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EDITORS' NOTE



Welcome to the 5th Edition of The Undergraduate Journal of Psychology at Berkeley! As the title suggests, this publication is the product of a variety of undergraduates from across the nation!

From cover to cover, this issue is a celebration of the ingenuity of these undergraduates and their dedication to celebrating the works of several inspiring undergraduates. By providing these authors a platform on which to speak, we hope that their work will motivate each reader to discover the true potential that lies within each budding undergraduate professional. Featured in this issue are the works of five authors from across the nation – from our own University of California, Berkeley to Kansas University all the way to the eastern seaboard at Harvard University.

This journal is dedicated to the numerous undergraduates who made this journal possible. First, we would like to thank our six authors for their creativity and hours of elbow grease that have culminated in the form of their manuscripts. In addition, we extend our thanks to our editing staff, who have been dedicated to strengthening the author's voice through revision, and to those in layout and graphic design, who have been focused on putting this issue together with care and talent. This issue was arranged, designed, inspired and made possible by an impressive team of undergraduates. Above all else, however, this journal is the direct manifestation of a collaborative effort of these undergraduates who have worked on this edition from page to page.

To our readers, we thank you for your support. By purchasing a copy of this issue, you are empowering these undergraduates by making their voices heard. By flipping through the pages of this issue, we hope that you are as inspired by their research as we are!

Chardèe A. Galàn & Bella Rivaldi
EDITORS-IN-CHIEF

PREFACE



I am pleased to introduce the 2012 edition of the Undergraduate Journal of Psychology.

The discipline of psychology entails a broad intellectual effort, one that spans the social and life sciences. This volume reflects this breadth, with contributions spanning the many subfields of psychology.

At the University of California, Berkeley, our faculty are honored to have the opportunity to teach, and collaborate, with such a talented population of undergraduates. Across the country, psychology is a very popular major, frequently resulting in large classes at the lower and upper division. Nonetheless, as shown by the work presented here, undergraduate students are able to create an intimate learning experience through their research projects. They are able to not only engage in the intensive study of a problem that builds on their idiosyncratic interests, but, as important, gain skills in the scientific method. An important part of this skill set is translating laboratory observations into a written work, one that makes clear the question at hand and then presents the results and conclusions in a concise and engaging manner. The reporting process is what makes science a cumulative, community endeavor. Our editors were pleased to receive submissions for this issue from universities and colleges across the country. The four articles you will find here have been selected as representative examples of this excellent body of work.

I also want to congratulate our student editors for assembling the journal. They have refined a different set of skills, helping shape the ideas and writings of other individuals to ensure that the papers are maximally impactful.

Congratulations to all of the participants who have put together this fine edition of the Undergraduate Journal of Psychology.

Richard Ivry
PROFESSOR AND CHAIR, DEPARTMENT OF PSYCHOLOGY
UNIVERSITY OF CALIFORNIA, BERKELEY

Getting to know: Natalyn Daniels

Biography

Natalyn Daniels is a recent UC Berkeley graduate with a major in Psychology and minor in Global Poverty and Practice. She worked for several semesters in Dr. Ann Kring's Memory and Emotion lab as both an Undergraduate Research Apprenticeship Program recipient and for a summer as an Undergraduate Research Apprenticeship Program Award recipient. She also participated in Dr. Stephen Palmer's Visual Preference and Aesthetics lab as an independent honors study research assistant, enabling her to complete both an honors thesis and a McNair Scholars research article. Natalyn graduated with highest honors and earned the Warner Brown Award of Research Excellence, along with a place in the Golden Key, Phi Beta Kappa, Phi Theta Kappa, Psi Chi, and National Society of Collegiate Scholars honors societies. Natalyn intends to pursue a career in clinical psychology, and hopes to be attending graduate school for clinical psychology in the near future.



Q&A

What sparked your interest in psychology?

I initially took psychology classes at my community college, and was immediately enamored by the topic. I then transferred to UC Berkeley as a pre-determined psychology major.

What led you to this topic?

I enrolled in Stephen Palmer's "Color and Consciousness" seminar in Spring of 2012. The final project for this seminar was to design and conduct an experiment regarding color, which is where I was the chance to truly delve in color preferences. The project has been expanding since then.

Did you have a mentor and how did you get involved with them?

My mentor was Dr. Stephen Palmer, who taught the "Color and Consciousness" seminar I enrolled in. I used his Ecological Valence Theory as the theoretical focus of my project. Also, one of his graduate students, Karen Schloss, was also a great resource for me, and just as influential of a mentor.

How long have you been working on this paper? What has the process been like for you?

I have been working on this paper/project since Spring of 2010, actually. The process has been long and arduous, but also one of the most beneficial projects of my academic career.

What was it like to be an undergraduate student completing your own research project?

It was very difficult, as I don't have as much experience in professional academia as many of my peers. However, I feel as though completing this project has further confirmed my desire to pursue Psychology professionally and academically, and this article will be a great start to my post-graduation academic journey.

The Effects of Color-Taste Associations on Color Preferences

Natalyn Daniels

University of California, Berkeley

Though several color preference theories have been developed and tested through thorough research, none have provided a wholly conclusive and universally applicable theory like the ecological valence theory. According to the Ecological Valence Theory (EVT), color preferences are determined by people's average affective response to experiences with correspondingly colored objects (Palmer and Schloss, 2010). The EVT implies that preference for a given color can be changed by positive or negative experiences with objects of that color. In the present study, we investigated whether tasting colored water that was sweet (positive) would increase preference for its color and tasting colored water that was sour (negative) would decrease preference for its color. Participants first rated their color preferences for 37 colors on a color preference task. They then tasted eight water samples of four different colors: two each that were red, green, yellow, and brown. For one group of participants, red and brown water samples were soured and green and yellow water samples were sweetened. A second group of participants received the opposite treatment: red and brown samples were sweetened and green and yellow water samples were soured. After tasting each sample, participants were asked to identify the flavor of each sample (mint, cherry, lemon, etc.) as well as to rate the sourness, sweetness, and preference. Finally, all participants repeated the initial color preference task. The drink samples affected color preference ratings in the predicted direction, where preferences for sour-associated colors decreased and those for sweet-associated colors increased. These results support the EVT's claim that color preferences are determined by positive and negative experiences with salient colored objects, making this study the first to demonstrate a definitive causal claim using the ecological valence theory of color preference.

Introduction

Development of Color Preference Theory

Color preference is an influential aspect of perception and evaluation. Though color preference has been a special focus for artists in creating aesthetically pleasing drawings and paintings, color preference also influences selection of other common items and appliances (Palmer & Schloss, 2010). Since color selection and preference are foundational to preference and selection in colored items, the question was raised of whether or not color preferences can be measured and studied. Cohn (1894) proposed that there is no general trend across individuals in color preference, and that color preference can only be observed individually. This argument was supported by later researchers who found that their group data was simply too variable, and that color preferences could only be determined on an individual basis (Dorcus, 1926; Von Allesch, 1924). Walton, Guilford and Guilford (1933) challenged this claim by suggesting that their participants maintained a "common basis of feeling", meaning their participants demonstrated similar color preferences, for different colors. Walton, Guilford and Guilford (1933) also claimed that color preferences have a natural, biological cause, a theory that was firmly supported by the work of other color preference theorists (e.g., Garth, 1922). This research formed the basis for future study on color preferences.

There have been several studies dedicated to determining which colors people prefer (e.g., Washburn, 1911; Eysenck, 1941; Palmer and Schloss, 2010). Though Cohn (1894) originally argued that color preference trends across different individuals do not exist, his work was the first to report that people have a general preference for saturated colors, which are col-

ors with high vividness and intensity. Similar results have been found by several different researchers, further supporting the claim that humans have a preference for single saturated colors (e.g., Walton & Morrison, 1931; Palmer & Schloss, 2010). However, Washburn (1911) challenged this claim, arguing that tints and shades are a more deciding factor in color preference. Titchener's (1901) research sought out to test whether tint, shade, or saturation is the most important factor in color preference. Titchener's results may have validated all of the previous studies surrounding this debate by suggesting that there are two types of observers: those who prefer saturated colors, and those who prefer unsaturated colors. In the years following Titchener's theory, Eysenck (1941) created a study which analyzed the results of subjects who were asked to rank order colors in preference, leading to two distinct groups that prefer either saturated or unsaturated colors. Subsequently, numerous studies found a general preference for blue hues and a dislike for yellow hues (e.g., Guilford & Smith, 1959; McMannus, Jones, & Cottrell, 1981; Palmer & Schloss, 2010).

These previous studies were primarily aimed at determining existing color preferences, but do not address why people like the colors they do, or where color preferences originate from. Humphrey (1976) suggested that color preference is based on various "approach" and "avoid" signals sent out by objects in nature. Humphrey's theory explains that objects emit natural approach or avoid signals, such as how the colors of specific flowers will attract pollinating bees and bats, or how the colors of a poisonous snake act as a warning to all surrounding animals to keep a distance. Though Humphrey states that color symbolism in nature has less of an influence

on humans in modern times due to exposure to a variety of arbitrarily colored material items everyday (e.g., shirts and cars), he argues that these color signals could still have an impact upon our color preferences. Willson, Graff, and Whalen (1990) tested Humphrey's theory by studying food preferences of frugivorous birds. According to Humphrey's theory, these birds should be attracted to red and black, the most common colors of fruits in their diet, and should avoid yellow, the color of unripened fruit. However, Humphrey found that there was little tendency for these birds to favor red or black or to avoid yellow, suggesting that his approach and avoid theory may only apply in very specific and focused circumstances, and that a more comprehensive theory is needed. Hurlbert and Ling (2007) studied color preferences from a physiological perspective, relating them to the cone receptor outputs within the human eye. An important premise for their theory is that primates have developed three cones for color vision to better discriminate between yellow and red hues of ripe fruit against green foliage (Regan et al., 2001). They argue that women, as gatherers, needed to better discriminate reddish hues in order to find fruit in primitive human society, so they should prefer reddish hues more than males do. Hurlbert and Ling (2007) found that 70% of the variance in their average color preference data could be explained by outputs from the cone opponent systems (L-M and S-(L+M)). In particular, females preferred hues weighted more positively on the L-M dimension, indicating that they preferred colors that were more red to colors that were more blue-green, and males showed the opposite pattern. Though the hunter-gatherer account explains females' preference for reddish hues, it does not explain why males prefer blue-greenish hues to reddish hues – as they were probably not searching for leaves among the berries – or why both males and females preferred colors that were more violet to those that were more yellow-green, which was their largest effect.

Ou, Luo, Woodcock, and Wright (2004) proposed that color preference may be related to the “color-emotions” associated with certain colors. The study tested several color-emotion dimensions and found that certain color-emotion associations are highly correlated with color preferences. Within these color-emotion associations, it was discovered that colors associated with cool, active, or light color-emotions were preferred over colors associated with warm, passive, or hard color-emotions. A regression model based on these factors accounted for 67% of the variability in color preference in their study. These findings suggest that color preferences may be based on the emotions that are associated with colors. However, the reason for these emotional responses was not investigated, nor was the reason that certain colors and their associated emotions are better predictors of color preferences than others.

Due to the considerable amount of counter evidence against the “approach” and “avoid” theory of color preference, the cone receptor output theory, and the color-emotion association theory of color preference,

for the purpose of this study, we addressed color preference using a more conclusive color preference theory known as the ecological valence theory. The ecological valence theory (EVT), proposed by Palmer and Schloss (2010), explains color preference as an adaptive process, through which color preferences depend on positive-to-negative experiences with all correspondingly colored objects. The EVT differs from the color-emotion theory of color preference in one important way. While the color-emotion theory suggested that the emotional perception of a color would solely determine color preference, EVT suggests that the affective response to items of a specific color will then influence a person's color preference for the color of that object. The EVT suggests that humans have a greater preference for blue because it is associated with positive things like clear sky and clean water, but a lower preference for dark greenish-brown, which is associated with negative things like rotting food and vegetation (Palmer & Schloss, 2010). To test the EVT, Palmer and Schloss conducted three tasks. In the object-association task, one group of participants were shown each of the Berkeley Color Project's (BCP) 32 chromatic colors and were asked to list as many objects as they could that were associated with that color. In the object-valence rating task, a different group of participants were given the names of objects reported by the object-association task participants and were asked to rate how affectively positive-to-negative each object was. In the color-object matching task, a third group of participants were given both the name of each object and the color for which it was reported and were asked to rate how much the characteristic color of the object matched the color on the screen. The data from these three tasks were used to calculate the weighted affective valence estimate (WAVE). The WAVE for each of the 32 colors is defined as the average value of the average valence for each object named for that color times the average match score for that object with the given color. These 32 WAVE values, which contain no free parameters, accounted for 80% of the variance in a different group's average preference ratings for the same colors. The WAVE predicts color preferences better than the previous models suggested by Ou et al. (2004) and Hurlbert and Ling (2007). This study established a strong correlation between color preference and preference for associated objects. However, the results are correlational and thus cannot support claims about the causal direction of the relation between object preference and color preference. Palmer and Schloss (2010) claim that object preferences cause color preferences, but the reverse could equally well be true – color preferences might cause object preferences – or some third factor might cause both color preferences and object preferences.

Schloss, Poggessi, and Palmer (in press) looked for causal evidence for the EVT by testing college students' color preferences at two rival institutions with strong color associations: the University of California, Berkeley (blue and gold) and Stanford University (red and white). Their logic was that the more positive affect (i.e.,

school spirit) students have for their own university and the more negative affect they have about their rival, the more they should like the colors of their own school and the less they should like the colors of their rival school. Indeed, university students prefer their school's colors to their rival's, and the degree to which they did so was positively related to their degree of self-reported school spirit. It is highly unlikely that students choose their institution and cultivate their degree of school spirit based on their existing color preferences, so any differences between Berkeley and Stanford students' color preferences have presumably been acquired through their affiliation with their university. Even so, these results are correlational, given that university affiliation is not experimentally manipulated. An experimental manipulation is required in order to provide a definitive test of the causal claim that object preferences cause color preferences.

Strauss, Schloss, and Palmer (in preparation) performed such a test by presenting participants with positive and negative images of items of a specific color. After participants completed a color preference task to establish baseline color preferences, they were divided into two groups: the +R/-G group saw positive red images (e.g., roses) with negative green images (e.g., moldy bread), whereas the +G/-R group saw positive green images (e.g., ripe kiwi) and negative red images (e.g., open wounds). Participants were then given the color preference task again to observe whether or not the positively or negatively charged images had altered corresponding color preferences, with increases in preference for red and decreases for green in the +R/-G group and increases in preference for green and decreases for red in the +G/-R group. A significant interaction was obtained between image exposure group and color preference change, but it was due mainly to the influence of the positive images. That is, positive images reliably increased color preferences, whereas negative images did not reliably decrease color preferences. Though these results support the EVT's general prediction, the evidence would be stronger if there were a significant impact of negative stimuli as well as positive stimuli. We reasoned that such effects might be achieved through tasting colored liquids that were soured and sweetened, respectively.

The primary aim of the present study is to further test the EVT's causal claim that object preferences influence color preferences by using color-flavor associations to try to change people's color preferences over the course of a 1-hour laboratory experiment. It was hypothesized that tasting colored water that was sweet (positive) would increase preference for its color and tasting colored water that was sour (negative) would decrease preference for its color. If color-taste associations indeed changed color preferences, that would provide strong evidence for the EVT's causal claim.

