging adults by emphasizing the developmentally relevant value of autonomy to encourage health behaviors. To our knowledge, this is the first study to directly target internal HLOC as a means of improving health behaviors. Investigations regarding how to improve the health of emerging adults are particularly relevant due to the important psychological and emotional changes that occur during this developmental time (Arnett, 2000), concurrent with increased exposure to unhealthy foods and marketing campaigns that advertise such food products (World Health Organization, 2018). Moreover, establishing healthy behaviors such as a diet rich in fruit and vegetables is particularly important during this developmental stage because it has the potential to improve adolescents' current health, future health during adulthood, and even the health of their future children (World Health Organization, 2018). Given what is already known about the developmental needs and characteristics of the emerging adult population, as well as the preliminary findings of this study, future research should continue to explore how autonomy, empowerment, and internal HLOC can be used to encourage healthier behaviors among emerging adults and others.

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Behavioral and Event Related Potential Measures of Response Initiation and Response Inhibition by Age and Sensation Seeking

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ABSTRACT. High sensation seeking is associated with increased propensity toward risky behaviors that can be detrimental to oneself and others (Horvath & Zuckerman, 1993). Younger adults not only tend to have higher sensation-seeking scores than older adults, but also demonstrate a greater inclination toward risky behaviors (Cowell, Patiel, & Peters, 2019; Turner & McClure, 2003). The present study considered whether risk-taking behavior is a function of an *overactive initiation system* (a strong, immediate response to a stimulus) or an *underactive inhibitory system* (inability to resist an immediate response). With this in mind, the present study examined differences in response initiation and response inhibition among low and high sensation seekers as well as older and younger adults. Participants (18 younger adults and 24 older adults) completed a sensation-seeking questionnaire and Go/No-go task. The results showed differences in inhibition between age groups, controlling for sensation seeking, as measured by the P300 component ($\eta^2 = .22$) and reaction time ($\eta^2 = .24$). In regard to response initiation measured by the late contingent negative variation, the results revealed no differences between age groups or sensation-seeking groups. Any significant findings were exclusive to certain electrode sites, however, so results remain somewhat inconsistent regarding widespread and stable group differences. The present study demonstrates that individual differences, such as age and sensation seeking, may play a role in response initiation and inhibition, underscoring the complexity of the process that leads to risky behavior.

Keywords: electroencephalography, sensation seeking, risky behavior, age

Sensation seeking, the tendency to seek out novel and stimulating experiences despite a high level of risk, is a personality trait that plays a crucial role in dictating human behavior (Zuckerman, 1994). A teenager who prefers lower sensation-seeking activities will likely elect to stay home rather than accompany similarly underage friends to a house party. Conversely, a high sensation seeker will choose to spend time skydiving or bungee jumping, because the adrenaline rush is enjoyable despite the possibility of injury. Many researchers have focused on studying individual differences in sensation seeking, especially when examining the risk-taking behavior often exhibited by individuals

who are high sensation seekers. One particular factor of difference is age; researchers have shown that younger adults often have higher sensation-seeking scores than older adults (Roalf, Mitchell, Harbaugh, & Janowsky, 2011; Roth, Schumacher, & Brahler, 2005). It follows, then, that younger adults would also be more likely to partake in high-risk behaviors. This is evidenced by the prevalence of risky behaviors such as drug abuse, crime, and risky sexual behavior seen in younger adults compared to their older adult counterparts (Cowell, Patiel, & Peters, 2019; Turner & McClure, 2003).

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Although high sensation seeking may indeed lead to higher levels of risky behavior, it is also important to consider the roles the initiation system and inhibition system play in risk-taking. Response initiation represents the speed at which people prepare and react on a response to a stimulus, which influences both the way they behave and make decisions (Collins, Corbly, Liu, Kelly, Lynam & Joseph, 2012). It is possible that risk-taking can be explained by an overactive initiation system because a strong initial response to a situation may be too powerful to resist. Individuals who have an abnormally strong impulse to shoplift may engage in that risky behavior because their ordinary ability to refrain from making that response is not sufficient. Response inhibition is another important consideration in behavior management and impulse control, because inhibition allows a person to resist a particular response. Risky behavior may also be due to an underactive inhibition system, because an initial impulse to engage in a risky act cannot be resisted by a weak inhibition system. In response to an urge to shoplift, an individual with an abnormally weak ability to resist that urge may then engage in that risky behavior. In summary, it is unclear whether people engage in greater sensation-seeking activities because they have difficulty refraining from the risky behavior or because they have a strong initial impulse oriented toward that behavior.

One hypothesis was that people make risky decisions because they have an *underactive* inhibitory system. Yet, some researchers have shown that response inhibition is enhanced in younger adults as compared to older adults (Butler & Zacks, 2006; Kramer, Humphrey, Larish, & Logan, 1994; Schmiedt-Fehr & Basar-Eroglu, 2011). Although these results do not take the sensation-seeking scores of these individuals into account, they do suggest that younger adults of any sensation-seeking level should be able to inhibit responses better than older counterparts of the same sensation-seeking level. This counteracts the idea that younger adults take risks because of difficulty in inhibition. Another important, although less studied, consideration is response initiation because a high sensation-seeking individual may act rashly due to an overactive initiation system. Although research on this component is sparse, one study did suggest that, in rats, adolescents may be less able to initiate a response than adults (Simon, Gregory, Wood, & Moghaddam, 2013). Again, this finding

seems counterintuitive to the fact that younger individuals engage in risky behavior because of an overinvolved initiation system, because they do not initiate a response as quickly as an adult.

Current research on response initiation and response inhibition has yielded conflicting results and made use of drastically different methodologies. Although many studies have focused on variability of response inhibition between individuals of different sensation-seeking levels and age groups (Butler & Zacks 2006; Cowell et al., 2019; Zheng & Liu, 2015), one study suggested that larger individual variability may be found between response initiation, rather than inhibition. Collins, Corbly, Liu, Kelly, Lynam, and Joseph (2012) used functional magnetic resonance imaging (fMRI) to examine brain areas involved in response initiation and response inhibition to uncover any differences that exist between individuals who are low sensation seekers and those who are high sensation seekers. Using a Go/No-Go task to test this hypothesis, the researchers were interested in whether high sensation seekers may engage in risky activities because of an overactive initiation system or an underactive inhibition system. In a Go/No-Go task, participants are asked to initiate a response by pressing a key every time a symbol (e.g., a letter) appears on the screen. These are considered "go" trials. Participants are also asked to inhibit a response by not pressing a key when one particular symbol appears (e.g., the letter X). These are considered "no-go" trials. If high sensation seekers have a weaker inhibitory system, they would have less activation than low sensation seekers in no-go conditions. Conversely, if high sensation seekers have an overactive initiation system, they would have more activation than low sensation seekers in go conditions. The results indicated sensation-seeking group differences in response initiation, not response inhibition. High sensation seeking participants showed greater activation in go conditions than no-go conditions, and this activation lasted longer in high sensation seekers than in low sensation seekers. These findings suggest that high sensation seekers have a more active initiation system than their low sensation-seeker counterparts (Collins et al., 2012).

The present study sought to close some existing gaps in the research by examining both response initiation and response inhibition using behavioral measures and *event related potential* (ERP) correlates. Many ERP studies do not address

response initiation, and therefore a standard ERP analysis of this process has not been identified. However, the *contingent negative variation* (CNV) has been used as an indicator of motor preparation and schema activation before a response is carried out and could signal the initiation of a response. The CNV, first described by Grey Walter and colleagues, is elicited by presenting one stimulus that acts as a cue, and then an imperative stimulus that requires a response from the participant. Between these two stimuli, the CNV is present as a slow negative potential (Tecce, 1972; Walter, Cooper, Aldridge, McCallum, & Winter, 1964). The CNV is used to indicate when an individual succeeds in activating the correct schema to respond to an imperative stimulus (Aasen & Brunner, 2016). In a Go/No-Go task, for example, participants will create a cognitive framework that includes the steps leading to a correct response in both go and no-go conditions. Because many more go trials than no-go trials appear throughout the task, the participant will begin to anticipate the need to activate the go schema. By using the CNV to explore when this schema is activated before go trials, it may be possible to track the initiation of each go response. The use of the CNV to indicate the preparation of a motor response has been widely researched and supported (Birbaumer, Elbert, Canavan, & Rockstroh, 1990; Brumia & van Boxtel, 2001; Nagai, Critchley, Featherstone, Fenwick, Trimble, & Dolan, 2004; Rohrbaugh, Syndulko, & Lindsley, 1976; Tecce, 1972). When employing a Go/No-Go task, for example, the CNV may be utilized to identify when participants begin preparing to make a button press, which is the motor response for the go trial they are anticipating. Thus, previous research has demonstrated that the CNV encompasses the first steps of responding to stimuli and therefore can be used as a sign of response initiation because it includes both stimulus processing and motor preparation.

Much more research has been focused on ERP indicators of response inhibition, and has designated the P300 wave as a reliable indicator of motor inhibition (Aasen & Brunner, 2016; Polich, 2007; Sach, Enge, Strobel, & Fleischhauer, 2017; Schmiedt-Fehr & Basar-Eroglu, 2011). In a Go/No-Go task, the P300 peaks about 300–500 ms after the appearance of the letter. Thus, the amount of P300 activation can be used to indicate the effort participants put into inhibiting their go response in each no-go trial (Luck, 2014). Research has

shown that both the amplitude and latency of the P300 differ in individuals of different ages. The P300 shows a larger amplitude and shorter latency in young adults, whereas older adults show a smaller amplitude and increased latency of this component (Dully, McGovern, & O'Connell, 2018; Polich, 2007; Schmiedt-Fehr & Basar-Eroglu, 2011). Age differences in an ERP component used to indicate inhibition may hint at overall differences in inhibition abilities in individuals as they age. Behavioral traits have also been shown to affect the P300, although presently the literature in this area is sparse. For example, low-arousal individuals, who will likely also be low in sensation seeking, tend to show smaller P300 amplitudes than those who are high-arousal (Polich, 2007).

The present study used the CNV and P300 ERP components as well as behavioral analyses of participants' performance on a Go/No-Go task to examine differences in response initiation and response inhibition among low sensation seekers and high sensation seekers. It also examined how response inhibition and initiation may differ between younger adults and older adults. Low sensation seekers were compared with high sensation seekers to examine differences in response initiation and inhibition abilities. If high sensation seekers had an overactive initiation system, then we expected the CNV to show large differences between low and high sensation seekers. Conversely, if high sensation seekers possessed an underactive inhibitory system, then we expected them to exhibit a larger P300 waveform on No-Go trials compared to the low sensation seekers. Any differences in response inhibition between sensation-seeking group or age group would also be indicated by differences in reaction time when responding to the Go/No-Go task. Previous research has demonstrated that older adults typically have slower reaction times (Fozard, Vercruyssen, Reynolds, Hancock, & Quilter, 1994). Older adults and younger adults were also compared on sensation-seeking scores and ERP components indicating initiation and inhibition. Based on previous literature, older adults were expected to have lower sensation-seeking scores than younger adults (Roalf et al., 2011; Roth et al., 2005). Additionally, younger adults have previously demonstrated a larger P300 amplitude and shorter latency than older adults, which may indicate that older adults struggle more with inhibition (Dully et al., 2018; Polich, 2007; Schmiedt-Fehr & Basar-Eroglu, 2011).

Rooted in the findings of previous research, we developed three exploratory hypotheses: (a) older adults would have lower sensation-seeking scores than younger adults; (b) ability to inhibit, as indicated by P300 and reaction time, would differ by age group (older vs. younger) and sensation-seeking group (low vs. high); and (c) ability to initiate a response, as indicated by the late CNV, would differ by age group (older vs. younger) and sensation-seeking group (low vs. high).

Method

Participants

Participants were a convenience sample consisting of 24 older adults ($M = 71.83$ years; $SD = 8.54$ years; range = 57–87 years; 54.20% women) and 18 younger adults ($M = 20.28$ years, $SD = 1.02$ years, range = 19–22 years; 38.90% women). Older adults were recruited through word of mouth, a local community center, church bulletins, and community flyers. The older adult participants were recruited from an upper Midwestern town located in the United States. Among residents of this town, 77.40% identified as White (U.S. Census Bureau, 2017). The younger adult participants were recruited from a small, private, four-year, primarily undergraduate, highly residential college located in the same town. The undergraduate student population from which younger adult participants were drawn most frequently identified as European American (87%). Many of the younger adults were recruited through an online participant pool and took part in the study in exchange for course credit. Participants in the present investigation were part of a larger study examining the influence of personality and early life experiences on risky decision making in younger and older adults.

Measure and Procedure

First, approval from the St. Norbert College institutional review board was obtained (FWA #14-02-006) for the study entitled Decision Making in an ERP Environment. At the beginning of each experimental session, participants were greeted and then completed an informed consent form, a demographics questionnaire (e.g., age, sex, employment status, living arrangements, marital status, level of education), the Sensation-Seeking Scale, and other measures beyond the scope of these analyses. Next, we asked participants to take a seat in a testing room with a computer. Then, the electroencephalogram (EEG) system was set up for data collection. We placed the 32-electrode cap on

each participant's head and inserted a small amount of conductive gel into each channel to allow for a clear signal. Subsequently, participants completed a resting state task and three other computerized tasks. Only the Go/No-Go task was used for the present study.

Sensation-Seeking Scale

We measured sensation-seeking level with the impulsive-sensation seeking section of Zuckerman's (1994) Zuckerman–Kulhman Personality Questionnaire (ZKPQ). The Sensation Seeking Scale was a 13-item, forced-choice, self-report inventory that measured overall sensation seeking, as well as four subscales (thrill and adventure seeking, disinhibition, experience seeking, boredom susceptibility). For each item, one statement was consistent with high sensation seeking and the other was consistent with low sensation seeking. Participants selected the statement (A or B) that they believed best described them. Each high sensation seeker response was coded as 1 and each low sensation-seeker response was coded as 0. Thus, scores could range from 0 to 13. Zuckerman demonstrated that the ZKPQ had high internal consistency for women (.81) and men (.77).

EEG Recording

We collected EEG data using a 32-electrode acti-CHamp system. The system was set at 2kHz and used the O1 and O2 electrodes as references. We set all 32 electrode impedances below 30 KOhms. We then conducted analyses of the electrophysiological data using Brain Vision Analyzer software. We downsampled the data offline from 512 Hz to 256 Hz. After referencing these data to an average of all electrodes, we used an IIR filter of 0.1-30 Hz along with a notch filter of 60 Hz. Using a 2200 mV to 200 mV threshold, we completed artifact rejection. Additionally, we visually inspected and removed bad channels. To identify and correct ocular movements, we used Gratton–Coles ocular artifact correction, seeded off of electrode Fp1. After the preprocessing procedures, we separated the data by stimulus type (i.e., go, no-go). We created Epochs with 200 ms baselines and 1000 ms stimulus presentation following the onset of each go or no-go trial. Next, each epoch was averaged, depending on stimulus type, and baseline corrected. We combined the corrected averages for each participant to calculate a grand average, allowing them to analyze the ERP component for each participant based on trial type. From these

data, we examined two ERP waveforms: the late CNV on all go trials (100 ms prestimulus of the following trial), and the P300 on correct no-go trials (300–600 ms poststimulus of current trial). Finally, we extracted the mean amplitude for the late CNV from the Pz, Fz, and Cz electrodes, and the mean amplitude for the P300 from the P3, P4, C3, C4, F3, and F4 electrodes.

Resting State

After the EEG equipment was in place, each participant completed two 4-minute resting state measures. For the first resting state measure, each participant was instructed to sit completely still with eyes open. For the second resting state measure, participants completed a similar process of remaining still, but this time with eyes closed for 4 minutes.

Go/No-Go Task

Each participant completed the Go/No-Go Task (Luria, 1961). In this task, participants watched as a series of letters appeared on a computer monitor. We instructed participants to respond when a go stimulus appeared and to refrain from responding when the no-go stimulus appeared. We told participants to initiate a response by pressing the spacebar each time they saw a letter (go stimulus), except if the letter was X (no-go stimulus). The task included 150 go trials and 50 no-go trials. Therefore, the number of correct responses for each participant could have ranged from 0 to 200. During each trial, participants saw a capital letter appear on the screen for 1000 ms. The interstimulus interval was jittered between 500 and 1000 ms, during which participants saw a fixation crosshair in the middle of the screen. Inhibition of a response occurred when the participant correctly refrained from responding to a no-go trial. Initiation of a response occurred when the participant correctly responded on a go trial. EEG data (P300 and CNV) was collected during this task, as well as data concerning the participant's reaction time for each trial.

Results

Sensation-Seeking Scores

The first hypothesis was that older adults would have lower sensation-seeking scores than younger adults. Using a median split of total sensation-seeking scores, we divided participants into a low and high sensation-seeking group. We placed all participants with a total sensation-seeking score of 0 to 5 in the low sensation-seeking group and all participants with total sensation-seeking scores of 6

to 13 in the high sensation-seeking group. We used a median split to create two nearly equal sensation-seeking groups for experimental comparison. These same groups were then used in subsequent analyses. Ultimately, the sample consisted of 22 low sensation seekers ($M = 4.00$, $SD = 0.93$, range = 2–5; 50% women) and 20 high sensation seekers ($M = 7.95$, $SD = 1.32$, range = 6–10; 45% women).

We conducted a chi-square test to examine the relationship between age category (older vs. younger) and sensation-seeking group (low vs. high). The relation between these variables was significant, $\chi^2 (1, N = 42) = 4.58$, $p = .03$. Older adults were more likely to be in the low sensation-seeking category than were younger adults, whereas younger adults were more likely to be in the high sensation-seeking category (see Figure 1). As a measure of effect size, we calculated a Cramer's V of .33, indicating a strong association between age category and sensation-seeking score.

Ability to Inhibit a Response

The second hypothesis was that ability to inhibit, as indicated by P300 and reaction time, would differ by age group (older vs. younger) and sensation-seeking group (low vs. high). We verified that the assumptions for the Analysis of Variance (ANOVA) were met before proceeding with the following analyses. To assess potential P300 waveform differences on no-go trials, we conducted a 2 (age group) \times 2 (sensation-seeking group) ANOVA, combining results from all electrodes to explore differences between each participant's average P300. We did not find any significant differences, $F(3, 38) = 1.62$, $p = .20$. Initially, we included all 32 electrodes included in the ANOVA. In an effort to reduce noise, we conducted additional analyses on the specific electrodes of interest for the P300 component previously identified in the literature (i.e., F3, F4, P3, P4, C3, and C4; Picton, 1992).