Experiment Objective

The primary aim is was to test whether color-taste

pairings can influence color preferences. According to the EVT, preference for colors paired with positive (sweet) drinks should increase after drink tasting and preference for colors paired with negative (sour) drinks should decrease.

The experiment was framed for participants as two separate, interwoven experiments, one on flavor perception and one on color preferences. Different experimenters conducted the taste and color preference tasks to increase the likelihood that participants would see them as entirely distinct experiments. First, participants took part in an initial drink exposure to encourage them to believe the primary goal of the experiment was to study taste perception. They then were asked to rate their color preferences for the Berkeley Color Project (BCP) 32 chromatic colors (Palmer & Schloss, 2010) in the initial color preference task in order to establish a color preference baseline. Participants were tested individually after random assignment to one of two main drink exposure groups. The +RB/-YG group consumed sweetened red and brown drink samples and soured yellow and green drink samples, and the -RB/+YG group consumed soured red and brown sampled and sweetened yellow and green drink samples. For each drink sample, participants completed a flavor identification task, a sourness and sweetness perception task, and a taste preference task. Immediately following the taste samples, participants were administered a color preference task identical to the initial color preference task. These color preference ratings were compared to the first color preference data to determine whether the drinks systematically and significantly changed color preferences.

Method

Participants

There were 22 participants (13 female, 7 males, $M_{age} = 20$, age range). All were volunteer psychology students at the University of California, Berkeley, who received course credit. Participants were tested for color deficiency with Dvorine Pseudo-Isochromatic Plates, and none were found to be color deficient. None of the participants reported having food related diseases or allergies. All participants gave informed consent, and the experiment protocol was approved by the UC Berkeley Committee for Protection of Human Subjects.

Design, Displays, and Procedure

In order to make it appear as though the color preference and taste experiments were entirely distinct and unrelated, they were conducted in different rooms, which were located on different floors of the Psychology Department, by two different experimenters, one for the color preference tasks and one for the taste tasks. There were a total of four phases to the entire experiment: (1) initial drink exposure, (2) initial color preference task, (3) drink tasting tasks with the experimental manipulation, and (4) post-exposure color preference task.

Initial drink exposure.

The experiment started with an initial drink expo-

sure task so that participants viewed the study as one primarily about taste. We believe this made them less likely to catch on to the manipulation than if we had started with the initial color preference task. All participants were given the same four drink samples in the following order: an orange-colored orange-flavored drink, a blue-colored vanilla-flavored drink, a blue-colored blueberry-flavored drink, and an orange-colored grape-flavored drink. The drink stimuli were all presented in small, transparent cups. The drinks were comprised of non-carbonated Safeway Select water and placed on a table in drinking order from left to right before the participant arrived.

After tasting each sample, participants completed three tasks: (a) flavor identification, (b) sweetness and sourness ratings, and (c) a preference rating. These tasks were conducted so that participants would think that the experiment was about how the color of the drinks influenced flavor perception and preference, rather than about manipulating color preference. All answers were recorded on a survey (see Appendix). In the flavor identification task, participants were asked to identify the flavor of each drink from a checklist of the four possible flavors in the drink exposure, and the participants were permitted to check as many flavor options as they felt were appropriate. In the sweetness and sourness rating task, participants rated how sweet and how sour they felt each drink was by circling a number on a scale from -5 ("not at all") to +5 ("very much") for each attribute. In the drink preference rating task participants rated how much they liked each sample by circling a number on a scale from -5 ("not at all") to +5 ("very much").

Initial color preference experiment.

In this phase of the experiment, participants were presented with each of Berkeley Color Project (BCP) 37 colors (see Table 1 for CIE 1931 xyY and Munsell coordinates), one at a time (Palmer & Schloss, 2010; Schloss, Poggesi & Palmer, in press). The colors included independent combinations of eight hues (red, orange, yellow, chartreuse, green, cyan, blue, and magenta) with four saturation-lightness conditions (high saturation at medium lightness, and medium saturation at medium lightness, high lightness, and low lightness). The remaining 5 achromatic colors were of 5 separate levels of gray, including both black and white. All color stimuli were presented on a medium gray background (CIE $x=0.312$, $y=0.318$, $Y=19.26$).

Colors were rendered and displayed using Presentation (www.neurobs.com) on a ViewSonic Graphic Series G70f computer monitor with a 1024x768 resolution. This monitor was calibrated using a Minolta CS100 Chroma Meter. Colors were presented as squares (100 px x 100 px) in the center of the screen. The participants rated how much they liked each color on a scale ranging from "not at all" to "very much", by sliding the cursor along a 400 px response scale at the bottom of the screen and clicking to record their response. The center of the scale was indicated as a neutral point, and was demarcated with a line. Ratings were rescaled to

range from -100 to +100.

Each color was presented twice, once in Block 1 and once in Block 2. In each block, the colors were presented individually in a random order. Colors remained on the screen until participants made a response, and the next trial began 500 ms later. After participants rated all 37 colors in both blocks, the experimenter calculated the correlation between their preferences for the same colors in Block 1 and Block 2. Participants' preferences were considered unstable and they were disqualified from the experiment if this correlation was not 0.70 or above (a total of five participants, which were already excluded from the 22 tested). If this Block 1 and Block 2 correlation criterion was met, participants went on to the next phase on the experiment. Otherwise they were excused from the session but given the same course credit as those who passed the correlation criterion.

Drink exposure with experimental manipulation.

This drink exposure phase mirrored the initial drink exposure phase except that there were eight drink samples total, two each of the following colors: saturated yellow (Y), dark green (G), dark red (R), and dark orange (B), otherwise known as brown. Participants were divided into two groups. The +RB/-YG group received sweetened R and B samples and soured Y and G samples. The -RB/+YG group received sweetened Y and G samples and soured R and O samples. Kroger food coloring was used to color each sample, and the amount of coloring for a given hue was always constant. The solutions used to sweeten and sour drinks were 3 Capella Liquid Sweetener and 3 Capella Tart & Sour Drops, respectively, both of which were uncolored. All sour drop amounts remained constant within sour samples, and all sweetener amounts remained constant within sweetened samples.

In order to reduce the possibility of participants making a conscious association between color and sweet and sour effects, each drink also received one of the following flavor treatments: banana, cherry, chocolate, coffee, lemon, mint, pear, or raspberry. Of the eight drink flavors, four were paired with "appropriate" colors while the other four were paired with "inappropriate" colors. Within each of the +RB/-YG and -RB/+YG drink exposure groups, participants were randomly assigned to one of two flavor exposure conditions. Half of the participants received "appropriate" lemon-Y, mint-G, cherry-R, and coffee-B flavor-color pairings while also receiving "inappropriate" banana-B, pear-R, raspberry-G, and chocolate-Y flavor-color pairings. The other half of the participants received "appropriate" banana-Y, pear-G, raspberry-R, and chocolate-B flavor-color pairings and "inappropriate" lemon-B, mint-R, cherry-G, and coffee-Y flavor-color pairings. The amount of flavoring in each sample of identical flavor remained constant, and all samples were flavored using unsweetened and uncolored Capella banana, cherry, chocolate, coffee, lemon, mint, pear, or raspberry flavor drops.

The order of drink consumption was randomized for each participant to reduce any taste-order effect. Af-

ter each drink sample, participants also ate a small piece of white Wonderbread to help eliminate the taste of the previously tasted drink.

After tasting each sample, participants completed the flavor identification task, sourness and sweetness perception task, and the drink preference rating task, just as they did in the initial drink exposure phase. Once all drink samples were consumed, participants were asked to describe what they thought the experiment was about. This was done to encourage them to believe that the taste aspect of the experiment was complete, and not related to the following color preference task. If participants described that the experiment was about changing color preferences through taste associations, their data was eliminated, though no participants guessed the manipulation at this phase.

Post-exposure color preference experiment.

This phase of the experiment was identical to the initial color preference phase, except that participants were told that this experiment would contain some colors different from the first color task to make the separate experiment framework more believable. To make this statement true, two irrelevant, non-BCP colors were added to the experiment, which were identical for all participants. After completing this task, participants were asked to describe what they thought was the purpose color preference experiments. If they successfully described the experiment manipulation, their data was removed (only three participants did so, and their data were excluded from the 22 participants whose results are described below). Participants were then debriefed as to the actual purpose of the experiment.

Results

Color Preference Experiment Results

To determine whether or not the taste stimuli induced a change in color preference, participants' average color preferences from the initial color preference experiment for the colors used with the taste stimuli (red (R), brown (B), yellow (Y), and green (G)) were subtracted from the average color preferences for these colors in the post-taste exposure color preference experiment. As shown in Figure 1 there was an interaction between taste exposure group and change in color preference ($F(1,20)=12.61, p<.01$). Participants in the +RB/-YG taste exposure group showed an increase in preference for R and B relative to that for Y and G ($t(11)=2.76, p<.05$), whereas participants in the -RB/+YG group showed the opposite pattern ($t(9)=2.32, p<0.05$). There was no main effect of color, indicating that there was no overall difference in preference change between the two color sets ($F<1$).

We also compared the effects of colors that covaried within groups of sweetness and sourness. There was no main effect of color with R and B ($F(1,20)=1.71, p>.05$), and there was no interaction between color and group ($F<1$). There was no main effect of Y and G ($F<1$), but there was an interaction between color and group ($F(1,20) = 4.38, p<.05$).

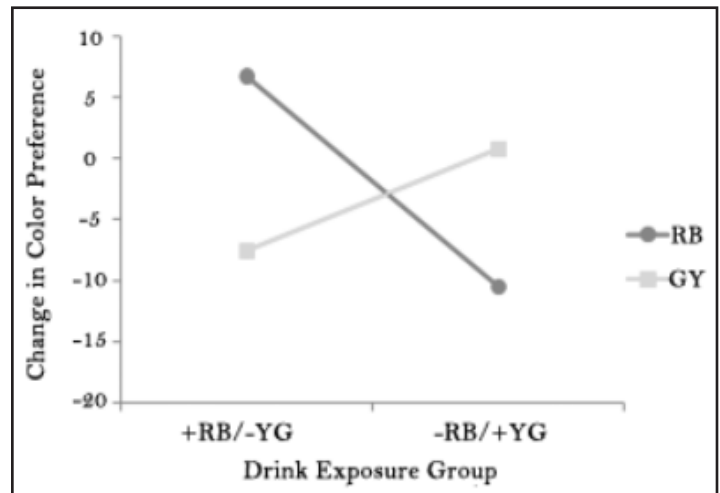


Figure 1. Changes in color preference between drink exposure groups for red and brown (dark gray circle points) and green and yellow (light gray square points).

Looking at each of the four colors separately (see Figure 2), there was a clear difference between groups for G ($t(20)=2.36, p<.05$) and R ($t(20)=3.44, p<.01$), but not for Y ($t(20) = .39, p>.05$) or B ($t(20)=1.23, p>.05$). While there was no main effect of color, there was an interaction.

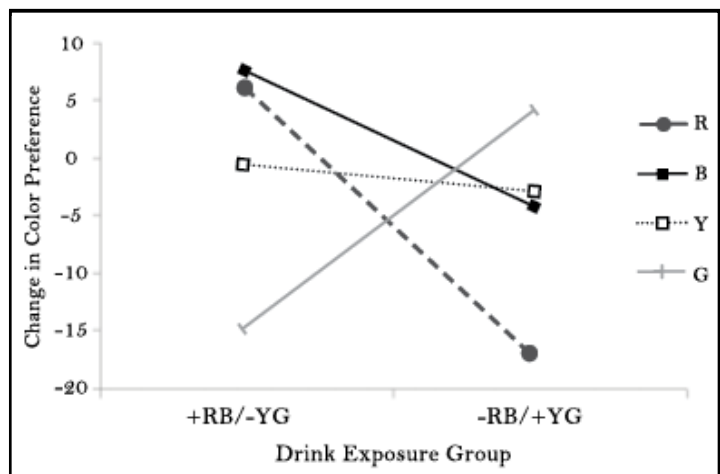


Figure 2. Changes in color preference between drink exposure groups for red (circle points), brown (square points), green (bar points), and yellow (hollow square points).

We also ran a comparison between groups, finding that people in the +RB/-YG taste exposure group had an increase in preference for R and B relative to those in the -RB/+YG ($F(1,20) = 3.57, p<.01$). This between group comparison found that the decrease in preference for Y and G in the +RB/-YG group and the decrease in preference for R and B in the -RB/+YG group was significant ($t(20) = 2.43, p<.05$), but that the increase in preference for R and B in the +RB/-YG group and the increase in preference for Y and G in the -RB/+YG groups was not significant ($t(20) = 1.04, p>.05$).

Discussion

Color Preference Experiment Discussion

As predicted, participants exposed to the +RB/-

YG stimuli reported an increase in preference in R and B compared to their change in preference for Y and G. These findings support the main EVT hypothesis suggesting that sweet-associated colors would increase in average preference, whereas sour-associated colors would decrease in average preference. The data demonstrate that the drink samples acted as salient objects that became associated with the color of the objects, resulting in the change in color preference. Participants appear to have associated the specific colors of the drinks with the pleasant experiences of tasting sweet drinks and the unpleasant experiences of tasting sour drinks. This demonstrates that experiences with colored objects can influence color preference, as EVT suggests. Additionally, by using taste stimuli as a manipulated variable to produce changes in color preference, the results of this support the causal claim of the EVT, which is stronger than the correlative evidence reported previously. For this reason, the use of taste samples as positively or negatively valenced stimuli to alter color preference response appears to be a compelling experiment method for testing the EVT, and should be useful for further tests.

In ensuring that there was justification in combining the average for R and B and the average for Y and G by comparing the effects of colors that covaried within groups of sweetness and sourness, it was determined that there was no main effect of color with R and B and no interaction between color and group. This means that the color preferences for these colors were moving in the same direction. However, although there was no main effect of Y and G, there was an interaction between color and groups where G showed the predicted direction in which the -RB/+YG drink exposure group had an increase in preference relative to those in the +RB/-YG drink exposure, but there was no effect for Y. Overall, R and G had the most powerful changes in preference, suggesting that future taste-color associated EVT color preference studies should include only those colors to maximize the strength of the effects. When observing each of the four colors separately, as seen in Figure 2, R and B produced the predicted interaction while Y and G did not. Although it is unclear why Y and B tend to produce less robust changes, the data continues to suggest that R and G may be the best options for EVT research on color preference change.

In our between groups comparison, we observed that the decrease in preference for the soured colors was significant, but the increase in preference for sweetened colors was not significant. This supports past literature suggesting that differences in valence extremities between positive and negative stimuli is an evolutionary adaptation (Rozin, Gruss, & Berk, 1979). Humans have evolved to become more sensitive to negative experiences and associative objects (such as the taste samples), making changes in their response to these objects and experiences more extreme.

Another consideration in explaining the difference in preference changes between sour associated and sweet

associated colors would be the novelty of sour drinks versus sweet drinks. The fact that the soured drinks are potentially new experiences suggests that the changes in preferences for sour-associated colors these wasn't due to priming, or activating known experiences and associations to encourage a bias in rating preferences. Instead, these soured drinks create new salient experiences with color objects, thus updating the associative memory that underlies color preference. As a result, the sour drink experiences would have been perceived as much more novel than the sweet drink experiences, and so it is possible that this also caused the difference in valence extremities between the sweet and sour stimuli.