FIGURE 1

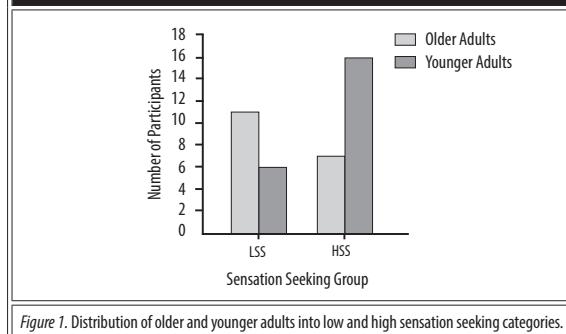


Figure 1. Distribution of older and younger adults into low and high sensation seeking categories.

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FIGURE 2

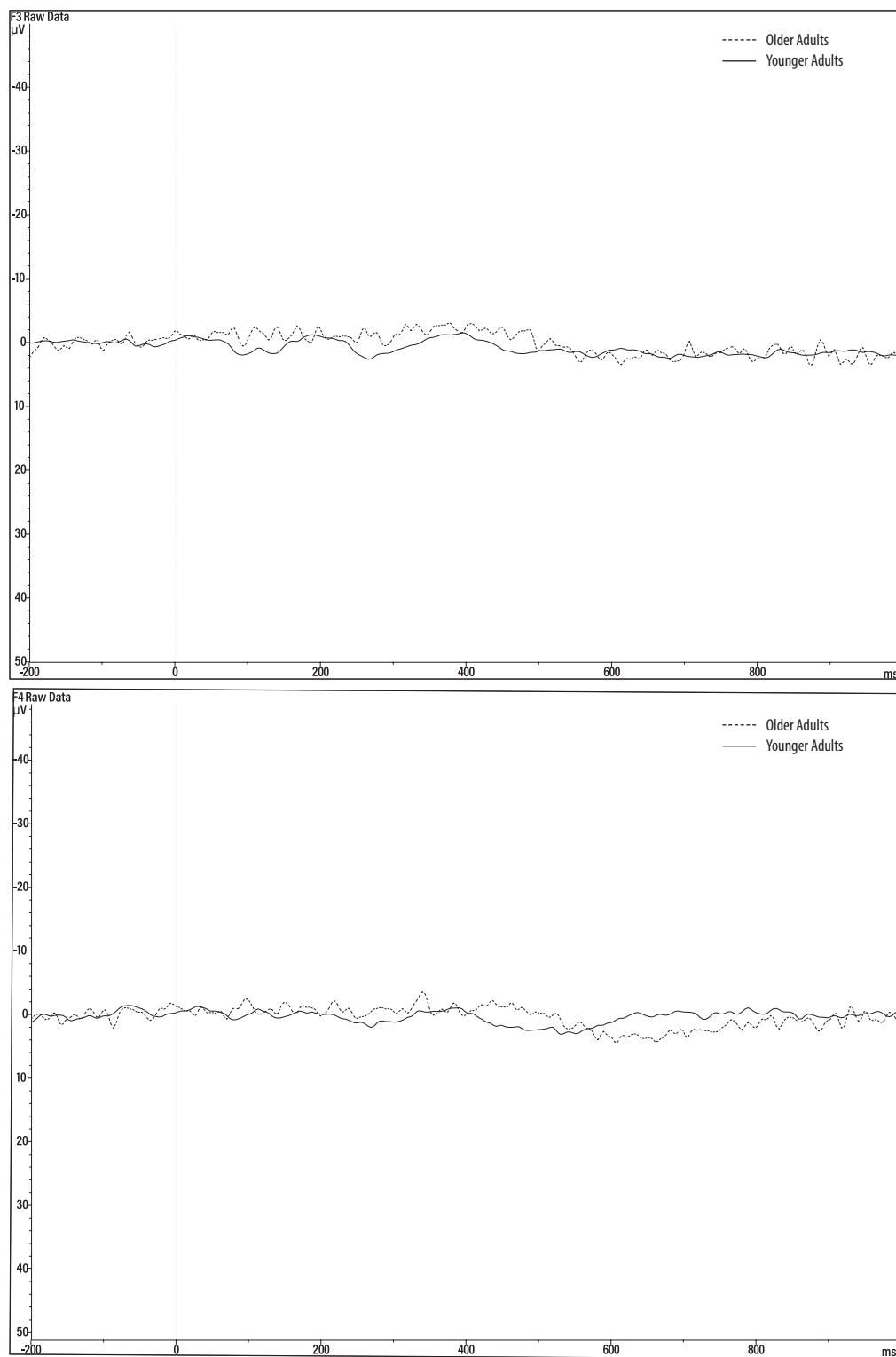


Figure 2. Mean P300 amplitudes are shown for older and younger adults at the frontal electrodes F3 (top panel) and F4 (bottom panel).

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To assess differences in the P300 on no-go trials at the frontal electrodes (i.e., F3, F4), a 2 (age group) by 2 (sensation-seeking group) ANOVA was conducted. There were no statistically significant interactions. There was a significant main effect of age group, $F(1, 38) = 9.65, p = .004$. This result indicated that older adults had more activation than younger adults (2.80 ± 4.40 vs. -0.02 ± 1.58 , respectively). This relationship had a moderate effect size, $= .20$ (see Figure 2).

To assess differences in the P300 on no-go trials at the parietal electrodes (i.e., P3, P4), a 2 (age group) by 2 (sensation-seeking group) ANOVA was conducted. There were no statistically significant interactions. There was a significant main effect of age group, $F(1, 38) = 11.69, p = .002$. These results indicated that younger adults had more activation than older adults (2.64 ± 1.97 vs. 0.77 ± 2.15 , respectively). This relationship had a moderate effect size, $= .24$ (see Figure 3).

To assess differences in the P300 on no-go trials at the central electrodes (i.e., C3, C4), a 2 (age group) by 2 (sensation-seeking group) ANOVA was conducted. After correcting for family-wise error due to running analyses with the same groups on three separate electrode pairings, the new alpha level was set at 0.0167. Therefore, there was no statistically significant interaction, $F(1, 38) = 5.71, p = .02$. There was not a significant main effect of age group, $F(1, 38) = 0.004, p = .95$, or sensation-seeking group, $F(1, 38) = 1.31, p = .26$.

Because of the relationship between age group and sensation-seeking score established in Hypothesis 1 (younger adults: 6 low sensation seekers, 12 high sensation seekers; older adults: 16 low sensation seekers, 8 high sensation seekers), we conducted additional tests, controlling for both age and sensation-seeking group in separate analyses, to determine whether this relationship was masking possible differences in the P300 component. Before performing Analyses of Covariance (ANCOVAs) for the frontal electrodes (i.e., F3, F4) or the parietal electrodes (i.e., P3, P4), we verified that the basic assumptions were met. We did not conduct an ANCOVA for the central electrodes (i.e., C3, C4) because those data did not meet the basic assumptions of homogeneity of regression slopes for ANCOVA.

A one-way ANCOVA, controlling for age, revealed no significant differences between low and high sensation seekers in the P300 component on no-go trials at the frontal electrodes (i.e., F3, F4), $F(1, 39) = 0.01, p = .91$, or the parietal electrodes (i.e., P3, P4), $F(1, 39) = 3.09, p = .09$.

A one-way ANCOVA, controlling for total SS score, revealed a significant difference between older adults ($M = 2.88$) and younger adults ($M = -0.12$) in the P300 component on no-go trials, at the frontal electrodes (i.e., F3, F4), $F(1, 39) = 11.09, p = .002$. This relationship had a moderate effect size, $= .22$. The results also showed a significant difference between older adults ($M = 0.64$) and younger adults ($M = 2.81$) in the P300 component on no-go trials at the parietal electrodes (i.e., P3, P4), $F(1, 39) = 10.99, p = .002$ (see Figure 2). This relationship also had a moderate effect size, $= .22$.

To assess potential differences in reaction time, we conducted a 2 (age group) x 2 (sensation-seeking group) ANOVA. No statistically significant interactions were found. There was a significant main effect of age group, $F(1, 36) = 11.21, p = .002$. According to this result, older adults had significantly slower reaction times than their younger adult counterparts (555.73 ± 100.29 vs. 452.48 ± 61.87 , respectively). Age group had a moderate effect on reaction time, $= .24$. The high variability in reaction times as seen by the large standard deviations could be a possible reason the investigators did not find other significant differences.

Ability to Initiate a Response

The third hypothesis was that ability to initiate a response, as indicated by the late CNV, would differ by age group (older vs. younger) and sensation-seeking group (low vs. high). We verified that the data met assumptions for ANOVA before proceeding with the following analysis. To assess potential differences in the CNV on go trials, we conducted a 2 (age group) x 2 (sensation-seeking group) ANOVA, combining results from all electrodes to explore differences between each participant's average CNV. The results indicated no statistically significant interactions as well as no significant differences in the CNV between age group or sensation-seeking group. After conducting an ANOVA using all 32 electrodes, we utilized previous research to identify specific electrodes that were of particular interest for the CNV (i.e., Pz, Cz, and Fz; Aasen & Brunner, 2016). To assess potential differences in the CNV on go trials at the Pz, Cz, and Fz electrodes, we conducted three separate 2 (age group) by 2 (sensation-seeking group) ANOVAs, one for each electrode. There were no statistically significant interactions. The results demonstrated no significant differences between sensation-seeking groups at the Pz, Cz or Fz electrode. In addition, the results demonstrated no significant differences in the CNV between older adults and younger adults in either the Pz, Fz, or Cz electrode.