Experimental Design Discussion

Though our data suggest that the EVT is significant in predicting the influence of color-taste associations on color preferences, it's important to recognize that the sample size of 22 is relatively small, especially when trying to establish a baseline color preference. However, while the sample size is small, this report presents a preliminary data set, and we plan to conduct more research of this nature in the near future.

Conclusion

The hypothesis that sweet-associated colors would increase in average preference whereas sour-associated colors would decrease in average preference was strongly supported by the results. The positively and negatively valenced taste samples changed color preferences as predicted by the EVT, meaning that the results support the causal claim of the EVT that object preferences impact color preferences. In providing support for the EVT, it suggests that the EVT should be used as an accurate tool to predict and influence color preferences, which may be extremely useful in both the fields of cognitive science as well as marketing and sales.

Future Research on the EVT

An important variable as yet unstudied is the time span over which the taste stimuli in this study would continue to influence color preferences. The present experiment was designed to test the immediate impact that pleasant and unpleasant colored drink samples have on color preferences, but it is not yet known how long these effects will last. The EVT suggests that, after a unique experience (e.g., like the drink samples that are not repeated), color preferences should gradually return to baseline. An interesting extension of this study would thus be to have participants return after a set time interval to complete a third color preference survey to determine whether or not their color preferences remained changed after a longer length of time.

Acknowledgements

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Appendix A

For Drink 1, please bubble in which flavor(s) the drink contained:

Banana	Cherry	Chocolate	Coffee Bean	Lemon	Mint	Pear	Raspberry
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For Drink 1, please rate how sour/tart this drink was, with -5 being the least sour/tart and 5 being the most sour/tart. Circle your response.

-5 -4 -3 -2 -1 0 1 2 3 4 5

For Drink 1, please rate how sweet this drink was, with -5 being the least sweet and 5 being the most sweet. Circle your response.

-5 -4 -3 -2 -1 0 1 2 3 4 5

For Drink 1, please rate how much you liked the drink, with -5 being that you liked the drink very little and 5 being that you liked the drink very much.

-5 -4 -3 -2 -1 0 1 2 3 4 5

Appendix B

CIE 1931 values and Munsell values for the 32 chromatic colors (from Palmer & Schloss, 2010) and CIE 1931 values for the four achromatic colors (CIE Illuminant C, see Schloss, Pogessi, & Palmer, in press).

Color		x	y	Y	Hue	Value/Chroma
Red	Saturated	0.549	0.313	22.93	5 R	5/15
	Light	0.407	0.326	49.95	5 R	7/8
	Muted	0.441	0.324	22.93	5 R	5/8
	Dark	0.506	0.311	7.60	5 R	3/8
Orange	Saturated	0.513	0.412	49.95	5 YR	7/13
	Light	0.399	0.366	68.56	5 YR	8/6
	Muted	0.423	0.375	34.86	5 YR	6/6
	Dark	0.481	0.388	10.76	5 YR	3.5/6
Yellow	Saturated	0.446	0.472	91.25	5 Y	9/12
	Light	0.391	0.413	91.25	5 Y	9/6.5
	Muted	0.407	0.426	49.95	5 Y	7/6.5
	Dark	0.437	0.450	18.43	5 Y	5/6.5
Chartreuse	Saturated	0.387	0.504	68.56	5 GY	8/11
	Light	0.357	0.420	79.90	5 GY	8.5/6
	Muted	0.360	0.436	42.40	5 GY	6.5/6
	Dark	0.369	0.473	18.43	5 GY	4.5/6
Green	Saturated	0.254	0.449	42.40	3.75 G	6.5/11.5
	Light	0.288	0.381	63.90	3.75 G	7.75/6.25
	Muted	0.281	0.392	34.86	3.75 G	6/6.25
	Dark	0.261	0.419	12.34	3.75 G	3.75/6.25
Cyan	Saturated	0.226	0.335	49.95	5 BG	7/9
	Light	0.267	0.330	68.56	5 BG	8/5
	Muted	0.254	0.328	34.86	5 BG	6/5
	Dark	0.233	0.324	13.92	5 BG	4/5
Blue	Saturated	0.200	0.230	34.86	10 B	6/10
	Light	0.255	0.278	59.25	10 B	7.5/5.5
	Muted	0.241	0.265	28.90	10 B	5.5/5.5
	Dark	0.212	0.236	10.76	10 B	3.5/5.5
Purple	Saturated	0.272	0.156	18.43	5 P	4.5/17
	Light	0.290	0.242	49.95	5 P	7/9
	Muted	0.287	0.222	22.93	5 P	5/9
	Dark	0.280	0.181	7.60	5 P	3/9
Achromatic	Black	0.310	0.316	0.30		
	Dark gray	0.310	0.316	12.34		
	Med Gray	0.310	0.316	31.88		
	Light Gray	0.310	0.316	63.90		

Getting to know: *Katherine Copeland*

Biography

Katherine Copeland, was born in the small town of Buffalo, Wyoming and moved to Allen, Texas when she was nine years old. She was always motivated to do something big with her life and knew that college was the only path for her. She is currently a senior undergraduate student at the University of Kansas, double majoring in Psychology and Applied Behavioral Science. She works as a preschool teacher at La Petite Academy, a research assistant in a clinical psychology lab under Dr. Rick Ingram, and volunteers as a big sister with Big Brothers Big Sisters. She loves working with children and hopes to go into the clinical child psychology profession.



Q&A

What sparked your interest in psychology?

As cliché as it sounds, when I was in high school I was always that friend that everyone would come to with their problems and I ended up being a kind of therapist for all my friends. So when I came to college I took an intro to psych class out of curiosity and I realized that it was so much more than just listening to people. I fell in love with all the different concepts and the research looking at things I didn't think could even be studied. After taking the intro class I started taking more classes and eventually decided to major in it.

What led you to this topic?

We joined a clinical psychology research lab spring of last year and one of the requirements was to write a literature review. Claire and I had just met and decided to be partners since we didn't know anyone else in the lab. We wanted to do something that we hadn't already read a lot about, and since I was interested in children we started looking into early life stressors like abuse and their impact on depression. We were a little overambitious in trying to look at the neurobiological perspective since neither of us had studied very much in that area before, but it ended up being a very interesting topic and it taught us both a lot.

How long have you been working on this paper? What has the process been like for you?

Claire and I worked on this paper over a period of about 4 months, meeting up several times over that period. We split up the paper into sections and would each write one section and then come together to discuss it. Making the paper cohesive was one of the hardest parts because we have such different writing styles and we were trying to fit together the parts that each of us wrote. About a year later we decided to turn it in to be considered for this journal, and we had a professor in the area look it over to see if she had any suggestions. Then we worked with the editors to fix a few minor things once it was accepted. It was a very long process, and it was definitely very exhausting, but it was all worth it in the end.

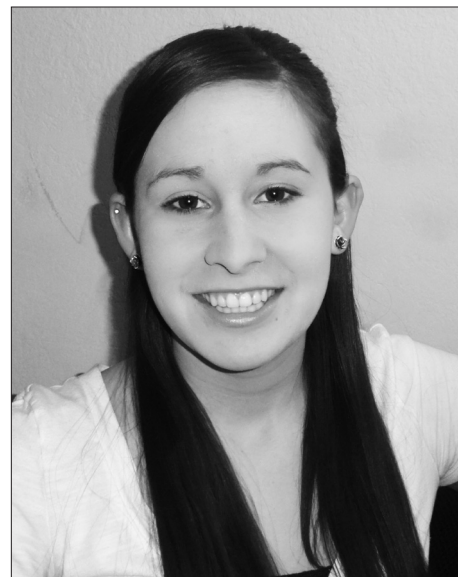
How was collaborating on a paper with another author?

Working on this paper with Claire has been an interesting experience to say the least. It is always nerve racking to work in pairs when you don't know the other person because there is always that fear that you will have to pull their weight too. But with Claire things ended up working out really well. She was just as driven as I was and we were both willing to put in all it took, and more, to come up with a good product. I really enjoyed working with Claire because she has a lot of great insight that I never would have thought of. It was also nice to be able to play on each of our strengths to make up for the other's weaknesses. The hardest part for us was trying to find time to get together since we are both double major's with internships and jobs outside of school.

Getting to know: *Claire Gorey*

Biography

Claire Gorey is a junior at the University of Kansas. She is majoring in Psychology and Applied Behavioral Science and minoring in Statistics. Claire is currently an undergraduate research assistant to both the Depression Laboratory and the Performance Management Laboratory. She has an internship at a facility that assess and treats disruptive professionals and is learning how to administer various neuropsychological tests. Claire is fascinated by the brain and hopes to get into a Ph.D. program that focuses on the biological and genetic vulnerabilities to substance abuse disorders.



Q&A

What sparked your interest in psychology?

I remember being fairly young and looking up topics in Psychology. Once I got to high school, I was just curious about certain mental disorders and why they developed, but college is when I really discovered that Psychology was definitely the career path for me. I took some courses that were really interesting, and I started reading research articles. I really connected with the material, and I knew no other major would spark my interest like Psychology did.

What led you to this topic?

Katie and I joined a Depression lab, and one of the requirements was to write a literature review. We both wanted to do a topic that was not covered in lab. I was interested in Early Life Stress, and Katie was able to connect it to Depression literature, so we went with it. We thought the neurobiological perspective was the most interesting, so we tackled this topic from the viewpoint. I had not even taken a brain and behavior course, but I learned a lot through out the paper. This is what really took the most time. I wanted to truly understand the material before writing the paper.

Did you have a mentor and how did you get involved with them?

We did not have a mentor for this specific paper. Katie and I wrote this independently. However, what we learned from Tiffany Meites in the lab helped us form this paper.

How long have you been working on this paper? What has the process been like for you?

We worked on the paper for a period of four months. Katie and I met up about 7 times over the course of writing paper. Each of us wrote parts on our own as well. Then, a year after we wrote the paper, we met with one of our professors before submitting it to the journal, just to correct any grammatical or formatting errors. The process has been stressful but definitely worth it. It would have been a lot easier if we asked for feedback early on, but it was definitely a learning experience for us by trying to tackle the whole paper on our own, especially as first semester sophomores.

How was collaborating on a paper with another author?

It was a good experience working with another author because you get their perspective on certain topics. It can help guide you toward a better paper, as the paper comes from the collaboration of two unique perspectives. It was also encouraging to have someone keep you on track and motivated. It was a little difficult in terms of writing style because we did not want our literature review to be choppy. We had to make sure it was cohesive because both of us were writing different parts in the paper and combining it.

The Effects of Early Adverse Life Experiences on the HPA Axis And Their Impact on the Development of Depression

Katherine Copeland and Claire Gorey

University of Kansas

In this review, the effects of early life stress (ELS) on the hypothalamic-pituitary-adrenal (HPA) axis and their role in the development of Major Depressive Disorder (MDD) later on in life are discussed. The HPA axis mediates one of the major stress response systems in the human body, and therefore, the damaging effects of ELS play a major role in the development of MDD. By examining research that studied non-depressed abused children, depressed adults, non-depressed abused adults, and control subjects, neurobiological similarities and differences are revealed. The hyperactive responses to ELS in childhood appeared to have adapted to chronic stress, and consequently, these individuals exhibit blunted responses later on in life. These blunted responses mimic those of depressed individuals without ELS, and thus, these responses may represent a vulnerability to developing depression. Despite this similarity, the hyperactive HPA axis in childhood results in a number of neurobiological differences between abused depressed and non-abused depressed individuals. Pending further research in this area, specific treatments for people with MDD and ELS would be supported.

Introduction

Researchers have classified early life stressors (ELS) as moderate to severe adversities experienced before puberty. Some of the common early life stressors identified are sexual, physical, and emotional maltreatment, but ELS also includes life stressors such as chronic illnesses, accidents, natural disasters, wars, poverty, parental loss, unstable families, and dysfunctional parent-child relationships (Heim, Plotsky, & Nemeroff 2004). It has been reported that there are about 1.5 million instances of early adverse life experiences each year in the United States, and almost half of these events were more serious in nature than others previously listed (e.g., physical, sexual, or emotional abuse) (Heim & Nemeroff 2001). It is essential to determine the effects of early adverse life events because this knowledge will aid in the development of successful treatments and interventions. This literature review will give an overview of the hypothalamic-pituitary-adrenal (HPA) axis and the studies examining the effects of childhood maltreatment on the HPA axis. It will also discuss how genes, gender, and the environment mediate the effects of ELS and will propose a working model for why depression develops after ELS for some individuals but not for others. Then, it will discuss possible treatment specific options for those with a trauma history. Lastly, it will help advance the existent research by discussing additional studies that could examine this phenomenon from a developmental perspective. The expected, differential effects could provide supporting evidence for treating those with ELS and MDD differently than those with just MDD.

Evolutionary and Developmental Impacts on the HPA Axis

The HPA axis mediates one of the major stress response systems in the human body. The function of the HPA axis has not changed much since we lived in caves, despite changes to our social environment. Activation of the HPA axis is referred to as the “defeat reaction” or the helpless reaction to stress because it is often triggered by stressors that appear to be out of the person’s control (Bauer, Quas, & Boyce, 2002). The HPA response was shaped by evolutionary forces that helped our ancestors survive life-threatening situations such as extreme cold, drought, famine, and threats to social dominance. However, in modern society, these same systems are activated much more frequently and by very different types of events, which are usually not life-threatening. Although this is the case with many types of stressors that we encounter today, it is not necessarily the case for children who are abused by their parents. Child maltreatment can potentially be life-threatening, and it is certainly a case in which children are helpless to get themselves out of the situation. If the abuse happens to be chronic, children’s HPA Axis’ will be in a constant state of activation. This enhanced activity will create sustained, chronic levels of cortisol throughout crucial stages of childhood development (Heim et al., 2002). The body will eventually adapt to these high levels of cortisol and continue to produce them even after the stressors have been resolved. When this occurs, it is much harder for the body to respond appropriately to novel stressors that are presented later on. In many cases, a hyperactive HPA axis produced by child maltreatment would lead to an adult with a blunted stress response, resembling the neurobiological activity of those with MDD. This eventual overlap in symptoms suggests a link between childhood maltreatment and the development of MDD later on in life. However, despite

this overlap, the effects of sustained CRH and cortisol during the critical periods of child development induces neurobiological changes that differentiate those with ELS and MDD from those with just MDD (Heim et al., 2002).

In a healthy individual, the HPA axis activation starts after it has received information from the amygdala and hippocampus. The amygdala sends information when the individual is experiencing emotions such as fear or stress-induced anxiety, and the hippocampus sends it when the individual is recalling a past memory. The HPA axis responds to the input from the amygdala and hippocampus by stimulating the corticotrophin-releasing factor (CRH) in the hypothalamus. The CRH then stimulates the secretion of the adrenocorticotrophic hormone (ACTH) in the anterior pituitary, leading to increased concentrations of cortisol produced by the adrenal cortex. Once the stressor has been resolved, a negative feedback loop suppresses the release of CRH and ACTH in order to regulate the concentration of cortisol being released into the body. Cortisol brings the body back into homeostasis and deactivates the stress response (Chrousos & Gold 2010, Shea, Walsh, MacMian, & Steiner, 2004). However, chronic early life stress damages the HPA axis, and as a result, the normal responses to stress are dysregulated. When the stress response is dysregulated, the HPA axis becomes hypersensitive. The dysregulated HPA axis will be activated frequently and for longer durations. The hyperactivity of the HPA axis will result in an increased amount of cortisol being released, and thus, more cortisol will be exposed to areas in the body, especially in the brain. This can have detrimental effects, not only on the normal functioning of the HPA axis, but also on children's development (Joels, 2010). The effects of ELS on the HPA axis in children will be examined in the following paragraphs (Liu et al., 1997; Kaufman et al., 1997). Then, adults with a history of ELS will be observed to discover how the HPA axis adapts to stress in adulthood, how it differs from childhood, and how it is different from those with current MDD but no history of ELS (Shenk, Noll, Putnam, & Trickett, 2010; Heim et al., 2002). These neurobiological differences in the HPA axis, along with further evidence addressing the gaps in the research and examining effective treatment options for those with ELS and MDD, will provide empirical support for the development of specialized treatments for those with ELS and MDD.

The HPA Axis' Adaptive Response in Childhood Compared to Adulthood

The HPA axis responds differently in children with ELS than it does in adults with ELS. In order to observe these differences, researchers studied the effects of early life stress on the stress response system in non-human animals first to determine what kind of responses to expect in humans. One study revealed that environmental events during the first ten days of a rat's life play a role in shaping the stress response of the HPA axis (Liu et

al. 1997). They discovered that the HPA axis response to stress was less active if the mother rat exhibited a greater frequency of licking and grooming their offspring during infancy. Specifically, those offspring displayed lower ACTH and corticotropin responses to stress (Liu et al, 1997). The results of these studies show that social relationships appear to be important to development in non-human species, and the findings can be generalized to human species as well.

In the absence of a positive support system, humans who experience abuse and ongoing stressors exhibit significant dysregulation of the HPA axis system (Kaufman et al. 1997). For instance, depressed abused children who would be likely to lack a positive support system appear to produce a stronger hormonal stress response. In one study, 39 children between the ages of 7 and 13 were given doses of CRH intravenously in order to trigger the HPA stress response. Depressed abused children exhibited a greater increase in ACTH and cortisol when compared to depressed non-abused children or the control group (Kaufman et al, 1997). Combined with the evidence from Liu et al. (1997), it appears that the initial hormonal trigger of the HPA axis produced elevated levels of CRH, ACTH, and cortisol in children who experienced ELS.

Although Kaufman et al. (1997) and Liu et al. (1997) showed elevated CRH, ACTH, and cortisol levels in response to stress in children, adults with a history of ELS and current MDD exhibit different neurobiological effects to stressors. One study compared four groups after the administration of the CRH intravenously, and it was found that women with a history of ELS and current MDD show a blunted, or decreased, ACTH response to the CRH challenge (Heim et al. 2001). These results were observed again in a study of 144 women, which measured their cortisol levels before and after the presentation of a laboratory stressor (Shenk et al. 2010). Therefore, it may be that the body adapts to repeated stress by forming a blunted ACTH response to protect itself and to prevent harm to the body.

When evaluating these four studies, the effects of ELS are different when observing children with ELS and adults with ELS and MDD. Children with current ELS exhibit augmented ACTH in response to CRH stimulation (Kaufman et al. 1997). Consistent with human data, rats that were handled during the first ten days of life displayed higher ACTH and corticotropin responses to stress than ones that were not (Liu et al., 1997). Therefore, it appears that children with a history of ELS exhibit elevated CRH, ACTH, and cortisol in response to stress. However, adults with MDD show a blunted or lower stress response, not an exacerbated one. Exposure to CRH produces a blunted ACTH and cortisol response that mimics the HPA axis activity of individuals with MDD without ELS (Shenk et al., 2010; Heim et al., 2001). Therefore, it is hypothesized that the initial hyperactivity of the HPA axis evolves into a blunted response over time because of the down-regulation of pituitary CRH receptors as a consequence

of hypothalamic hypersecretion. It is possible that this results in symptoms of depression because excess CRH is released in the extra-hypothalamic circuits (Heim et al., 2002).

Thus, it is proposed that ELS produces a vulnerable phenotype, and upon further exposure to stress in adulthood, individuals with ELS are more susceptible to developing MDD. Those with a history of ELS and current MDD and those with current MDD alone may display similar neurological effects such as a blunted ACTH response to CRH administration and elevated levels of CRH in extra-hypothalamic circuits. However, despite the overlap, there are marked differences between the two groups of individuals.

Neurobiological Differences Between MDD with ELS and MDD Alone

Although individuals with current MDD and ELS have similar neurobiological responses to stress as individuals with MDD alone, there are other neurobiological differences that exist between the two groups. These differences are observed when the hippocampus, CRH 1 pathways, and oxytocin levels are examined in the two clinical groups. For instance, those with a history of ELS exhibit decreased hippocampal volume (Joels, 2010). The left hippocampus in those with a history of ELS is 18% smaller than those with MDD alone. This may be a result of cortisol hypersecretion during development and over the course of time. Cortisol has been shown to result in neurogenesis and, as a result, restricts the development of new cells, the migration of cells, and the differentiation of neurons (Joels, 2010). Therefore, since the hippocampus is still developing when early life stress occurs, the hypersecretion of cortisol will not allow the hippocampus to function and develop normally. As a result, these individuals' stress response systems would be even more dysregulated because the hippocampus plays such a pivotal role in the negative feedback loop. They would also have a harder time with memory and concentration because the hippocampus would have trouble converting short-term memories into long-term memories (Vythilingham, 2002). This decreased concentration and memory mimic some of the behavioral symptoms of major depression.

The hippocampal atrophy existent in those with a history of ELS reveals one of the neurobiological differences between those with ELS and MDD and those with MDD alone. However, there are also differences in the CRH 1 pathways and oxytocin levels. Those with a history of ELS show an even greater dysfunction in their CRH 1 pathways than those with MDD. Evidence of this greater dysfunction is proven through the increased levels of CRH in the cerebrospinal fluid of individuals with a history of ELS compared to those with just current MDD (Kehne and Maynard, 2008). Although those with ELS had higher CRH in the cerebrospinal fluid, they showed decreased concentration of the neuropeptide oxytocin compared to those with MDD alone. Oxytocin has a role in mediating social affiliation,

parent and child attachment, social support, trust, and also protects the stress response. In a famous study comparing nursery-reared monkeys to mother-reared monkeys, nursery-reared monkeys displayed markedly decreased oxytocin levels, and as a result, demonstrated decreased reciprocal social behaviors and decreased likelihood to use social support to mediate their response to stress (Winslow et al., 2003). Early life stress disrupts the development of brain components involved in social attachment. Those with ELS, then, are more vulnerable to the development of depression.

The overlap in neurobiological responses in those with current MDD and those with current MDD and ELS represent the effects of depression. However, the neurobiological differences suggest that the effects of ELS may require additional or alternative treatments than those recommended for patients with MDD alone. Early life stress produces persistent changes in the HPA axis and related systems during development, and as a result, these systems function differently than in those who experience stressors in adulthood and develop MDD.

Factors that Moderate the Effects of ELS

Through the analysis of ACTH levels, cortisol levels, and the HPA axis, researchers have demonstrated the impact of early adverse life experiences and have shown a link between childhood trauma and the development of major depression later on in life. However, some individuals who experience early adverse life experiences do not develop major depression. It is crucial to identify variables that moderate the effects of childhood trauma on the development of major depression. The characteristics of the early life stress, such as the timing and frequency, are among these variables. However, genetics and the environment also play a major role on whether or not an individual will develop depression.

Frequency and Timing of Early Life Stress

Even the characteristics of the early life stress can influence the developmental outcome. Some of these characteristics include the frequency of the stressor and the timing of the stressor. When studying the effects of the frequency of ELS on mental health, one study revealed a dose-response relationship between the number of early life stressors and the number of depressive symptoms (Feletti, et al., 2003). When examining rat pups under stress during different time periods in early development, researchers have seen differential outcomes, i.e. significantly different cortisol and ACTH levels (Enthoven et al., 2008). This evidence suggests that even the characteristics of the early life stress can have differential effects on an individual. However, because most of the research on this topic is on animals, further studies with humans will be necessary to substantiate the results found in the studies discussed.

Gene by Environmental Interactions

Although the different characteristics of the early life stress influence the development of major depression,

genes also interact with early life stress to produce varying outcomes. For those with a history of early adverse life experiences, multiple studies indicate that the importance of the 5-HTTLPR (Caspi et al., 2003; Kendler et al., 2005). The 5-HTTLPR is a polymorphic area in the promoter region of the serotonin transporter protein, SLC6A4. The serotonin transporter regulates the serotonin function in the brain, and thus, a polymorphism in this gene affects the rate of serotonin reuptake. The polymorphism on the 5-HTTLPR region has two common variations, either the short allele (s) or the long allele (l). The short allele results in reduced transcription for the serotonin transporter protein compared to the long allele. Individuals with two copies of the short allele have shown more depressive symptoms, diagnosable depression, suicidal tendencies, neuroticism, and amygdala reactivity to fearful stimuli than those who have one copy of the short allele or two copies of the long allele (Caspi et al., 2003; Kaufman et al., 2004; Lesch et al., 1996). However, the effect of more depressive symptoms is only present for those with a history of early adverse life experiences. Therefore, it is hypothesized that individuals with a short allele are characterized by the stable trait of neuroticism, but under conditions of early life stress, this neuroticism develops into psychopathology (Caspi et al., 2003). This evidence suggests a gene-environment interaction specifically for those with a history of early adverse life events. Although many researchers have confirmed the results of Caspi et al. (2003), other studies have observed this gene by environment interaction only for females (Barr et al., 2004). This suggests an interaction between the environment, gender, and genetics.

Gender

The role of gender in the development of psychopathology remains a major question for researchers. Researchers discovered that women are more likely to develop major depression after ELS. Thus, many researchers have questioned whether women experience more early life stressors or if there are neurobiological differences between the genders that contribute to a higher incidence of depression in women (Weiss et al., 1999). Researchers have indicated that the HPA axis in females is more sensitive than in males. For example, when under a psychosocial stress test, females demonstrate a greater magnitude and duration of activation in their HPA axis (Rhodes & Rubin., 1999). Sex steroids have also been targeted for their role in sensitizing females to stress and, as a result, becoming more vulnerable to depression. For instance, when men are treated with the female sex hormone, estradiol, they exhibit increased ACTH and cortisol responses to stress. Thus, females may have a sensitive reaction to stress due to estradiol and other sex hormones (Kirschbaum et al., 1996).

The impact of early life stress is mediated by the characteristics of ELS, and also by an individual's genes and gender. By understanding the ways in which ELS

can be moderated, researchers can understand how mental illnesses develop in those with a history of ELS and, as a result, devise strategies to prevent the development of MDD in those with a history of ELS. To make these interacting variables easier to analyze and interpret, researchers have developed a model to understand this phenomenon.

Working Model for the Effects of Various Factors on the Development of MDD

Due to the many factors contributing to the development of depression, Heim et al. (2004) adapted a working model for why some individuals develop depression in response to early life stress while others do not. Early life stress is associated with persistent sensitization of the stress response and alterations of the components in the HPA axis. However, these effects are moderated by environment and genetic factors, and thus, the working model that Heim et al. (2004) presents takes these factors into account. The early life stressors, (i.e. the frequency and timing of them) and the genome (i.e. the gender and genetic polymorphisms of an individual) contribute to the development of a vulnerable phenotype with alternations in the cortical-limbic-brainstem circuits. This phenotype will be more vulnerable based on certain characteristics of the ELS, genes, and gender. When trauma or stress occurs later in life, this vulnerable phenotype exhibits psychopathology including increased emotional, behavioral, and automatic responses. However, if treatment or social supports occur before the onset of psychopathology, reversing the HPA axis damages and maladaptive behavior may make an individual resilient to major depression and other mental illnesses. Many things can contribute to the development of psychopathology; it is therefore helpful to have a rough model that demonstrates how all of these factors interact to ultimately result in depression or not.

Treatments

Interventions in Childhood

By examining the working model by Heim et al. (2004), early treatments and interventions appear to be essential in preventing individuals with ELS from developing major depression later on in life. Both human and non-human studies have shown that environmental interventions have helped reverse the effects of early life stress. Maccari et al. (1996) demonstrated that early adoptions in rats, after having experienced prenatal stress, completely reversed the effects on the HPA axis. In collaboration with this research, Fisher et al. (2000) demonstrated that maltreated children who were placed in an early intervention foster care program showed significant improvement in behavioral adjustment and decreases in cortisol compared with children in normal foster care. The foster care program in this study promotes positive parenting strategies in which parents provide consistent, non-abusive discipline, high levels of positive reinforcement, and close monitoring

and supervision of the child. Although the study is limited due to the small sample size, it still suggests that environmental interventions after the ELS are crucial for preventing the long-term behavioral and neuroendocrine effects of ELS. This means reconstructing children's environment, so the caregivers are able to provide positive reinforcement, love, consistent discipline, and support. In cases of severe, ongoing abuse in early childhood, children should be placed in a foster home where more social support is provided. Treatments that are most effective are those that are put into effect early in the child's life; however since this is not always a possibility, there are other treatments that have been proven to be effective in treating MDD with a history of ELS.

Interventions in Adulthood

Early interventions should target the alternations in the HPA axis during its most plastic period – before ELS can produce more permanent changes. However, in many cases, early intervention is not possible, which leaves individuals vulnerable to develop major depression in adulthood. Although treatments for major depression have been used in the past to treat those with a history of ELS, recent research has suggested treatment specific options for those with a history of ELS and current MDD (Kehne et al., 2008; Nemeroff et al., 2003). Researchers compared the effects of Nefazodone, psychotherapy, or the combination of both (Nemeroff et al. 2003). Treatment response varied according to ELS status. Patients with current major depression but without ELS responded to combination treatment the best. However, those with current MDD and ELS were two times more likely to achieve remission when treated with psychotherapy alone than Nefazodone alone. Unlike those with MDD but without ELS, those with current MDD with ELS did not have any increase in treatment response to combination treatment (Nemeroff et al., 2003). This evidence presents psychotherapy as being crucial in treating those with a history of ELS. CRH 1 receptor antagonists are another treatment specific option for those with ELS because they are particularly suitable for hyperactive CRH 1 pathways. These drugs block the receptor sites for CRH and, as a result, block the secretion of ACTH and cortisol. Therefore, the drugs could be useful for reducing the consequences of sustained cortisol levels on hippocampal organization and volume and increasing treatment response by lessening the deleterious effects of chronic stressors (Kehne et al., 2008).

Further research is needed in this area in order to support the differentiation of treatments for those with MDD alone and those with MDD with a history of ELS. Previous research failed to look at this phenomenon from a developmental perspective, and this component of the research is critical in order to apply empirical, treatment specific options for those with MDD and ELS. Cross-sectional or longitudinal research looking at how the HPA axis functions in childhood, in adolescence, and in

adulthood would help to support the idea that having a history of ELS damages the HPA axis and results in differing brain chemistry from that seen in individuals who have MDD without a history of ELS. It would also help to examine how the HPA axis, in those with ELS, is functioning at each developmental period. These results would show the changes in the effects of ELS throughout the lifespan.