FIGURE 3

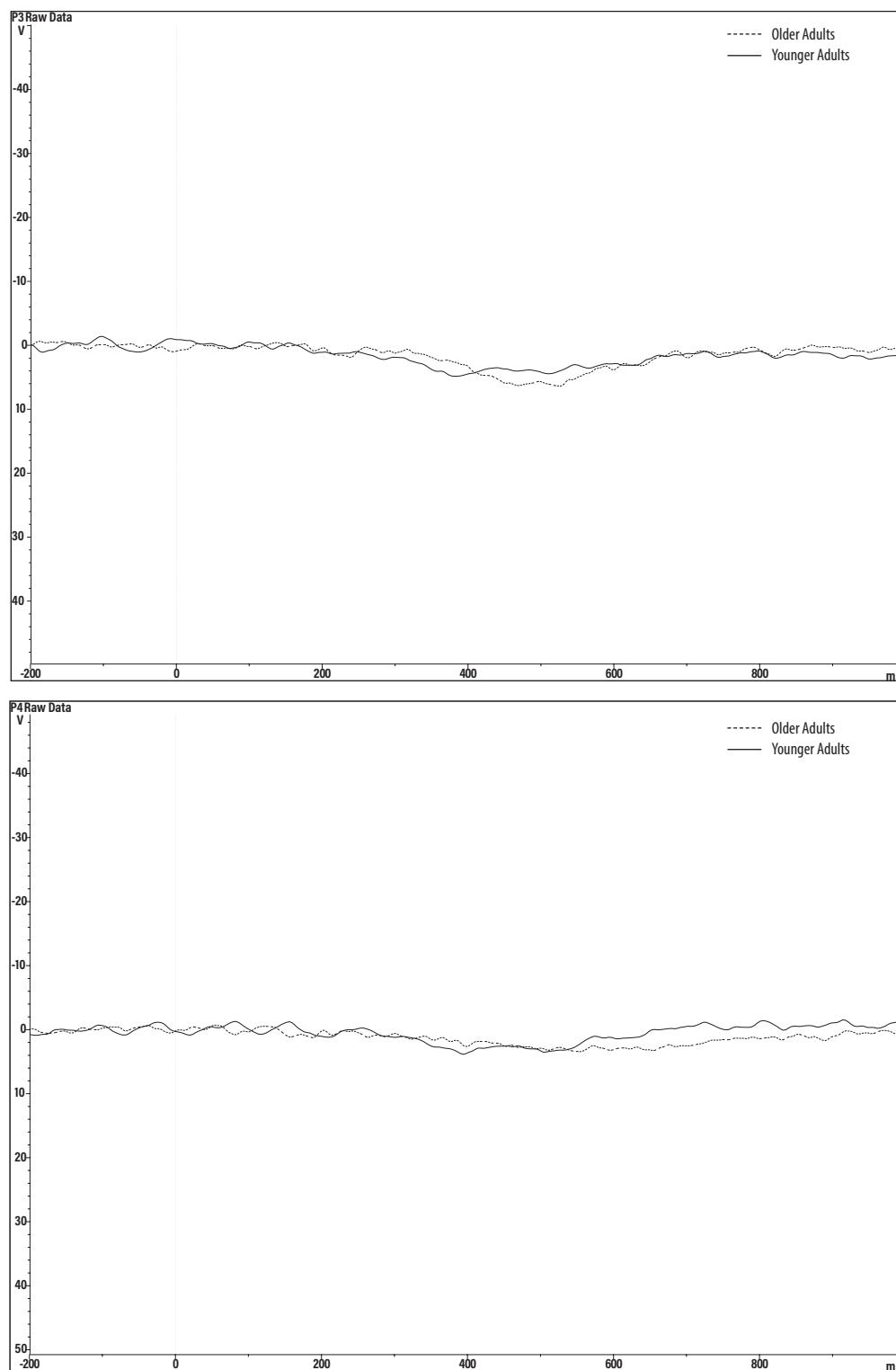


Figure 3. Mean P300 amplitudes are shown for older and younger adults at the parietal electrodes P3 (top panel) and P4 (bottom panel).

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Again, we conducted additional analyses controlling for both age group and sensation-seeking score because of the previously determined relationship between the two variables (younger adults: 6 low sensation seekers, 12 high sensation seekers; older adults: 16 low sensation seekers, 8 high sensation seekers). These analyses helped determine possible differences in the CNV that were obscured by the association between age and sensation-seeking group. Before conducting these analyses, we ensured that the data met all basic assumptions for ANCOVA. A one-way ANCOVA, controlling for age, revealed no significant differences between low sensation seekers and high sensation seekers in the CNV on go trials at the Pz electrode, $F(1, 38) = 3.79, p = .06$, the Fz electrode, $F(1, 39) = 0.78, p = .38$, or the Cz electrode, $F(1, 39) = 0.27, p = .61$.

A one-way ANCOVA, controlling for total SS score, revealed no significant differences between older adults and younger adults in the CNV on go trials at the Pz electrode, $F(1, 38) = 0.18, p = .68$, the Fz electrode, $F(1, 39) = 0.26, p = .62$, or the Cz electrode, $F(1, 39) = 0.24, p = .63$.

Discussion

The purpose of the present study was to investigate two possible explanations for engagement in risky behavior: an overactive initiation system and an underactive inhibitory system. Further, we sought to determine how individual differences such as sensation-seeking level and age could influence response initiation and inhibition. We also aimed to discover potential differences in sensation-seeking levels between younger and older adults.

Sensation-Seeking Scores

Based on previous research, we hypothesized that older adults would have lower sensation-seeking scores than younger adults (Roalf et al., 2011; Roth et al., 2005). Consistent with this hypothesis, older adults did have lower sensation-seeking scores than younger adults. This suggests that individual differences in sensation-seeking may be partially attributable to age. Moreover, because older adults are less likely to be high sensation seekers, they are also less likely to engage in risky behaviors, compared to their younger adult counterparts. Based on this premise, older adults are unlikely to seek out risky behaviors such as speeding or gambling. It is possible that less risk is necessary for older adults to achieve optimal arousal levels, so additional novel sensations are unnecessary.

Ability to Inhibit a Response

For our second hypothesis, we expected ability to inhibit, as indicated by P300, and reaction time to differ by age (older vs. younger) and sensation-seeking group (low vs. high). The ability to inhibit—examined in this study via the P300 component and reaction time—is an essential component to understanding an individual's impulse control and decision making. If a specific group of individuals struggle to inhibit their responses, they may engage in high-risk behaviors because of an inability to quell their initial desire to participate in the activity. This is one possible explanation for why individuals who are high in sensation seeking often make more risky decisions than their low sensation-seeking counterparts. Additionally, research has shown differences in response inhibition between older and younger adults (Butler & Zacks, 2006; Schmiedt-Fehr & Basal-Eroglu, 2011). To explore both of these possibilities, we examined possible age and sensation-seeking differences in both the P300 component and reaction time.

In previous research, differences in the P300 component have been cited between both age and sensation seeking group. In general, the P300 component has been found to increase in latency with increasing age (Dully et al., 2018; Falkenstein, Hoormann, & Hohnsbein, 2002; Polich, 1997) and decrease in amplitude (Dully et al., 2018; Schmiedt-Fehr & Basal-Eroglu, 2011). Sensation seeking has also been implicated in differences in the P300. Specifically, Zheng and Liu (2015) found that, when responding to a gain or loss, higher sensation seekers tended to have lower P300 amplitudes.

When examining the P300 component using both age and sensation seeking, the current study found differences only between age groups, not sensation-seeking groups. Even when we controlled for these observed age differences and only explored the effect of sensation seeking, results still indicate a lack of differences between individuals who are low and high sensation seeking regardless of their age. Thus, the current study differs from those previously conducted in that, when utilizing the P300 component as an indicator, inhibition did not appear to differ between those of different sensation-seeking levels. Based on differences in the P300 component, however, older and younger adults did appear to differ from each other in inhibition abilities. Results revealed clear age group differences in the P300 at both frontal and parietal electrodes, which remained significant even after controlling for any possible variance due to differing sensation-seeking scores. The direction

of this relationship is unclear, however, because older adults had significantly more P300 activation than younger adults at the frontal (i.e., F3, F4) electrodes, but significantly less at the parietal (i.e., P3, P4) electrodes. Although previous research has suggested that younger adults should have better inhibitory abilities than older adults (Butler & Zacks, 2006; Schmiedt-Fehr & Basar-Eroglu, 2011), this relationship was not clear in the present investigation. It is possible that younger and older adults were approaching the Go/No-Go task using different neural networks, as indicated by older adults having more activation in the frontal lobe but less activation in the parietal lobe compared to their younger adult counterparts. Previous research (Schmiedt-Fehr & Basar-Eroglu, 2011) has demonstrated that older adults use compensatory activation to enlist other brain areas not usually activated during the task to assist them in completing it. Thus, older adults might have been activating frontal brain areas that younger adults did not need to activate in order to effectively inhibit a response. Future research would benefit from employing an imaging method with more spatial resolution, such as fMRI. This would allow investigators the ability to tease apart which areas of the brain are specifically activated in each age group.

The examination of reaction time revealed differences that exist between age groups, but not sensation-seeking groups. Results showed that older adults have significantly slower reaction times than younger adults. Considering previous research on age and reaction time (Fozard et al., 1994), the finding that older adults react slower is not surprising. Based on this finding, inhibition seems to be more difficult in older adults, and therefore takes more time. During no-go trials throughout the task, participants become used to inhibiting the go response in order to refrain from pressing the button on each no-go trial. Older adults need to expend more effort to engage in this response inhibition, but during go trials, they are required to override this inhibition in order to make the correct response. Our results indicate that this process takes more time for older adults, suggesting that it is more difficult for them.

Our findings suggest that inhibition does seem to differ between those of different age groups but not sensation-seeking groups, although specific conclusions are difficult to draw. It is possible that, with more participants, the relationship between one's age or sensation-seeking level and the inhibition of responses would have been more clear.