Conclusion

Although those with a history of ELS begin to exhibit neurobiological effects that closely resemble those with MDD, there are distinct differences due to the early life stress occurring at such a vulnerable period in their lives. For instance, the chronic elevation of cortisol during childhood results in the neurogenesis of many important organs, including the hippocampus. Other evidence includes increased CRH 1 receptors and decreased oxytocin concentrations in the cerebral spinal fluid of those with ELS. These all provide support for neurobiological effects specific to ELS. If research addresses the gaps identified in treatment research and produces the anticipated results, treatments may need to be altered in order to respond to the effects of ELS throughout developmental periods. However, in order for this to happen, more research is needed to provide more conclusive evidence. Therefore, longitudinal studies should be considered to discover the effects of abuse during different developmental periods. Also, new studies should divide groups based on the types of abuse to discover how these can have differential effects. However, it may be difficult because as studies have shown, abuse rarely occurs in pure forms. Lastly, studies investigating the effects of MDD should account for individuals with a history of ELS. Some of the studies examining the effects of MDD in the past could have been confounded because they did not take into consideration the number of individuals with ELS. It would be useful if these studies could be reviewed or even replicated to separate the effects of MDD and the effects of ELS. This area of research needs a significant amount of work, and it will be a long time before major improvements can be made. However, by separating the effects of ELS and MDD, clinicians may be able to treat these groups based on their specific behavioral and neurobiological needs.

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Getting to know: *Marc Weintraub*

Biography

Marc Weintraub graduated from UC Berkeley in 2010, majoring in Psychology and Social Welfare. After graduating from Berkeley, he worked at UCLA's Semel Institute under Dr. Miklowitz. In this lab, he was engaged in a few psychological intervention research projects, including family focused therapy for children at-risk for bipolar disorder and a mindfulness-based cognitive therapy for perinatal women with mood disorders. He is now starting his first year of graduate school at the University of Miami where he will be working towards his PhD in Clinical Psychology. The research he is currently doing in Miami involves a family focused therapy for patients with schizophrenia. He hopes to synthesis his current research with his past experience with mindfulness, and create an intervention for patients with schizophrenia using a family-focused mindfulness model.



Q&A

What sparked your interest in psychology?

My interest in psychology was first sparked by my interest in the social world in which we live. We are fundamentally social creatures, and those social interactions and systems are critical for our survival and success. Learning more about how we engage with other people was (and still is) a fascinating subject to me. Also, the mysteries of the brain is a topic that drew me to psychology. The brain is a frontier of research that has so much room for exploration, and is an organ that is immensely interesting to me.

What led you to this topic?

I was led to my honors thesis topic by merging two main psychology interests—social systems and mood disorders. While the brain can do so many amazingly wonderful things for us, it can also lead us astray. Psychological disorders are a clear example of this, and I wanted to study how we can help reduce or eliminate the impairments that mental disorders often create. Combining my interests in social and clinical psychology, I studied how romantic partners of people with bipolar disorder can help their significant other, and, also, help themselves stay happy in their relationship.

Did you have a mentor and how did you get involved with them?

My mentor for my thesis was Dr. Dacher Keltner. I first started volunteering in his lab, and after a year of coding couples, laughter, and prosocial emotions, I decided to further my research experience and look into conducting an honors thesis. After consulting with some graduate students (Alex Kogan and Amie Gordon) and Dacher Keltner, we came up with a topic and a hypothesis. From there, the research process took its course.

How long have you been working on this paper? What has the process been like for you?

I've been working on this project for about 1-1.5 years. The process of compiling the data, analyzing the data, and writing up the report was about an 8 month process. Then, the editing and publishing process took another 4 or 6 months.

What advice do you have for students who would like to publish in the future?

For future or potential thesis-writers, I'd recommend a nice dose of patience and a general expectation that something will go awry. Don't let those long days/nights throw you off course. Writing a thesis is a great experience, and will give you a lot of insight into the world of research. I'm glad that I decided to write a thesis, and certainly encourage others to give it a go.

Prosocial Personality and Cognitive Buffers for Partners of Manic Individuals

Marc Weintraub

University of California, Berkeley

An extensive amount of research examines the ill effects of bipolar disorder for romantic relationships (e.g. Miklowitz & Johnson, 2009; Lam, Donaldson, Brown, & Malliaris, 2005), but little research has examined whether there are some people who can better cope with their partners who suffer from bipolar disorder, especially during the manic phase of the disorder. This paper attempts to fill that gap by examining how romantic partners of individuals higher in manic symptoms (measured with the ASRM; Altman, Hedeker, Pederson, & Davis, 1997) can experience greater satisfaction with their relationships. Specifically, this study investigates whether people who are higher in agreeableness and reappraisal tendencies report less declines in relationship satisfaction as well as engage in greater behavioral indicators of relationship quality—namely, touch and laughter—relative to people lower in these traits. Results from sixty-three couples in romantic relationships provide initial evidence that agreeableness and the tendency to reappraise are indeed important traits that help romantic partners of individuals with mania experience greater satisfaction and engage in more touch and laughter behaviors in comparison to partners lower in these tendencies. These findings suggest the dispositional and cognitive buffers that can safeguard against the ill effects of a partner with manic symptoms and demonstrate the importance of prosocial research in understanding manic and bipolar relationships.

Romantic relationships are one of the most important social connections that we make in our lives; however, maintaining these relationships is not easy. When a couple is faced with a partner's psychological disorder, relationship stress can be exacerbated. In the case of bipolar disorder, researchers have discovered that a romantic partner suffering from a manic episode often creates increased financial, emotional, and social problems for the relationship (e.g. Hunt, 2004; Steele, Maruyama, & Galynker, 2010; Lam et al., 2005).

This paper focuses on mania, which is typically researched within the context of bipolar disorder—a disorder that includes episodes of both mania and depression. The symptoms of a manic episode in the Diagnostic and Statistical Manual (IV-TR) include elevated or irritable mood. Additional symptoms include increases in goal-directed activity or physical restlessness, unusual talkativeness or rapid speech, flight of ideas, decreased need for sleep, inflated self-esteem, distractibility, and excessive involvement in pleasurable activities. These symptoms can vary from a euphoric mental state to an irritable and aggressive state (Moreno & Andrade, 2010). While a manic episode can become stressful for many people around the manic individual, a reduced need for sleep and an inflated self-esteem can make the individual with mania feel elated and confident (Braun, Daigneault, Gaudet & Guimond, 2008).

Mania and Intimate Relationships

Currently, little research explores the role mania may play in romantic relationships. Most of the literature regarding bipolar disorder views the disorder in its entirety, and fails to distinguish depression from

mania in the examination of its subjects, leaving the diametrically different effects the two poles of bipolar disorder (i.e. depression and mania) have on bipolar individuals unaddressed (e.g. Rosa et al., 2008). This means of investigating bipolar disorder provides an unclear understanding of the specific aspects of the experiments' results that can be attributed to the particular symptoms of bipolar disorder. For example, the literature cited in this paper has only examined patients with bipolar I disorder, a condition characterized by one or more manic episodes, and possibly one or more depressive episodes. Consequently, the results of many studies investigating the effects of bipolar disorder on relationships include findings that may be attributable to mania or depression, or both. While investigating bipolar disorder in its entirety certainly has its strengths, exploring the nuances of the disorder can greatly expand the current literature by providing more specific insight into the particular workings of each distinct episode. Due to the fact that mania is considerably understudied, the present study seeks to understand whether certain characteristics can help those in relationships with partners who suffer from mania better cope with their manic partners. Specifically, the present study examines whether prosocial tendencies can buffer partners of individuals who suffer from mania against experiencing decreased relationship quality.

The current literature on bipolar I disorder notes that there is added stress in relationships with manic people (Hunt, 2004), but some partners of individuals who suffer from mania may have traits or coping mechanisms that may potentially shield them from the stresses of manic symptoms. Financial issues, for example, are major concerns that are closely connected to bipolar disorder (Rosa et al., 2008) and influence

satisfaction in romantic relationships. Across studies, researchers have found that people experiencing manic episodes often have unwise spending patterns and increased desire to partake in pleasurable activities such as drug use (Kulkarni et al., 2008), behaviors that create financial and emotional difficulties for families (Lam et al., 2005; Rosa et al., 2008). Although an individual experiencing a manic episode may view the mania as pleasurable, the negative effects of the disorder are detrimental to both the diagnosed individuals and the people around them (Moreno & Andrade, 2010). Mania puts an emotional strain on romantic relationships; one study found that a little over 50% of spouses tend to feel overwhelmed with their bipolar partners, and 65% felt miserable and conflicted about staying with their partner (Lam et al., 2005). The emotional toll becomes so taxing that about 53% of spouses said they would have not married had they known beforehand of their partner's illness (Targum, Dibble, Davenport & Gershon, 1981). In light of the difficulties of mania, some studies have started to examine methods that can help couples cope with bipolar episodes. These practices include better communication, problem solving, and decreased expressed emotion, a variable that is measured by criticism and hostility (Miklowitz & Johnson, 2009). Therapists attempt to teach these beneficial strategies to the individuals, couples, and families. While these therapies have been found to be rather successful, they still are in their beginning stages.

The difficulties confronting couples in which one partner experiences manic episodes are detrimental to the health of such relationships. The present study focuses on whether certain dispositional and cognitive tendencies of the non-manic partners can help buffer the non-manic against decreased satisfaction in a relationship with a partner who suffers from mania.

Can a Partner's Prosocial Orientation be a Buffer?

To examine the prosocial behaviors of individuals who rate higher on manic symptoms, positive psychology was applied in the present study. This positive psychology framework focuses on factors that contribute to an individual's health, happiness, and ability to cope with life circumstances (Gillham & Seligman, 1999). In the context of this study, positive psychology pertains to the prosocial, internal and external characteristics that help individuals experience greater levels of relationship satisfaction (i.e. increased levels of agreeableness and reappraisal, described below). Specifically, the question of whether certain individual personality differences and cognitive responses can help buffer people against the ill effects of a partner who suffers from mania is examined. Since some potentially problematic behaviors of partners who suffer from mania are related to the non-manic partner's inability to sympathize with their partners (a dispositional component; Lam et al., 2005) and control their own emotions (a cognitive component; Miklowitz & Johnson, 2009). This paper will examine both prosocial dispositions and prosocial

cognitive tendencies that may assist couples in better coping with partners who suffer from mania. The present study examines whether being more agreeable (John, Donahue, & Kentle, 1991) and having a stronger tendency to reappraise emotional situations (Gross & John, 2003) help people better cope with partners who suffer from mania, relative to people who are less agreeable and engage in less reappraising.

The first point of examination, agreeableness, refers to prosocial traits such as compassion, kindness, and sympathy (John et al., 1991). Research has shown that for most couples, those who are more agreeable tend to be more accommodating of their partner, especially during stressful times (Perunovic & Holmes, 2008). Furthermore, higher levels of agreeableness predict more commitment and willingness to deal with problems in a relationship (Urbaniak & Kilmann, 2006). Overall, this prosocial disposition seems to make the individual more flexible, understanding, and proficient in resolving problems. Thus, it is hypothesized that people who are more agreeable will be less adversely affected in relationships with partners who are higher in manic symptoms than those who are less agreeable.

The present study's hypothesis is that people who have a greater tendency to reappraise, meaning that they tend to mentally move away from the issue at hand and think through a problem during times of stress (Gross & John, 2003), will experience fewer negative effects in relationships with manic partners than those who reappraise less. Partners of individuals higher in manic symptoms may experience more stressors and negative situations than people whose partners have less or not mania (Hoover & Fitzgerald, 1981). For example, the non-manic partner may be dealing with a partner who is engaged in several difficult behaviors, such as increased irritability, a lower libido, substance use, and frivolous money spending (e.g., Moreno & Andrade, 2010; Lam et al., 2010; Kulkarni et al., 2008). Those who are able to deal with these situations by reappraising their partner's negative behaviors and emotions may be better equipped to cope and interact with a partner who has mania (e.g. by re-evaluating the situation before reacting) than those who do not have such tendencies. In this way, reappraising will benefit both partners and can be seen as a prosocial tendency that can counteract the stress of manic relationships. In sum, the present study hypothesizes that people who are more agreeable and who reappraise more experience higher quality relationships with manic partners than individuals who are less agreeable and reappraise less.

Using data from 63 couples, the present study examined whether people who had greater prosocial tendencies were better able to cope with partners with mania. That is, the present study tested whether people in relationships with partners who are more manic, more agreeable, and had a greater tendency to reappraise were more satisfied with their manic partners,

compared to those who were less agreeable and reappraised less. The present study also examined whether people in relationships with partners who rated higher in mania, touched and laughed more during their interactions were more satisfied with their relationship, relative to people who touched and laughed less.

The present study extended prior findings in three important ways. First, prior research has focused on the broad spectrum of bipolar disorder, whereas the present study focused only on mania, allowing the specific episode of mania to be an isolated and uniquely educational piece to learn from (i.e., higher levels of cheerfulness, talkativeness, sleepiness, activeness, and self-confidence). Second, researchers have previously focused on ways in which manic symptoms negatively impact relationships while this study examined the pro-social ways in which people with partners with mania can make the relationship more satisfying (i.e., through agreeableness and reappraisal). Finally, previous research on the role of mania in romantic relationships (which primarily focused on self-reported relationship quality) is extended by including behavioral indices of relationship quality—namely touch and laughter.

Method

Participants

Sixty-three heterosexual couples in romantic relationships were recruited from the San Francisco Bay Area using advertisements on Craigslist.org and paper flyers. The participants comprised a diverse range of ethnic backgrounds in which 52% were European or European-American, 20% were Chinese or Chinese-American, 8% were African or African-American, 5% were Mexican or Mexican-American, and 15% were of other races/ethnicities. The mean age among participants was 28 years ($SD = 6.7$; Range = 18 - 60). On average, the couples had been in their relationships for a little over two years ($SD = 24.4$; Range = 2 months to almost 8 years) and about half (48%) were cohabiting.

Procedure

After both partners had agreed to participate in the study, each partner was sent a link to a secure website where he or she completed demographics as well as questions assessing his or her personality and relationship quality, including measures of manic symptoms, agreeableness, reappraisal tendencies, and relationship satisfaction. The couples then arrived at the lab and participated in several videotaped interactions. The couples discussed three different topics, with each being the “speaker” and the “listener” for a total of six conversations. Each partner was asked to think of a time when they had made a sacrifice for their partner, a time during which they had felt a lot of love for their partner, and a time when they had experienced a great deal of suffering. These three conversation topics, each ranging from 51 seconds to 8 minutes 22 seconds with a mean conversation time of 3 minutes 37 seconds ($SD = 1$ minute, 10 seconds), were chosen to evoke

emotional sentiments from both partners, with the intent of fostering behavioral responses (such as touching and laughing). The order of speaking was decided randomly by randomly flipping a coin. Each person was paid \$30 dollars as compensation for participating in the laboratory portion of the study.

Within the laboratory setting, each partner was seated in a chair that was facing the other partner, allowing the couples the opportunity to touch each other. There were two small cameras mounted on the wall about 6 feet above the ground. Each camera was angled directly in front of the respective participant, allowing for a full frontal recording. The cameras were visible to the participants and captured images from the top of their heads to their laps. Research assistants controlled the cameras from an adjacent room where they could hear the conversations and communicate to the participants through an intercom.

Background Measures

Mania. Mania was measured using the Altman Self-Report Mania Scale (ASRM; Altman, Hedeker, Pederson, & Davis, 1997), a self-report inventory with five items. This scale exhibited good reliability, $\alpha = .79$, and scale items rated the severity of the following five symptoms within the past week: cheerfulness (“I feel happier and more cheerful than usual”), inflated self-confidence (“I feel more self-confident than usual”), sleepiness (“I can go all day or night without any sleep and still not feel tired”), talkativeness (I talk constantly and cannot be interrupted”), and excessive activity level (“I am constantly active or on the go all the time”). The items were measured on a 5-point scale that assessed the level of the symptoms. For example, cheerfulness scores ranged from 0 (I do not feel more cheerful than usual) to 4 (I feel much more cheerful than usual). The five items are summed to create a composite score that can range from 0 (not at all manic) to 20 (most severe manic symptoms). The ASRM is highly correlated with both clinical interviews and self-report levels of mania (Altman, Hedeker, Pederson, & Davis, 2001).

Agreeableness. Agreeableness was measured with the Agreeableness subscale of the Big Five Inventory (BFI; John et al., 1991), and, in this sample, it was highly reliable with an $\alpha = .77$. This subscale includes nine items such as “I sympathize with other’s feelings” and “I make people feel at ease.” The items were measured on a 5-point Likert Scale and ranged from 0 (strongly disagree) to 4 (strongly agree).

Reappraisal. Reappraisal was measured using the Emotion Regulation Questionnaire, (ERG; Gross & John, 2003), and the scale was highly reliable, with an $\alpha = .83$. The ERG measures reappraisal with six items that assess overall reappraisal tendencies (e.g. “I control my emotions by changing the way I think about the situation I’m in”), as well as reappraisal in both positive (e.g. “when I want to feel more positive emotion, I change the way I’m thinking about the sit-

uation”), and negative (e.g. “when I want to feel less negative emotion, I change the way I’m thinking about the situation”) situations. Reappraisal was measured on a 5-point Likert Scale, and ranged from 0 (strongly disagree) to 4 (strongly agree).

Relationship satisfaction. Relationship satisfaction was measured with the full questionnaire from Rusbult, Martz, & Agnew, which includes five items such as “I feel satisfied with our relationship” (1998). Satisfaction was measured on a 7-point Likert Scale and ranged from 0 (strongly disagree) to 6 (strongly agree). In this study, $\alpha = .89$.

Measuring Relationship Quality

Relationship satisfaction is a global measure of how people feel about their relationship (i.e., how satisfied they feel with their partner and their relationship at the present time; Rusbult, Martz, & Agnew, 1998) and has been associated with long-term relationship outcomes (Wieselquist, Rusbult, Foster, & Agnew, 1999). In this research, the present study examined both self-reports and behavioral indicators of relationship quality. The present study investigated whether prosocial tendencies of people with partners with mania influenced their self-reported relationship satisfaction, as well as their frequency of touch and laughter during interactions with their partners.

Touch and laughter are two behaviors that are closely linked with relationship quality. Touch has been found to play an important role in interpersonal relationships, and Montagu goes so far as to say that “touch and love are indivisible” (1971). A study examining stress found that cortisol levels and heart rates were lower as a result of being touched by one’s partner (Ditzen et al., 2007). Further, an individual’s reactivity to stress is reduced by the touch of one’s partner, while increases in the levels of oxytocin (the “pair bonding hormone”) have been found after couples hug (Whitcher & Fisher, 1979; Light, Grewen & Amico, 2005). The benefits of touch seem to be universal, especially within romantic relationships, and touch is correlated with greater relationship satisfaction (Gulledge, Gulledge, & Stahmann, 2003).

Laughter is another important indicator of relationship quality. Dinkmeyer and Carlson (1984) explain that the reason humor is so important in relationships is that it strengthens positive emotions and promotes a creative way for couples to bond and work together. In fact, one of the best ways to index marital happiness is through laughter (Farley, 1979). In addition, humor has been found to be a necessary component for long-term relationships, and is one of the two major characteristics of happily married older couples (Bluennfeld & Alpern, 1986; Carstensen, Gottman, & Levenson, 1995). Taken together, these two distinct measures of relationship quality help fully capture the influence of people’s prosocial tendencies when dealing with partners with mania.

Observer Ratings of Touch and Laughter

Fourteen of the 63 couples could not be included in the behavioral analyses because of audio malfunctions during the interactions, leaving 49 couples with coded touch and laughter data.

Touch Frequency. Two independent coders rated how frequently each person touched his or her partner during each conversation. The three conversations were broken down into five-second intervals and the coders rated whether or not (1) a touch had occurred during each increment. Coders had good reliability, with only 4% disagreement with regards to overall touching. For each partner, the total amount of touches was created by summing the number of times a touch had occurred across all 6 conversations.

Laugh Frequency. Two independent coders reviewed the videotapes and noted whenever a laugh occurred during each conversation by marking down the start time. A third coder then reviewed each start time that was marked by only one of the two original coders. The third coder made the final decision as to whether or not the participant in the video laughed at those noted times. This procedure ensured that two coders agreed upon the laughs identified before they were finalized as laughs. Coders were instructed to look for laughter sounds, exhalations, smiles, and body shakes. For each partner, laughter was the sum of the number of laughs for each partner in each of the 6 conversations.

Results

To interpret the results, the data were analyzed using mixed models in PASW 18.0. Since this study included both members of dating couples and violated assumptions of independence, mixed models analysis was necessary as it treats the dyad rather than the individual as the unit of analysis. In addition, the present study used the Actor-Partner Interdependence Model (APIM; Kenny, Kashy & Cook, 2006) to analyze the data. This model assesses the interdependence that exists between members of a couple by taking into account both actor effects and partner effects. For example, an actor effect of mania on relationship satisfaction would examine whether one’s own manic symptoms influence one’s own relationship satisfaction while controlling for one’s partner’s manic symptoms. A partner

Table 1
Actor and Partner Mania Predicting Relationship Quality

Actor’s...	Actor Mania	Partner Mania
<u>Self-Report Measure</u> Satisfaction	.11	.03
<u>Observation in Lab</u> Touch	.10	.21*
Laughter	.04	.01

Note: * = $p < .05$

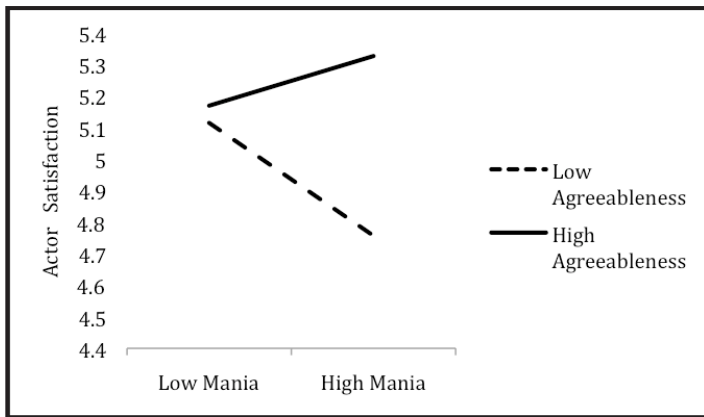


Figure 1. Actor's Agreeableness Moderates the Association between Partner Mania and Actor Satisfaction

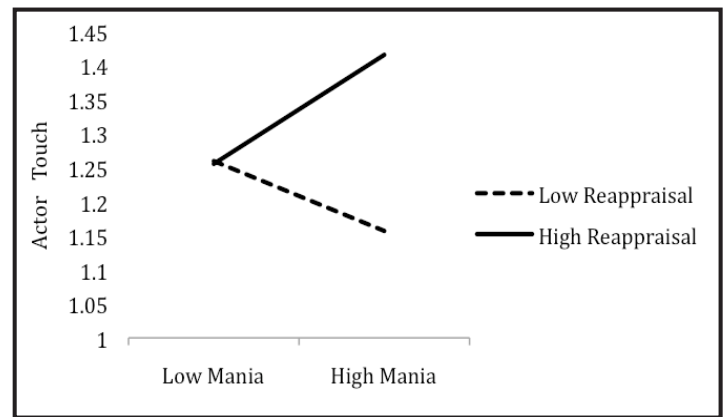


Figure 3. Actor's Reappraisal Moderates the Association between Partner Mania and Actor Touch (marginal significance)

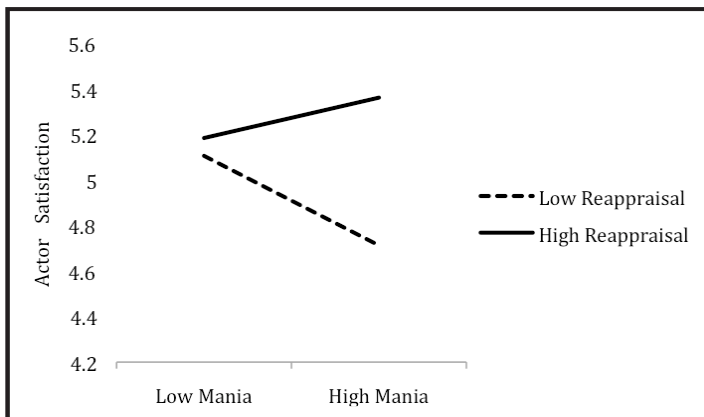


Figure 2. Actor's Reappraisal Moderates the Association between Partner Mania and Actor Satisfaction

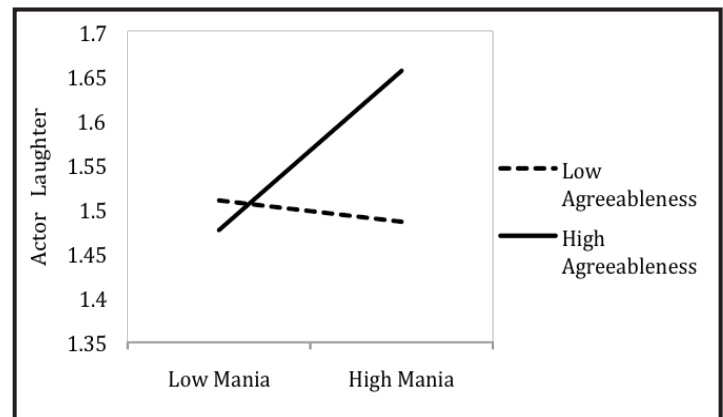


Figure 4. Actor's Agreeableness Moderates the Association between Partner Mania and Actor Laughter

effect of mania on relationship satisfaction would examine whether one's partner's manic symptoms influence one's own relationship satisfaction while controlling for one's own manic symptoms.

Overall, the average score for mania was 5.67 (SD=4.08) and scores ranged from 0 to 18 (out of 20). Men and women did not differ significantly in their levels of manic symptoms (Men's $M = 6.10$, Women's $M = 5.25$), $t(124) = 1.16$, ns. There was also no significant correlation between partners' mania, $r = .11$, ns.

The present study also examined whether people who were more manic, or who had partners who were more manic, were less satisfied and if they touched and laughed less with their partner (Table 1). The only significant finding reveals that people with partners who exhibit more manic symptoms touched their partners more than people with less manic partners.

The present study examined whether this lack of association between one partner's mania and the other person's relationship quality could be due to the fact that people's prosocial tendencies moderate this association. For each of these analyses, relationship quality was regressed (measured as satisfaction, touch or laughter) onto standardized actor agreeableness (reappraisal), standardized partner mania, and their interaction term.

Relationship Satisfaction

First, it was assessed whether people who were more agreeable and/or reappraised more reported feeling greater satisfaction levels in their relationships with partners who displayed more manic symptoms, relative to people who were less agreeable and reappraised. In other words, for people who were less agreeable and reappraised less it was hypothesized that relationship satisfaction would decline as partner mania increased. However, the hypothesis also stated that people who were more agreeable and reappraised more should not experience this same decline in satisfaction. There was a main effect for agreeableness such that people who were more agreeable were more satisfied in their relationships, $B = .16$, $p < .05$. However, as predicted, this effect is qualified by the predicted interaction between actor agreeableness and partner mania, $B = .13$, $p < .05$. This interaction suggests that for people who are less agreeable (i.e., 1 SD below the mean) the more manic their partners were, the less satisfied they were with their relationships (Figure 1). In contrast, when people were higher in agreeableness (i.e., 1 SD above the mean), partners' mania was not associated with a decline in satisfaction. Specifically looking at people whose partners were higher in manic symptoms, the more agreeable the people were, the more satisfied they

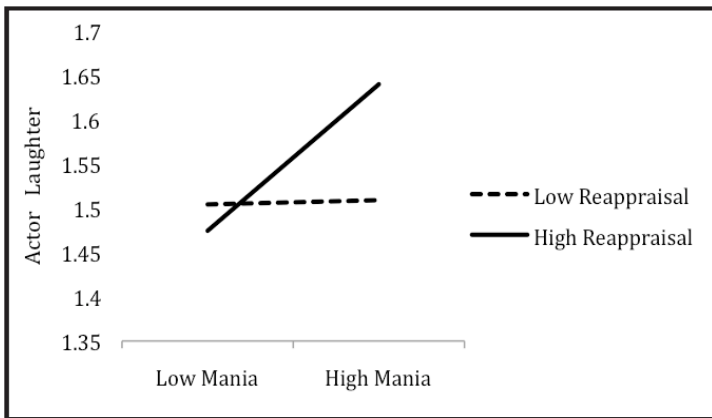


Figure 5. *Actor's Reappraisal Moderates the Association between Partner Mania and Actor's Laughter*

were with their relationships.

A similar pattern was shown for people's tendency to reappraise. People who were more likely to reappraise were more satisfied with their relationships than those who reappraised less, $B = .18$, $p < .01$. This effect was qualified by a significant interaction between actor reappraisal and partner mania ($B = .14$, $p < .05$; shown in Figure 2), which suggested that for people with a lower tendency to reappraise, satisfaction declined as the degree of their partner's manic symptoms increased. In contrast, for those with a higher tendency to reappraise, partner mania was not associated with a decline in satisfaction. In other words, for individuals in relationships with partners who have more mania, a greater tendency to reappraise was associated with greater relationship satisfaction relative to people who were less likely to reappraise.

Behavioral Indicators of Relationship Quality

Both touch and laughter scores indicate a strong positive skew, therefore prior to analysis, these variables were transformed using a log transformation.

Frequency of Touch.

A comparable pattern was shown for people's tendency to touch, as was found in the cases of reappraisal and agreeableness. Individuals who reappraised more were more likely to touch their partners than those who reappraised less, $B = .21$, $p < .05$. This effect was qualified by a marginally significant interaction between actor reappraisal and partner mania ($B = .07$, $p = .07$; shown in Figure 3), suggesting that for people in romantic relationships with more manic partners, a greater tendency to reappraise was associated with more touch. The results for agreeableness moderating the association between actor touch and partner mania were not significant; however, the values did trend in a similar direction as reappraisal.

Frequency of Laughter.