Ability to Initiate a Response

The third hypothesis was that ability to initiate a response, as indicated by the late CNV, would differ by age (older vs. younger) and sensation-seeking group (low vs. high). Individuals' response initiation, or how quickly they begin to react, also plays a large role in their behaviors and decisions. Someone who has a very strong initial response to a situation, regardless of the amount of risk, will be more likely to act on it. Some have argued that high sensation seekers engage in risky behaviors for this reason, because their original desire for something overpowers everything else (Collins et al., 2012). Our goal was to consider this possibility, as well as potential age and sensation-seeking differences in initiation ability.

An examination of the late CNV component demonstrated no differences between low and high sensation seekers. This suggests that all individuals, regardless of sensation-seeking level, should have a similar ability to initiate a response. This finding conflicts with previous research conducted by Collins et al. (2012), which indicated that high sensation seekers exhibited more activation and therefore were able to initiate a response more readily. These inconsistent results may indicate that other individual differences not explicitly measured in these studies are leading to observed differences or similarities in initiation ability. Perhaps a specific facet of sensation seeking, or another variable entirely, plays a larger role in determining an individual's ability to initiate a response. The initiation of responses by sensation-seeking level has not been widely studied, so more research is needed to clarify these conflicting results and reach a more sound conclusion.

Based on research conducted by Simon et al. (2013), we also expected possible differences in initiation between older and younger adults, but did not find results to support this. There were no differences in the initiation of responses between older and younger adults as measured by the CNV, which is inconsistent with the findings of Simon et al.'s study. This study, although conducted on rats, demonstrated age differences in the initiation of responses, particularly that younger rats had a more difficult time with initiation. More research on the initiation systems of human subjects is necessary to draw a firm conclusion as to how initiation of responses may change as we age.

Limitations and Future Research

The present study presents several limitations and recommendations for future research. First, although the sample size was sufficient to examine participants by age or sensation-seeking group—as indicated by the samples used in similar previous research which split participants into two groups (Zheng & Liu, 2015; Schmiedt-Fehr & Basar-Eroglu, 2011)—a power analysis revealed that a larger sample (i.e., 45 per group) would have been ideal when participants were split into four Age x Sensation-Seeking groups. Thus, this sample did not allow for the statistical power necessary to detect all of the potential differences we were interested in investigating. Future studies should thus recruit a larger sample to effectively study these differences.

Additionally, the present study did not collect all relevant participant characteristics such as race and ethnicity. Thus, it cannot be determined if participant race or ethnicity was related to the initiation or inhibition of a response on the Go/No-Go task. Future investigations should collect all potentially relevant participant characteristics to best capture individual differences that occur in the inhibition and initiation of responses.

By examining both older and younger adults in this study, we were able to explore possible age differences in both initiation and inhibition between these two groups. Because these two groups are so disparate, however, there was no way to track the pathway of changes that occurs as participants age. Future research may benefit from including participants in middle adulthood as well to examine the direction of these changes more closely. Another age-related limitation might have been that younger adults often feel more comfortable with using technology. As a result, they might have performed the computer tasks with greater ease and felt more comfortable with the EEG system.

Further, although EEG methodology is a helpful tool, it does not allow for the precision necessary for localization of specific neural structures that may be differentially impacted as individuals of different sensation-seeking levels grow older and make risky decisions. In the current study, for example, activation at frontal and parietal electrodes differed between age groups when inhibiting responses. Because of the inability to localize these responses, however, it is unclear exactly which brain regions were utilized by members of each age group. Future research may benefit from a more precise methodology, such as using fMRI.

The present study found differences in response inhibition, but results did not indicate any complementary differences in response initiation. Very little previous research has examined both systems in the same group of individuals. Future research on risky decision making should continue to explore initiation, not just inhibition, to clarify and augment the findings in this study. Further, the current study used the CNV as an indicator of initiation. However, because initiation has not been widely studied in humans, more research is needed to determine if the CNV is the singular best component to study initiation. In future studies, participants could be asked to complete several types of cognitive tasks which require response initiation, such as oddball tasks, in order to explore ERP components that are consistently activated during these tasks. Perhaps the CNV in conjunction with other ERP components provides even a better indicator of the response initiation process. Lastly, the use of the Go/No-Go task in the present investigation allowed for examination of the processes of response initiation and inhibition, but future research is needed to more confidently translate these findings to risky decision making. This version of the Go/No-Go task had little to no risk attached because participants did not gain or lose points, nor were they rewarded for their performance. When completing a task that incorporates more risk, the cognitive processes of initiation and inhibition may be altered, and differences between age and sensation-seeking group may become more or less prominent. In future research, these cognitive processes should be examined using a risky task in order to more clearly understand how differences in response initiation and inhibition can be linked to risky decision making.

Conclusion

The purpose of this exploratory study was to add to what is known about how differences in response initiation and response inhibition may contribute to risk-taking behavior, and how this relationship could be affected by age and sensation-seeking score. The results revealed that older adults are lower in sensation-seeking level compared to younger adults. Additionally, age differences were detected in the ability to inhibit a response, although it is unclear which age group has the most difficulty with inhibition. Results indicated no differences in response inhibition between those of different sensation-seeking levels, as well as no differences in initiation based on either age

or sensation-seeking group. An absence of clear and consistent group differences in initiation and inhibition makes it difficult to draw possible conclusions about which groups may possess either an overactive initiation system or an underactive inhibitory system. As this study has shown, the process that leads individuals to engage in risky behavior involves several factors, including aspects of age and other possible individual differences not yet identified. This process is extremely complex and requires continued research to be more accurately understood.

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Miniature Horses Have Big Advantages: Improved Stress, Mood for Both Airport Travelers and College Students

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ABSTRACT. The current research expanded the field of animal-assisted therapy by utilizing miniature therapy horses for the first time in research. We sought to determine if and how animal-assisted therapy with miniature horses affected positive mood, negative mood, and stress levels in 2 distinct populations: (a) airplane travelers at an international airport and (b) residential and commuter college students at a Midwestern university. In a repeated-measures design, a convenience sample consisting of 67 individuals and diverse in gender and ethnicity (17 airport travelers, 50 college students) was given a pretest survey, interacted with the horses as long as they wanted, and completed a follow-up survey. Participants showed decreases in negative mood ($d = .41, p < .001$), decreases in current stress ($d = .93, p < .001$), and increases in positive mood ($d = .26, p = .003$), without indicating changes in our manipulation check, general stress level ($d = .14, p = .36$). The findings suggest temporary benefits of interactions with the miniature horses for two very distinct populations.

Keywords: animal-assisted therapy, miniature horses, airport travelers, college students, mood.

Stress has become commonplace in modern society and has been a major topic of discussion in recent years. Although stress is necessary for survival and is a natural response to even favorable situations, the unfortunate reality for the millions of people who suffer from stress is that it can also have negative consequences on mental and physical health if not managed properly. Adults who report high stress are more likely to suffer from heart diseases or even to succumb to chronic cardiac conditions such as strokes (Davidson, Alcántara, & Miller, 2018; Huang et al., 2015; Wargo, 2007). Although stress issues are prevalent worldwide, the United States of America tends to rate in the top 10 in the world on stress compared to other nations; for American adults in particular, overall rates of stress increased in 2018, with young adults ages

15–49 reporting higher rates of stress, worry, and anxiety than older adults (Ray, 2019). The American Psychological Association's (2018) 12th Annual *Stress in America* survey of 3,458 respondents indicated that work, money/debt, sexual harassment, and gun violence are frequent stress concerns for Americans, especially among Generation Z respondents. Currently America's youngest adults, Generation Z respondents are the least likely of adult subgroups to say that their mental health is good, yet they are also the most likely group of adults to seek professional help. Given that the detrimental effects of stress are widely documented, the current study investigated the use of miniature horses as a way to reduce stress and increase mood for two distinct populations who frequently report stress: airport travelers and college students.

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Airport Travelers and Stress

Despite the luxuries and resources that Americans are afforded compared to other nonindustrialized nations, they often face stress issues at disproportionate rates. With modern life comes advancement, and such growth can bring new challenges. Inventions and discoveries such as the Internet have many benefits but have also created their own unique problems. One such innovation is air travel. Whether for leisure or work, air travel is a widely viable and occasionally mandatory means to reaching desired destinations. When airplanes were first commercialized, air travel could be hazardous because many of the safety precautions travelers have today were not established. Even as safety has increased, fear of flying (*aviophobia*) often remains for many travelers (van Almen & van Gerwen, 2013). Although not all apprehensive flyers meet the criteria for a specific phobia, nearly 10%–40% of the general population in industrialized countries have a fear of flying, and about 20% of the flying population have continuous or mild apprehension about flying but fly anyway (Gerwen, Spinhoven, Dyck, & Diekstra, 1999). After the destruction of the Twin Towers in New York on September 11, 2001, Americans became particularly apprehensive about traveling on planes (Marshall et al., 2007). As a result of 9/11, airport security intensified to reduce the chances of another attack. Despite these efforts, because terrorist attacks have persisted globally, the stress and fear around flying remains pervasive for many individuals worldwide (Weiss et al., 2016).

Many factors can contribute to stress in regard to air travel, including being away from home, phobias of airplanes or airports, traveling for work, and anxiety disorders (Bricker, 2005). The environment on airplanes also adds potential stressors because passengers are seated in cramped spaces with strangers for a prolonged period of time, miles above the ground. Bricker (2010) indicated that there are two main groups of flyers with the most stress: anxious or distrustful. Anxious flyers are afraid to board the planes, and distrustful flyers are wary about their security on the flight. In fact, it was found that increased security measures can intensify the apprehension that flyers have toward airports and airplanes. With these explanations, it is clear why flight-specific stress is such a problem. Without ways to combat the impending stress or anxiety, such issues will continue to impact many current and future airline travelers.