As predicted, there was a significant interaction between actor agreeableness and partner mania, ($B = .05$,

$p < .05$; shown in Figure 4), suggesting that for people in relationships with more manic partners, more agreeable disposition is associated with more laughter. Similarly, a significant interaction exists between actor reappraisal and partner mania ($B = .04$, $p < .05$, shown in Figure 5). This interaction suggests that for people in relationships with more manic partners, a greater tendency to reappraise was associated with more frequent laughter as they interacted with their partners. That is, when examining these more objective indicators of relationship quality, we still find the same buffering effects for people who are more agreeable and reappraise more.

Discussion

Findings from the present study support the original hypothesis and show that for people who are romantically involved with individuals possessing manic symptoms, being higher in agreeableness and having a greater tendency to reappraise functions as a buffer against the potentially negative effects of manic symptoms on relationships. In particular, these people report feeling more satisfied and actually engage in more touch and laughter as they converse with their partners. That is, being sympathetic, compassionate, and deeply caring for one's partner (agreeableness) and having the cognitive inclination to reconfigure one's attitudes and emotions during times of stress seem to be invaluable for these potentially problematic relationships. Together, these results provide initial evidence that people who have more prosocial tendencies (in this case, are more agreeable and reappraise more) are more satisfied in their relationships with partners who exhibit more manic symptoms, relative to people who possess less prosocial tendencies.

Implications

These results illustrate that people with higher levels of agreeableness, reappraisal, touch, and laughter can better cope with partners with mania. The undesirable effects of mania shown in previous literature (e.g. Lam et al., 2005; Hunt, 2004; Kulkarni et al., 2008) may only be applicable to certain people, as this research shows that mania's stresses can be moderated. In fact, it appears that there is potential for greater happiness in dealing with manic symptoms within romantic relationships. People who are more agreeable and reappraise more seem to do well in these relationships, since their relationship satisfaction and frequency of touch and laughter are greater than for those who are less agreeable and reappraise less. On the other hand, those who do not have these prosocial tendencies seem to struggle with partners who display more mania as their relationship satisfaction, touch, and laughter decrease. Furthermore, the behaviors of touch and laughter provide insight about the actions that people who are more agreeable and reappraise more engage in. People who are more agreeable and reappraise more engage in greater behavioral indicators of relationship

quality when they have partners who are higher in manic symptoms. Rather than ignoring or exacerbating their partner's stress, individuals with more prosocial tendencies are able to connect with their partners through increased touch and laughter. This reveals that engaging in these prosocial tendencies are very important when dating a partner with manic symptoms, and are linked to experiencing a more rewarding relationship. An interesting aside, however, is the data from the present study that seem to suggest that for individuals who are not romantically involved with manic partners, these prosocial tendencies have a lesser effect on relationship quality. As displayed in the interaction figures, cognitive reappraisal and agreeableness are correlated with virtually identical levels of relationship satisfaction. However, as one's partner's manic symptoms increase, the prosocial tendencies seem to really play a role in relationship satisfaction and cause the non-manic partner to become more satisfied with their partner who exhibits manic symptoms. With this aside, these findings have implications both for our understanding of manic relationships, and when prosocial tendencies influence relationship quality.

In the present study, sub-clinical mania was examined in an effort to reveal the nuances of less severe levels of mania, and to shed light on trends that pertain to the entirety of the manic spectrum. Although the participants in the present study were not clinically diagnosed with mania, the present research shows that the sub-clinical levels of mania still affect the quality of romantic relationships. While the DSM creates rigid and defining criteria for disorders, such rigid criteria may not be equally applied to individuals across situations. In the case of this research, there is a full range of severity within the manic spectrum, and the same may be true for other mood disorders as well as any other psychological disorder. Therefore, these findings reveal the importance of studying the entire spectrum of a disorder. By examining all levels of disorders, a more complete picture of disorders can be captured, and studying different angles of the same disorder can help triangulate the specific aspects of the pathology. Being below the threshold of a clinical diagnosis does not mean that there are no ill effects on people's relationships, and, clearly, studying this population can provide insightful information.

Additionally, these findings could be useful for therapeutic settings. Although it is clear that the findings here are correlative, they still may be important for therapists in understanding that a correlation between high reappraisal and increased relationship satisfaction with a partner who exhibits manic symptoms does exist. Since reappraisal is a cognitive process and is thus a partly acquired behavior, individuals can possibly learn to reappraise, and thereby be better equipped to handle the possible negative outcomes of manic behavior. If a couple face problems stemming from having a partner with mania, the non-manic partner can be taught to take a step back during stressful situations, calm them-

selves down, and reappraise the situation, rather than reacting immediately or suppressing their emotions. This way, individuals with romantic partners who display manic symptoms can alter the way in which they assess situations with their partners and potentially benefit from this new perspective (just as Beck (1967) and Seligman (1967) have proposed with their cognitive models for other mood disorders).

Limitations and Future Directions

Although this study has important implications, it also has several limitations. One of the limitations of the study is concerned with the assessment of mania. The Altman Self-Rating Mania scale has been found to have external clinical validity (Altman et al., 2001), but this study examined a population that was sub-clinical. This sample gave us key information about a largely unstudied population, making it more difficult to generalize the results to people experiencing clinical mania. A future study may aim to replicate these findings in a clinical sample, thereby adding to this new body of knowledge.

As noted previously, the findings from this study suggest that even sub-clinical levels of mania have important implications for relationship quality. People are not just manic or not manic. While there are boundaries between clinical and sub-clinical populations, the problems do not just surface once the boundary is crossed. Thus, future research should work not just with clinical mania but also with people experiencing less severe manic symptoms and examine their experiences with the world and their interpersonal relationships. Additionally, it is very important to understand the manic spectrum at its various levels of severity, rather than just looking at the on/off, clinical/non-clinical distinction. This perspective gives credence to examining sub-clinical populations and should be further pursued in connection with clinical research. The DSM has strict guidelines for what falls into a diagnosis, which inevitably excludes people who may be slightly sub-threshold of the disorder. Mapping the full spectrums of various disorders will be a more comprehensive means of ensuring that the conclusions based on clinical groups are related to those drawn from sub-clinical populations.

Another limitation is the correlational nature of this study. Without conducting an experiment where we assign people to be agreeable and reappraise in varying degrees, we cannot assert whether these prosocial tendencies actually bring about the buffering effect discussed in the paper. Although it could be difficult to manipulate trait variables such as agreeableness, there are examples of previous research that has successfully manipulated reappraisal tendencies (Richards & Gross, 2000). Future research should, therefore, look at the most efficacious way to manipulate reappraisal. This would help clinicians to train their clients on how best to adjust to the potential difficulties of relationships with manic partners. Researchers could also look

at whether manipulating other aspects of prosociality (e.g., being more compassionate) produces the same beneficial effects. These studies would be a crucial first step in creating interventions.

Finally, the full bipolar disorder should be studied to discover if these same prosocial tendencies aid those with a depressed loved one or if there are other prosocial traits that better address the problems of depression. Agreeableness and reappraisal, while potentially not very useful for all relationships (as this study's data show), are extremely helpful in manic relationships, and it would be logical for this trend to follow a similar pattern for relationships involving a individual with depression. Additionally, these and other potential prosocial tendencies should be examined in the context of other disorders, for they are likely to make a beneficial impact.

Even with the limitations of this study, the findings are compelling and shed light upon the importance of prosocial tendencies, especially when faced with serious stressors such as having a partner with mania. Not everyone suffers equally from the stress of a manic relationship, as there are some who seem to handle these relationships better than others. This research highlights several individual differences that seem to help people better cope with their partners who exhibit mania symptoms, thus underscoring the potential benefits of being more agreeable and having a greater tendency to reappraise.

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Getting to know: Alexa Fishman

Biography

Alexa Fishman is a junior at Harvard University majoring in Psychology. She is fascinated by self-presentation and team dynamics, specifically with regard to organizational behavior. Currently, Alexa is a research assistant in J. Richard Hackman's Social and Organizational Psychology Laboratory. When not in the lab, Alexa enjoys fencing on Harvard's Varsity Fencing Team and singing the Radcliffe Choral Society. Alexa would like to thank Sarah Hope Lincoln for her help preparing this manuscript, as well as Professor J. Richard Hackman, Sujin Jang, and Lisa Kwan for supporting her research endeavors.



Q&A

What sparked your interest in psychology?

I have always been interested in why people do what they do. My parents are both physicians, and having learned from their example I knew that I wanted my field of study to allow me to help others and humanity at large. Psychology has both satisfied my curiosity about people and given me an academic field through which I can improve others' quality of life.

What led you to this topic?

I have been a competitive fencer since the 7th grade, and I am a member of the Harvard Varsity Fencing Team. Thus, balancing my aspirations as an athlete and my aspirations as a scholar has been an integral part of my life. I wanted to investigate the topic of student athlete stereotype threat because it is so relevant to me.

Did you have a mentor and how did you get involved with them?

I have two mentors. My first mentor is Professor J. Richard Hackman. I took a class on the Social Psychology of Organizations with him my sophomore fall and fell in love with this subset of the field. He is an amazing scholar and inspires me to think creatively about how to investigate psychological research questions. My other mentor is Sujin Jang, who I met through working in the Hackman lab. I have worked with her one-on-one for the past year, and through this experience I have learned what it means to be an experimental psychologist -- to constantly be tweaking my experiment, to deal with disappointment, and to celebrate triumph. I owe so much to them both.

How long have you been working on this paper? What has the process been like for you?

I have been working on this paper since the spring of my sophomore year (2010). I wrote a draft of this paper for my Sophomore Tutorial. Revising this work further through the process of submitting it to this journal has been a very rewarding experience, for it has given me a taste of the process I may use in the future.

What was it like to be an undergraduate student completing your own research project?

This paper fits with my future aspirations in that I hope to use this publication experience to help me as I write my senior thesis. Moreover, I hope to use what I have learned through writing this paper to aid my own performance as a student athlete and that of my teammates.

I'm Game On and Off the Court: *Mitigating Stereotype Threat in Student Athletes*

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Steele and Aronson (1995) initially developed the concept of stereotype threat as an alternative explanation for racial and gender minorities' poor academic performance. Today, however, their work serves as a pioneer study on stereotype threat in demographic groups in many domains. Although student athletes are stigmatized because of an activity in which they participate rather than an innate trait, the effects they experience parallel those endured by the demographic groups that predominate stereotype threat literature. Student athletes experience stereotype threat in a cognitive domain, just as African Americans in the academic domain, women in the quantitative domain, and Asians in the verbal domain. However, research in the area of intervention techniques to alleviate stereotype threat in student athletes has thus far been limited. Studies on stereotype threat in student athletes suggest that intervention techniques used to mitigate more traditional cases of stereotype threat would succeed in this population as well. Adapting the intervention techniques known to work in these groups thus appears to be a viable solution to stereotype threat in student athletes.

Stereotypes are meant to help humans categorize others more efficiently. However, since such categorization is often misguided, victims of this phenomenon experience stereotype threat. They want to avoid personal identification with the negative characteristics of their group (Steele, 1997). Student athletes, who are often positively stereotyped as the most popular figures on college campuses, are negative stereotyped by their peers in the academic domain and thus experience stereotype threat (Harrison et al., 2009; Yopyk & Prentice, 2005). Because the application of stereotype threat to the student athlete population occurred recently, starting in the early 2000s compared to its application to demographic minorities since the 1990s. Thus, little information exists regarding how to reduce stereotype threat in this group. Stereotype threat seems to affect student athletes much like it affects other previously researched groups. Therefore, adapting the methods used to reduce stereotype threat in these groups should successfully mitigate the negative effects of stereotype threat experienced by student athletes.

What is Stereotype Threat?

The term "stereotype threat" refers to the social-psychological predicament first proposed and described by Steele and Aronson (1995). A stereotype is a widely believed yet often misleading notion of a particular type of person that categorizes groups of people based upon visible differences. When one risks confirming that a negative stereotype about one's group applies to oneself, the stereotype can become threatening (Steele & Aronson, 1995). Individuals experience stereotype threat when they fear validating the negative stereotype and having it define how others perceive them (Steele, 1997).

People only experience stereotype threat under certain conditions (Steele & Aronson, 1995). First, stigmatized individuals only experience stereotype threat when engaged in activities in a domain in which they

are negatively stereotyped. For example, women are often negatively stereotyped in mathematics, but they will only experience this stereotype threat when engaged in a task in the mathematics domain. Additionally, individuals experience stereotype threat when the negative stereotype becomes relevant to their self-definition. They want to avoid inadvertently characterizing themselves or having others characterize them according to this negative stereotype. Finally, for the negative stereotype to threaten an individual's sense of self, he or she must identify psychologically with the domain in question because his or her self-concept hinges on performance in the domain. The individual's ability to maintain a positive self-concept depends on the situation in which he or she is placed so the negative stereotype is self-threatening.

As mentioned in the second condition listed above, stereotype threat can also cause disidentification with the threatening domain, which can negatively affect performance. Stigmatized individuals may redefine their self-concept so that the stereotype-threatening domain no longer serves a basis for self-evaluation or personal identity. However, this method of escaping the threat simultaneously decreases interest and motivation in the domain, resulting in worsened achievement.

Mechanisms of Stereotype Threat

Steele's 1997 paper, one of the earliest accounts of stereotype threat, proposed stereotype threat as a "different diagnosis" for the achievement gaps experienced by minorities (p. 624). This explanation refuted previous assumptions that minority students achieve less due to dispositional qualities. The stressful situation characteristic of stereotype threat manifests itself physiologically as an anxiety response. Schmader, Johns, and Forbes' (2008) Integrated Process Model of Stereotype Threat Effects on Performance summarizes the major mechanisms that work in tandem to create the debilitating ef-

fects of stereotype threat. According to this model, the elements of stereotype threat that impair performance are threefold. First, stereotype threat induces a physiological stress response in the stigmatized individual that interrupts the processing of the prefrontal cortex. This disrupts the coordination of actions with goals. Additionally, the propensity to scrutinize performance while engaging in an action siphons attention away from the task at hand. Finally, stigmatized individuals under threat tend to stifle their negative thoughts and anxious emotions. They suppress these negative feelings and deny their experience of threat in the hopes of avoiding its negative effects.

Through their interactions with one another, these processes strain the executive resource utilized to succeed on cognitive and social tasks that require controlled processing – working memory capacity. People use working memory to retain and access information in the short-term and to suppress task-irrelevant information. Therefore, stereotype threat diminishes one's ability to regulate attention during tasks that require the coordination of information processing and the inhibition of irrelevant thoughts, feelings, and behaviors. Steele argues that minorities face achievement barriers because of the pressure to rebuff the negative stereotypes. This process consumes the cognitive resources they need to operate at their highest level. Poor performance then reinforces the negative stereotypes, which creates a vicious cycle of underperformance among minorities. In an earlier study, Schmader and Johns (2003) found that priming negative stereotypes regarding both gender and race reduced working memory capacity in stigmatized individuals. Stereotype threat decreased women's math performance by diminishing their working memory capacity through the combination of a physiological stress response, monitoring processes, and suppression processes. Without optimal working memory capacities, threatened individuals are distracted by performance elements that draw attention away from accomplishing the task and cannot perform in a short-term, context-dependent situation.