Stress and College Students

Airport travelers are clearly not the only individuals for whom stress can be a problem. For many if not most undergraduate and graduate students, the college years are a period of growth that includes high levels of freedom and responsibility but also social pressure and strain. In the process of discovering and defining who they want to be as adults (Bistricky et al., 2018), college students in particular face a wide variety of stressors on interpersonal, intrapersonal, academic, environmental, and financial fronts (e.g., Pierceall & Keim, 2007; Ross, Niebling, & Heckert, 1999; Tran, Mintert, Llamas, & Lam, 2018). College students' stress levels can ebb and flow with the academic year, tending to peak around final exam times in December (Barker, Howard, Villemaire-Krajden, & Galambos, 2018). The stressors that college students face are so significant, in fact, that their mental health has been declared a global public health issue due to the disproportionate number of mental health problems they experience (Stallman, 2010). Clearly, university students are another population that can continue to benefit from effective stress-reduction programs.

Helping Adults Cope With Stress: Animal-Assisted Therapy

Many adults encounter stress in day-to-day living and therefore turn to some form of self-help or structured therapy for assistance. Behavioral approaches including virtual reality therapy are widely used with *aviophobia* (see Côté & Bouchard, 2008, for a review). Both short-term and long-term options have been shown to be effective for helping undergraduate and graduate students deal with stress and related disorders (Huang, Nigatu, Smail-Crevier, Zhang, & Wang, 2018; Yusufov, Nicoloro-SantaBarbera, Grey, Moyer, & Lobel, 2018). Some effective therapies for stress in general and psychological disorders specifically have employed the assistance of a variety of animals (Ein, Li, & Vickers, 2018). Many different populations interact with therapy animals including children, adolescents, adults, and older adults, people with physical ailments, people needing speech therapy, people with psychological disorders, and people with developmental disabilities (Boyer & Mundschenk, 2014; Braun, Stangler, Narveson, & Pettingell, 2009; Fedor, 2018; Matuszek, 2010; Nimer & Lundahl, 2007). *Animal-assisted therapy* has been incorporated with everything from cats (De Kok, 2004) to dogs (Arnold, 1995; Elmaci

& Cevizci, 2015; Zafra-Tanaka, Pacheco-Barrios, Tellez, & Taype-Rondan, 2019) to even dolphins (Nathanson & de Faria, 2015). The therapy is adjusted depending on the intended population or the people's needs (Bokkers, 2006). The intended use of animals in animal-assisted therapy is to aid the handler in providing compassion and stimulation for the patients or targets (O'Callaghan & Chandler, 2011). Previous research has found that an hour of interaction with trained therapy dogs reduces stress, anxiety, and blood pressure in college students more effectively than an hour of quiet reading (Muckle & Lasikiewicz, 2017; Nepps, Stewart, & Bruckno, 2014). These findings were supported by a study conducted by Stewart, Dispensa, Parker, Chang, and Cunnien (2014), who found that anxiety in their participant group of college students decreased after spending up to two hours with trained therapy dogs. Indeed, pet therapy events tend to draw crowds on college campuses (Adamle, Riley, & Carson, 2009) and can be an efficient way to help college students temporarily reduce stress (e.g., Crossman & Kazdin, 2015).

Although dogs are perhaps the most commonly deployed animal-assisted therapy animal, farm animals are not outside the scope of possibility. Berget, Ekeberg, and Braastad (2008) observed the interactions between farm animals and psychiatric patients. They determined that interaction with farm animals was able to help patients improve self-efficacy and coping abilities. Goats have increased quality of life for individuals with disabilities (Scholl et al., 2008). *Equine-assisted (horse) therapy* is an especially noteworthy farm animal species for animal-assisted therapy. Equine-assisted therapy has been in practice for hundreds of years; doctors in the 1800s prescribed horseback riding to help with depression and other ailments (McConnell, 2010). Horses are reported to be emotionally sensitive animals, which facilitates bonding and serves many functions for those suffering from psychological problems (Dunlop & Tsantefski, 2018; Johansen, Arfwedson Wang, Bind, & Malt, 2014). Particular beneficial tasks can be done with therapy horses. Reportedly, grooming or petting these therapy horses promotes bonding between horses and human targets, which can be comforting to humans (McConnell, 2010). In addition, therapeutic riding with horses (sometimes called *hippotherapy*) has been seen to have positive effects on emotional health, such as the improvement of self-esteem and self-efficacy (Bizub, Joy, & Davidson, 2003). However, there are also significant drawbacks to utilizing equine

therapy. For example, a sizable portion of people are afraid of horses due to their size. Also, because of their size, traditional-size horses are also usually only accessible at farms. Patients may not be able to consistently travel long distances to visit these horses for therapy. Some patients also may not be able to ride therapy horses due to certain physical disabilities, which can limit their treatment options. Miniature horses—which are different and smaller than ponies, defined by their height of under 38 inches at the last hairs of the manes (American Shetland Pony Club, 2019)—cannot be ridden by people, but they may provide a more physically and emotionally accessible form of interactive equine therapy than standard-sized horses.

The Current Study: Miniature Horses Have Big Advantages?

To the best of our knowledge, studies have not evaluated the potential effectiveness of miniature horses as therapy animals, despite the fact that they share the emotionally sensitive qualities that regular horses are known to have. In addition, miniature horses' smaller stature means they can travel into areas such as airports and college campuses with less risk of injury and more convenience in order to provide mental, emotional, and physical benefits to both children and adults in various locations. Based on prior research regarding animal-assisted therapy and equine therapy specifically, we hypothesized that interaction with the miniature horses would result in an increase in reported positive affect and a decrease in reported negative affect. We also hypothesized that, after interacting with the miniature horses, participants would report a decrease in their stress levels in the moment but would not indicate changes with stress in general.

Method

Participants

For the airport travelers, we recruited a convenience sample of 22 participants visiting an international airport in the Midwestern United States. For the individuals who filled out the survey both before and after interacting with the miniature horses ($n = 17$), participants ranged in age from 18 to 77 years old, with a mean age of 41.35 years ($SD_{age} = 16.33$; female = 10). The airport location allowed for some variation by ethnic group, with 1 African-American, 3 Hispanics/Latinx, 1 Native American, 10 White Americans, 1 person that identified as "other," and 1 who did not indicate ethnicity. Typical annual household income for participants ranged from

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\$20,000 to \$300,000, with a mean of \$117,500 ($SD_{income} = \$85,073$), and a median of \$100,000.

Participants from the college sample included 100 college students at a Midwestern public doctoral institution (64 female students, 33 male students, 2 did not report gender). The data was collected from three visits by miniature horses at two campuses: a main, residential campus ($n = 37$) and a regional, commuter campus ($n = 63$). Faculty, staff, and students over the age of 18 were eligible for participation ($M_{age} = 22.76$, $SD_{age} = 9.64$); however, only student data are included and reported here. The sample was primarily White American (69), but consistent with campus demographics, also included people from a variety of ethnic backgrounds: Chinese (4), African American (2), Hispanic (2), Japanese (1), and Biracial/Other (12), with 10 individuals not identifying ethnicity. Participants had grown up in an array of geographical locations: Urban/city (25), suburbs (44), and rural/small town (25). Family income ranged between \$0 and \$200,000 ($M_{income} = \$55,304$, $SD_{income} = \$54,335$, $Mdn_{income} = \$50,000$). A subsample of 50 college students provided identification numbers that allowed us to compare their pre–post results. No compensation or benefits apart from getting to interact with the miniature horses were provided to any participants.

Materials

Mood measures. The preinteraction, paper-based survey included a list of 20 items regarding current pleasant and unpleasant emotions from the widely used Positive and Negative Affect Schedule (Watson et al., 1988). Responses are divided into two, independent subscales: Positive Affect and Negative Affect. The positive affect score was found by adding the positive adjectives (interested, excited, strong, enthusiastic, proud, alert, inspired, determined, attentive, and active). The negative affect score was found by adding the negative mood adjectives (distressed, upset, guilty, scared, hostile, ashamed, nervous, jittery, irritable, and afraid). Each of the questions were answered on a 5-point Likert-type scale from 1 (*do not feel that particular mood adjective currently*) to 5 (*definitely feel that adjective currently*). Therefore, larger scores showed more pleasant and more negative current mood, respectively. The measure is widely used, with strong reliability and validity indicators in other studies. In the current study, the subscales were also sufficiently reliable for both positive affect ($\alpha = .89$) and negative affect ($\alpha = .87$).

Stress measures. On one item, participants rated their stress at the moment from 1 (*not at all stressed*) to 10 (*extremely stressed*). On a second item, they rated their stress in general on the same scale from 1 (*not at all stressed*) to 10 (*extremely stressed*). Therefore, higher scores indicated greater stress levels.

Demographic items. Ethnicity, age, gender, student status (where applicable), and geographic area growing up (urban/city, suburbs, rural/small town) were included to describe the samples. In addition to demographic questions, we also inquired “How many animals do you currently have/have you owned in the past?” (open-ended).

Other measures. On the postinteraction survey, participants were asked with open-ended questions whether their stress and mood levels had changed. If they indicated yes, we asked them to describe why they thought their state had changed. We asked whether or not they enjoyed interacting with the horses and why. “How much of an animal lover are you?” was rated by participants on a scale from 1 (*not at all*) to 10 (*huge animal lover*).