Identity Salience and Competing Identities

Studies on the relative salience, or accessibility, of competing identities in the same context illustrate stereotype threat's domain-specific nature. An individual harbors two competing identities when he or she simultaneously belongs to one group negatively stereotyped in a particular domain and another group positively stereotyped in that same domain. Researchers classically study this phenomenon in Asian women. While Asians are culturally stereotyped to have good math capabilities, women are culturally stereotyped to have poor quantitative skills.

Shih et al. (1999) found that priming Asian women's ethnic identity helped them achieve better results on a math test than the control group (54% of questions attempted correct vs. 49% correct), but priming Asian women's gender identity caused them to perform worse

than the control group on the test (43% of questions attempted correct vs. 49% correct). In this case, solely altering elements of the situation rendered drastic effects on the stereotyped group's performance since both groups were tested in the same mathematical context. Making the identity associated with a negative stereotype salient hampers the individual's performance in the domain, while making the identity associated with a positive stereotype salient helps the individual succeed in the domain (Shih, Pittinsky, & Ambady, 1999). The salient identity ultimately affects performance. These findings reinforce that stereotype threat both decreases performance and depends upon the situation.

In a counterpart study, Shih, Pittinsky, and Trahan (2006) explored the performance effects of activating different social identities in this same group but in a different context – the verbal domain. While women are culturally stereotyped to have good verbal capabilities, Asians are culturally stereotyped to have poor verbal skills. Shih et al.'s (2006) examination of this domain supported their previous findings, as their results mirrored those of the previous study. Priming Asian women's gender identity helped them achieve better results on a verbal reasoning test than the control group, but priming Asian women's ethnic identity caused them to perform worse than the control group on the test. Hence, the identities made salient in pressure-filled situations can greatly affect individuals' performance on identity-relevant tasks.

Student Athletes

Steele and Aronson (1995) emphasized that any group can experience stereotype threat in a domain in which it is negatively stereotyped, regardless of the characteristic that defines this stigmatized status. This pertains to student athletes because the student and athlete identities compete; students are expected to have academic prowess, whereas athletes are expected to lack academic ability. In 2005, Yopyk and Prentice demonstrated the parallels between Asian females and student athletes empirically. When primed with their athlete identity, male student athletes exhibited lower self-regard, the emotional dimension of self-esteem. This priming, in turn, made them perform worse on a difficult math test (Fleming & Courtney, 1984). In contrast, priming their student identity elicited the opposite effect. The ability of these competing identities to elicit different effects on academic performance mirrors the phenomenon found in previous studies of Asian women (Shih et al., 1999; Shih et al., 2006). Such similarity provides a logical bridge between stereotype threat research and its application to student athletes in the academic domain.

However, studies of stereotype threat in student athletes have yielded seemingly inconsistent results. Yopyk and Prentice (2005) reported that in addition to exhibiting lower self-regard, male student athletes primed for their athletic identity withdrew effort by attempting fewer items on the test. This suggests that they dis-

identified with the academic domain to cope with stereotype threat. Harrison et al. (2009), on the other hand, found that priming the athletic identity improved male athletes' performance in the academic domain. The researchers propose many possible reasons for these different findings, including differential academic investment between selective liberal arts universities and large public schools, differential identification with the "dumb-jock" stereotype based upon whether the sport has a professional league, and stereotype reactance processes (Harrison et al., 2009).

Ultimately, the seemingly conflicting data demonstrate not only that stereotype threat in student athletes requires further research, but also that making the athletic identity salient can elicit both negative and positive effects. Since student athletes' dual identity can yield positive academic results, a potential way to mitigate stereotype threat in student athletes is to build upon the positive effects of identification with their athlete identity in order to retrain the "dumb-jock" stereotype. This insight emphasizes the necessity of developing intervention techniques to mitigate stereotype threat in the student athlete population. Eliminating the threat could maximize the potential positive effects of the athlete stereotype. Successful intervention techniques to assuage stereotype threat fall into three categories: reframing the threatening task, retraining the negative stereotype, and reaffirming the self. These techniques can be applied to student athletes in order to alleviate the stereotype threat in this population as well.

Mitigating the Stereotype Threat Experienced By Student Athletes

Reframing the Threat

The stereotypes that plague Asian women elicited opposite effects on their academic performance in the mathematics and verbal domains based on the identity made salient in the domain. This pairing of studies illustrates the pervasiveness of stereotype threat, as it affects performance in multiple domains. The coupling also illustrates how identities are situationally, rather than globally, detrimental. One could thus mitigate the negative effects of stereotype threat by changing how stigmatized groups perceive the domain in which they are negatively stereotyped.

The depletion of cognitive resources that accompanies the physiological stress response contributes to the performance decrements of stereotype threat. Reframing the task so it does not elicit this response would remove stereotype threat from the situation. Alter et al. (2010) found that reframing a task usually perceived as a threat so it was instead perceived as a challenge successfully mitigated the detrimental effects of stereotype threat in the academic setting. Since people feel they lack the resources to accomplish tasks perceived as threats, they experience the performance-impairing physiological stress response. However, when they are perceived as a challenge, these tasks no longer activate this physiological stress response because people feel

they have the resources to accomplish them. In Alter et al.'s (2010) study, the reframing strategy alleviated the threat of negative racial stereotypes in black schoolchildren and the threat of marginalization in Princeton undergraduates from poorly represented high schools. When black schoolchildren's race was made salient by having them report their race before taking a math test, they performed significantly better when prompted to reframe this stereotype-threatening situation as a challenge (67.71% correct vs. 37.71% correct) ($F(1, 45) = 4.80, p < .04$). Similarly, when reminded that they graduated from high schools poorly represented at the Princeton University before taking a math test, undergraduates performed significantly better when they reframed this stereotype threatening situation as a challenge (90.99% correct vs. 72.21% correct) ($F(1, 115) = 11.74, p < .001$.) These results illustrate that in both stereotyped groups, those in the "threat" condition thought a math test had a diagnostic purpose and experienced stereotype threat, while those in the "challenge" condition thought the test had an educational purpose and did not experience stereotype threat. Differential task framing can thus influence self-evaluation of ability and, ultimately, performance in a stereotyped domain.

By reframing threatening academic tasks as challenging, educators can mitigate the negative effects of stereotype threat experienced by student athletes. It might seem impractical to apply this intervention technique in the real world because a classroom examination by definition aims at testing ability. However, reframing is less about the task itself and more about the individual's perception of the task. Student athletes could benefit from task reframing even if only some threatening elements of the task were removed. Alter et al. (2010) accomplished threat reframing by altering the instructions they gave to test takers. Similarly, educators could use test instructions to remind students that the examination tests the knowledge they have successfully gleaned from the class, not their overall ability in the subject. Framing the examination as an evaluation of learning and asserting instructor confidence in the student's ability to succeed can at least decrease the threatening nature of the test.

Nevertheless, the possibility of poor performance remains threatening even after altering how this threat is perceived. Given that reframing works by changing the individual's perception of the task, illustrating that poor academic performance does not merit student athletes' extreme anxiety could help them succeed in the classroom. For example, conditioning student athletes to emphasize the benefits of learning rather than the need for academic excellence would diminish their fear of validating the "dumb-jock" stereotype. This would thereby inhibit the performance-impairing stress response. Thus, reframing the threatening task as a challenge may not eliminate stereotype threat completely, but it can certainly help stigmatized individuals to perform at a higher level.

Retraining Negative Stereotypes

When the negative stereotypes associated with a domain are challenged and retrained, individuals gain the sense of competency and the cognitive capacity they need to overcome stereotype threat (Forbes & Schmader, 2010). However, retraining negative attitudes does not yield the same effect. Forbes and Schmader (2010) found that training women to have positive attitudes toward math motivated them to work on math. Yet, this attitude change did not improve women's working memory capacity. On the other hand, retraining women's stereotypes so they associated their gender with high math capabilities increased working memory capacity and resulted in better math performance. Forbes and Schmader's findings indicate that although retraining student athlete's negative attitudes toward academics would encourage these students to persist in their academic endeavors, it would not eliminate the negative effects of stereotype threat. Therefore, retraining of the "dumb-jock" stereotype itself must occur to prevent the working memory impairment associated with stereotype threat. Training student athletes to associate their athletic identity with academic excellence can enhance their cognitive capacity in the academic domain (Peterson & Barrett, 1987).

Optimally, retraining the negative cognitive association between participation in athletics and the academic domain could trigger stereotype lift. Stereotype lift occurs when partaking in a domain in which one's group is positively stereotyped improves one's performance by increasing working memory capacity. Peterson and Barrett's (1987) investigation of the relationship between explanatory style and academic performance supports the viability of this type of intervention. Explanatory style is a personality characteristic that influences whether a person reacts with determination or submission in the face of adversity. Peterson and Barrett found that university students who explained bad academic events using internal, stable, and global causes received lower grades than those who explained such events using external, unstable, specific causes. In other words, those who exhibited a negative explanatory style performed worse in the classroom than those who exhibited a positive explanatory style. Although explanatory style is a personality characteristic – and thus is an innate, immutable factor to some degree – the elements of a positive explanatory style can be encouraged in everyone. If student athletes attribute their previous poor academic performance to transient circumstances of a particular situation, they will have a more positive explanatory style. This positive explanatory style should maintain their academic motivation and help them perform better in the classroom, which would allow them to associate their athleticism with academic excellence. Hence, even small changes to how a student athlete interprets academic frustrations can help to attenuate the negative effects of stereotype threat through retraining the negative dumb-jock stereotype.

Reaffirming the Self

In order to experience stereotype threat, one must feel uncomfortable with the association between oneself and the negatively stereotyped characteristics of one's group. Therefore, to cope with stereotype threat, individuals may disidentify with the presumed negative aspects of their group while continuing to identify with those aspects that do not have negative valence (Pronin et al., 2004). Deemphasizing the negatively stereotyped aspects of a group can be implemented as an intervention technique. In the case of women in the math domain, for example, stereotype-threatening situations make women's poor quantitative abilities salient. On the other hand, highlighting the achievements of women as a group improved individual females performance on mathematical examinations (McIntyre et al., 2003). These positive achievements were more salient than the negative stereotype because task-related anxiety contributes greatly to the negative effects of stereotype threat. Hence, reassuring women that their group could succeed despite their individual performance on the task lessened the pressure and threat they felt. Given McIntyre et al.'s finding, making both team achievements and individual player achievements salient can mitigate stereotype threat in student athletes.

Along similar lines, training student athletes to engage in self-affirmation techniques prior to academic testing could mitigate the stereotype threat they experience. In their review of the self-affirmation literature, McQueen and Klein (2006) observed that individuals who reflected on their positive attributes either preceding or following an identity threat experienced less distress. This effect generalized to a vast range of threatening situations. Similarly, Harrison et al. (2009) postulated that self-affirmation processes may mediate the transformation of the "dumb jock" stereotype into a positive stereotype in males. Male college athletes performed better on the more difficult test items of an analogies test when their athletic identity was primed, whereas female college athletes performed worse after this manipulation. In accordance with this difference, male student athletes seem to derive more pride from their participation in athletics than do females (Harrison & Lawrence, 2004). Males' athletic identity may thus cause them to focus on a positive image of themselves. By affirming the integrity of the self, their athletic identity may protect them from the threat of the "dumb-jock" stereotype (Harrison et al., 2009). All student athletes could benefit from focusing on the positive aspects of their dual-identity, like their ability to manage the demands of their academic and athletic roles. This could induce a more positive frame of mind for academic testing – implicitly framing the test as a challenge, a way for student athletes to prove their worth in the academic setting through capitalizing on this unique time management skill. Therefore, self-affirmation could limit the physiological stress response and mitigate stereotype threat (Harrison et al., 2009).

Such self-affirmation processes seem to be particu-

larly lacking in the female student athlete population, partially because they are more engaged in academics than are male student athletes (Harrison et al., 2009). Thus, confirming the “dumb-jock” stereotype is more threatening to them than it is to male student athletes (Harrison et al., 2009). To mitigate this fear, it seems essential that coaches encourage women to reflect on the positive aspects of the link between their student identity and especially their female athlete identity. Their participation in athletics not only gives them a constructive break from their schoolwork but also realizes their foremothers’ dreams of gender equality in the athletic, as well as the academic, domain.

Conclusion and Suggestions for Future Research

The case of student athletes’ experience with stereotype threat highlights two often overlooked aspects of this psychological phenomenon. First, stereotype threat is a problem relevant to all negatively stereotyped groups, not just racial and gender minorities. The negative performance effects experienced by “non-traditional” groups, like student-athletes, mirror those experienced by the demographic groups typically associated with stereotype threat. As such, more research into the effects of stereotype threat on “non-traditional” groups in the academic domain should be performed. Since stereotypes and their impact on performance extend beyond the classroom, further research into the implications of stereotype threat in non-academic settings should be performed. With regard to student athletes specifically, researchers should test whether priming the student identity in the athletic setting causes performance decrements in the athletic realm. Stone (2002) determined that some white athletes experience stereotype threat due to the conception that whites are not as athletic as African Americans. To cope with this threat, these individuals erected barriers to their success so they could attribute their failure to these barriers rather than their abilities. If making the student identity salient in the athletic domain leads to performance decrements, the dual-identity nature of student athletes suggests that the strategies proposed to help athletes succeed in the classroom could be modified to help students succeed on the field as well.

Although negative stereotypes have the potential to severely harm performance, there is hope for mitigating the detrimental effects of stereotype threat using simple, low cost interventions. As the interventions proposed in this paper illustrate, by addressing the three main aspects of stereotype threat (i.e. the task, the stereotype, and the individual), stereotype threat can be reduced in the student-athlete population. However, as the assertions made in this paper are based on theory and comparison rather than on experimental manipulation, empirical research into these interventions still needs to be performed. Researchers must investigate the relative efficacy of the aforementioned interventions, determining which technique consistently mitigates stereotype threat in student athletes.

Mirroring the experimental procedure used by Forbes and Schmader (2010), repeatedly exposing student athletes to the counter-stereotypic association can retrain their “dumb-jock” stereotype. The experimenters can recruit student athletes whose self-reports indicate that they experience stereotype threat in the academic setting. The sample should be demographically uniform to ensure that the stereotype threat manipulation mitigates the effects of the student athlete stereotype only and not a separate racial or gender stereotype. Additionally, the participants should attend the same university to ensure that they experience the same level of academic pressure and the same culture with regard to stereotyping of athletes. Participants would perform a modified version of the personalized Implicit Association Test (pIAT). Through the use of this instrument, those in the stereotype retraining condition would see the category labels “athletes are good at” and “school” together in the one corner of the computer screen and the labels “students are good at” and “sports” in the other. Those in the stereotype reinforcement condition would see the opposite pairings. Participants would then classify academic/athletic words into these school/sports domains. Those in the retraining condition would thus categorize school-related words along with activities society perceives athletes to be good at, and this exposure should retrain their stereotype such that they perform better on a threatening test administered 24 hours later (Forbes & Schmader, 2010). This intervention technique’s effectiveness has only been shown in the short-term, so if it works in the student athlete population further experiments should examine the durability of this effect and the influence of multiple retraining sessions.

Only by testing these interventions both in the lab and in the field will researchers be able to determine whether each is successful in student-athletes. Moreover, empirical testing can determine the conditions under which each technique will have the greatest impact. Nonetheless, the fact that these possibilities appear to be feasible options, given the efficacy of these interventions in demographic minorities, offers a much brighter future for student athletes in the academic domain.

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