Design

The study utilized a 2 (time: pretest and posttest) \times 4 (type of outcome measure: positive affect, negative affect, current stress, stress in general) \times 3 (location: main campus, commuter campus, airport) mixed design. Mood/stress served as the dependent variable. Location served as a between-subjects factor, and time and measure type were within-subjects factors.

Procedure

After receiving approval for the project from the Institutional Review Board, we secured miniature horses in partnership with a therapeutic miniature horse farm in Southwest Ohio. With therapy being the nonprofit’s primary goal, the farm provides trained miniature horses and handlers that travel to different locations in order to provide mental, emotional, and physical benefits to both children and adults. People have the ability to interact with the miniature horses for as long as they like, while trained handlers hold onto the miniature horses and supervise the interaction. The organization often visits the airport, assisted living homes, universities, and a variety of other locations. This nonprofit organization has received a lot of media coverage because it is rare to see miniature horses in facilities such as the ones they visit. They have been featured by local media news stations, radio

stations, magazines, journals, and Internet blogs, and have even been featured by NPR, NBC News, and USA Today (Baskas, 2016; Steigerwald, 2017; Thompson, 2017). This organization was a strong and reputable partner for this study because they already service a variety of locations and had the resources required to provide for the animals' care and transportation.

Because the first author of the research was also employed by the horse farm at the time of the study, she helped handle the horses at the campus events but did not collect data or speak to participants except to answer questions about the horses themselves, so as to minimize potential researcher bias in the data outcomes. As potential participants approached the horses, the research team (minus the first author) informed participants that they were welcome to interact with the horses and that, additionally, there was a study being conducted involving the horses. Because the times with the horses were already events scheduled by the hosting location, individuals could decline the research study and still spend time with the horses. If they agreed to participate in the study, participants (age 18 and older only) provided informed consent and completed the pretest survey, which included demographic information, mood, and stress items. All of the participants were asked to write down a personalized code for the purposes of matching their surveys from Time 1 to Time 2. Some participants only wanted to take pictures with the miniature horses, while others wanted to pet and sit with the miniature horses for up to 20 minutes. After the interaction with the miniature horses, participants completed the posttest survey, which included mood and stress items again and the follow-up questions (see "Other measures"). After the two surveys were completed, researchers provided the participants debriefing and contact information for their records.

Results

Please see Table 1 for descriptive statistics. We hypothesized that, for all three locations (airport, regional campus, main campus), participants' interaction with the horses would increase positive affect, decrease negative affect, and decrease current stress but not general stress. To test our hypothesis, we ran a mixed-model, 2 (time; within) x 4 (stress/mood measure; within) x 3 (location; between) Multivariate Analysis of Variance. A significant main effect existed for time, $F(1, 57) = 49.54, p < .001$, $\eta^2_p = .47$, and outcome measure, $F(3, 55) = 190.58$,

$p < .001, \eta^2_p = .91$, with a significant interaction for Time x Outcome, $F(3, 55) = 20.12, p < .001, \eta^2_p = .52$. With no significant effects for location, $F(2, 57) = 0.52, p = .60, \eta^2_p = .02$, or interactions with location, location was subsequently dropped from the model. Given the main effect for time and interaction with measure, a series of follow-up, paired-sample t tests were conducted (see Figure 1).

As hypothesized, positive mood increased significantly from preinteraction positive mood score to postinteraction positive mood score, $t(66) = -3.12, p = .003, d = .26$; negative mood decreased significantly from preinteraction to post interaction, $t(66) = 4.45, p < .001, d = .41$; and self-reported current stress decreased significantly from preinteraction to postinteraction current stress, $t(66) = 6.71, p < .001, d = .93$. Also as hypothesized, there was no significant change in scores for self-reported

TABLE 1				
Descriptive Statistics for Dependent Variables by Location				
Variables	Commuter Campus M (SD)	Residential Campus M (SD)	Airport M (SD)	Total M (SD)
Pretest				
PANAS-PA	3.13 (0.78)	2.85 (0.77)	3.38 (0.38)	3.12 (0.71)
PANAS-NA	1.81 (0.95)	1.56 (0.55)	1.33 (0.31)	1.62 (0.74)
Current Stress	5.21 (2.44)	5.00 (2.16)	4.81 (1.94)	5.05 (2.21)
General Stress	3.54 (0.79)	3.50 (0.73)	3.38 (0.81)	3.48 (0.77)
Posttest				
PANAS-PA	3.18 (0.91)	3.24 (0.73)	3.64 (0.61)	3.32 (0.80)
PANAS-NA	1.57 (0.77)	1.23 (0.40)	1.08 (0.13)	1.36 (0.60)
Current Stress	3.46 (0.92)	3.56 (1.67)	3.06 (1.82)	3.38 (1.22)
General Stress	3.43 (2.01)	3.31 (0.60)	3.06 (1.57)	3.30 (1.66)

Note. PANAS-PA = Positive and Negative Affect Schedule, positive affect. PANAS-NA = Positive and Negative Affect Schedule, negative affect.

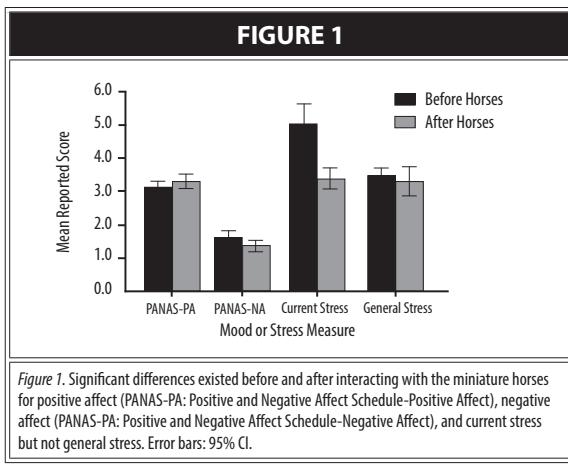


Figure 1. Significant differences existed before and after interacting with the miniature horses for positive affect (PANAS-PA: Positive and Negative Affect Schedule-Positive Affect), negative affect (PANAS-PA: Positive and Negative Affect Schedule-Negative Affect), and current stress but not general stress. Error bars: 95% CI.

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general stress from Time 1 to Time 2, $t(59) = 0.93$, $p = .36$, $d = .14$. Given that significant skew existed in the negative affect data and that stress variables were ordinal, we additionally ran Wilcoxon signed ranks tests as a more sensitive, nonparametric equivalent ($n = 67$), which were similarly significant for positive affect, $z = -3.37$, $p = .001$, $d = .29$; negative affect, $z = 4.76$, $p < .001$, $d = .41$; and current stress, $z = 5.46$, $p < .001$, $d = .47$; but not general stress, $z = 1.09$, $p = .28$, $d = .09$.

Supplementary Analyses (Qualitative Themes)

Almost without exception, participants stated in their postsurveys that they enjoyed their interactions with the miniature horses and found their interactions beneficial for several key reasons. The experience enabled participants to forget about their troubles momentarily; for example, one college student stated that the horses “distracted me from my great-grandmother’s death yesterday.” Another common response was it being a pleasant surprise to see the animals because they are rarely seen at locations such as airports and college campuses. Participants most frequently stated that the horses were comforting because they were “soft and cute” and that petting the horses made participants “feel calm and more centered.” The themes from the qualitative responses were similar for both airport travelers and college students.

Discussion

As hypothesized, the results suggested that miniature therapy horses provided a significant reduction in negative affect, a significant increase in positive affect, and a significant reduction in reported stress in the moment (but not in general). These results further provide supporting evidence that miniature horses can be used for animal-assisted therapy both to help reduce stress levels in travelers in airport settings and to help students in college settings. The pattern of results suggested that similar benefits for miniature horses exist as found in other animal-assisted therapy studies (e.g., Banks & Banks, 2002; Nordgren & Engström, 2013). One reason for this finding could be because people create a special bond with animals because of the animals’ ability to connect with humans (Willens, 2013). Participants also noted aspects like being animal lovers or the animals’ cuteness as reasons why their stress and mood improved.

Due to the distinctions of our two samples in two very different applied settings, the external validity of our findings increases. We collected

data three times at the airport, once at a regional (commuter) campus and twice at the main campus, which adds to the geographic and socioeconomic diversity of our samples. Admittedly, however, sampling at one airport and one university in the Midwest does not necessarily make our findings widely generalizable. Given this was a pilot study, the sample was also a small, self-selected, convenience sample for pre-existing events scheduled by the horse farm and hosting institutions. Creating a more structured experimental design could help increase internal validity, and repeated visits with the horses might answer questions about whether the beneficial effects of interaction with the miniature horses have more than a temporary effect.

Regarding additional limitations, even with the diversity in the sample, mainly White women chose to participate. Although people from a variety of gender and ethnic backgrounds were represented, considering the small sample size, higher proportions of men and participants in more ethnic groups would lead to greater generalizability for this study. The possibility of self-selection bias also exists due to the convenience sampling that took place: People were not randomly assigned but chose whether or not to interact with the horses, and many people that decided to interact with the horses did not choose to participate in the survey. Time was also a limitation in our study in two ways. First, some potential respondents did not have time to interact with the miniature horses or do the survey because they needed to reach their respective departure gates (airport) or campus obligations (college students). Second, because we were working in a real-world setting, the time participants spent interacting with the horses was not controlled but was self-determined, which might be a confounding variable. In the future, permission to gain access past the airport security could allow some people to be close to their departure gate while interacting with the miniature horses. Additionally, future studies could create timed interactions where each participant is interacting with the horses for a specific length of time in order to see if length of time would affect the data.

Finally, given that this was not a double-blind study, it is possible that the results were influenced either by social desirability (participants knowing what the researchers were asking for and therefore attempting to answer accordingly, especially considering the one-item stress measure) or inadvertent experimenter bias and influence. For future research purposes, it may be useful to

evaluate whether repeated exposure to the miniature therapy horses affects stress and mood and to compare the effects of miniature horses to other therapy animals, as well as include a larger, more diverse sample. It would also be beneficial to use a more rigid blind or double-blind experimental design so that potential changes in mood and stress could be compared to a control group or groups (e.g., saw but did not interact with the horses, pet a stuffed horse instead of a live one, looked at pictures or horses, imagined petting horses rather than petting horses *in vivo*). Lastly, future research with miniature horses should expand to new target locations, including senior centers and preschools, as well as other populations like individuals with autism, intellectual or developmental disabilities, cerebral palsy, or even behavior disorders (e.g., Feltman, 2019; Johansen, Arhwedson Wang, & Binder; 2016; McDaniel Peters & Wood, 2017).

Conclusion

Despite the study's limitations, this research was the first to show that, even if the effects might be short-lived, miniature horses have potential to help reduce negative mood, increase positive mood, and reduce stress for both airport travelers and college students, two distinct populations who share a tendency to report high stress levels. Personnel at airports and colleges—or even other kinds of organizations—could benefit from this study by utilizing miniature horses to positively impact the quality of life for their constituents.

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Learning R Programming Language With Psi Chi

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ABSTRACT. Public archival of research materials and the use of free open software such as R programming language help promote the tenants of transparency, openness, and reproducibility. For many, learning a programming language can be overwhelming. Recognizing the need for a fun and engaging learning project, the Psi Chi Research Advisory Committee (RAC) decided to establish the PsiChiR contest. The goal of the contest is to provide an opportunity for users of all levels to practice and further develop their R skills. The first PsiChiR contest launches March 2020.

Keywords: R programming, research methods, statistics, conducting research, open science

A growing body of evidence suggests that the tenants of transparency, openness, and reproducibility are lacking in the routine practice of scientific research (Nosek et. al., 2015). Contributing to the problem of reproducibility is the pervasive nature of publication bias. Publication bias occurs when the results of a study negatively impact the probability of its publication (Carter, Schönbrodt, Gervais, & Hilgard, 2019). For example, if a replication study finds a nonsignificant result on a previously statistically significant effect, the researchers may be less likely to submit the finding for publication because of the likelihood of rejection by editors and reviewers. Publication in a scientific journal not only lends itself to coveted authorship, but more importantly, it makes the research data accessible to the research community. When nonsignificant findings go unpublished, the nonsignificant data becomes virtually invisible (Rosenthal, 1979). The result is an overabundance of published false positives, which leads to the distorted perception that good research is only as valuable as its statistically significant effect. In the end, many false positive studies end up becoming *de facto* truth, and future efforts to dispel the findings become challenging.

To better understand the depth of the reproducibility problem, social psychologist Brian Nosek (2011) led a project in collaboration with 270 contributors (Open Science Collaboration, 2015).

The goal was to replicate 100 different psychological studies; an undertaking that came to be known as the “Reproducibility Project: Psychology.” The first report of findings was posted online in April 2015, and found that, of the 100 studies, only 36 successfully replicated. Unique characteristics of the project included the preregistration of research plans, public archival of data and materials, and the development of software driven scripts for statistical analysis, written using the R programming language. R is a free open source programming language and statistical computing environment that allows researchers to clean, analyze, and graph data (R Core Team, 2018). It is an important tool that can be used across a variety of disciplines for both research and teaching purposes. The use of these scripts ensured consistency across all 100 studies and made the complete analysis of the data reproducible. There are many reasons to learn R, but the reproducibility project established its utility in the promotion of transparency, collaboration, and most importantly reproducibility.

By publicly archiving research materials and data, researchers make nonsignificant findings visible, and free open source software (such as R) allows researchers to explore and reproduce the statistical analysis without the high cost of propriety software. Despite these benefits, many researchers are still hesitant to switch from (or complement) their current methods. Anecdotally, resistance to

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using R might be rooted in the perception of a steep learning curve—not just for students, but for statistics instructors as well as other faculty in the department who work with student research assistants. The merits of using R, SPSS, or a myriad of other statistical analysis tools is a separate, dynamic conversation that is frequently held in many spaces wherever teachers of psychological statistics gather (e.g., online, at conferences, in journals). Therefore, this is a conversation that (for the most part) we will avoid here. One of the functions of the Psi Chi Research Advisory Committee (RAC; <https://www.psichi.org/ResearchAdvisory>) is to help members build research skills. Our committee members' experiences as professionals mirror the anecdotal experiences expressed by colleagues who want to learn R but do not have the time. So, several years ago, seeing the value in R, the RAC began exploring ways to introduce the programming language and provide learning opportunities to our membership.

Our first step was to compile an R resource list for members. This list provided links to other online sources and books that members of the RAC

found helpful in developing their own skill with R. The struggle with a static list of resources, though, is that the resources change so frequently, are geared toward different types of scientists, and have so many different points of entry that its helpfulness is limited. In thinking through the best way to support our members' R learning, we decided the next step was to develop a regularly occurring contest for members that contained multiple points of entry to build competence in R and promote participation in the larger R community.

One of the most valuable aspects of R is its vibrant, open community of users, which can be experienced by searching the hashtag #rstats on Twitter. Using this hashtag, students, researchers, developers, writers, and collaborators work together to solve programming problems and participate in a variety of social projects. One of the most popular social projects in R is a weekly project known as #TidyTuesday. This project was established with the primary goal of connecting mentors and learners (Mock, 2018). Each week, a link with a new data set is released on Twitter, and participants attempt to create or copy a visualization of that data. This is a lot of fun and a wonderful resource for those who have even basic knowledge of the R programming language; however, for individuals who are completely new to R programming, it can be intimidating. The goal of the R contest established by the RAC is to provide a similar opportunity for Psi Chi members to engage in a social project with no or minimal experience using R. Additionally, the contest provides the opportunity for members with more experience to refresh and further develop their own R skills.

The rest of this editorial presents the general guidelines for this forthcoming contest, *PsiChiR*. We invite you to read, get excited, and then participate. You may win a laptop sticker, and you will definitely learn some R.

Contest Guidelines

On the first of every month (starting in March 2020) we will release a link to a public dataset with instructions for participants to write code that accomplishes some goal. There will be four levels of goals (see Table 1 for a description of these levels along with examples of tasks)

To submit a response for a level, participants *must* submit all lower levels. Participants who submit correct responses (correct at ALL levels submitted) will be entered into a contest for a laptop sticker for that level (see Figure 1).

TABLE 1
Levels, General Task Descriptions, and Examples of Tasks for PsiChiR

Level	General Task Description	Example of Specific Tasks
1	Date Processing	Remove cases with missing values on X variable
2	Descriptive Statistics	Find means and standard deviations for specific variables
3	Data Visualization	Create a plot to visualize the differences in means between X and Y groups on Z variable
4	Inferential Statistics	Perform a <i>t</i> test to test the hypothesis that the means of X and Y groups are different

FIGURE 1



Figure 1. A sample laptop sticker for the March 2020 contest winner.

Contests will be released on the first of each month, with submission deadlines on the 15th (submissions won't be accepted past the 15th anywhere on earth). The RAC will then look through the responses and post correct responses for each level, along with their authors' names and institutions, on a public forum by the 22nd of each month. After that, the RAC will work on getting the next contest put together and posted. Contest details will be posted on the OSF page for this project (<https://osf.io/f5zjr/>), which will also serve as the central clearinghouse for all contest-related items.

We will primarily use data that is associated with Psi Chi in some way: open data from a publication in the *Psi Chi Journal of Psychological Research*, data from one of our Network for International Collaborative Exchange (NICE; <https://www.psichi.org/ConductingResearch>) projects, and so on. We will also use the same data for three contests (three months), with tasks increasing in difficulty at each level throughout the three-month rotation. Data for the first contest is from Cramblet Alvarez et al.'s (2019) paper on students' relative abilities to recognize important figures from psychology's history by those figures' gender and racial identities.

The movement toward reproducibility and openness in the field is gaining in momentum, with R in particular being used by many researchers and instructors in both their labs and classrooms. We believe this contest will be a valuable learning experience for Psi Chi members at all types of institutions, ranks, and programming skill levels—a

contest that folks can join at any time, but also use as motivation for distributed practice with the R language. We invite our readers to get involved in this exciting new project from Psi Chi's RAC.

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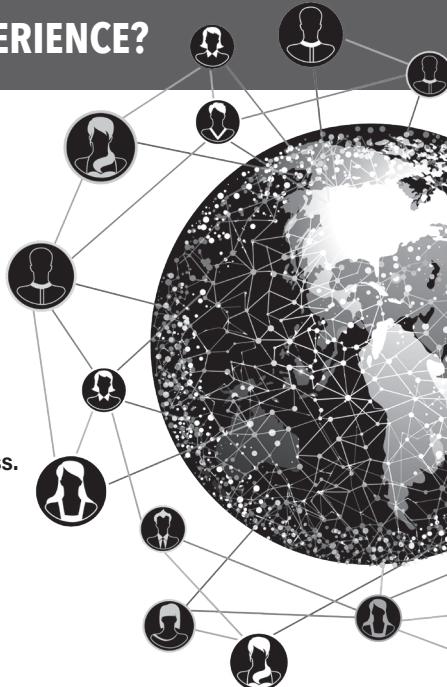
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