



McNair Journal

FALL ■ 2013



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On the Cover: Ashley Schulz, School of Natural Resources,
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Message from the Director

It is with great pride that I introduce this outstanding collection of articles from the 2012-13 participants of the MU McNair Scholars Program. The papers presented here represent the culmination of a year's worth of research and scholarly activity. They reflect the energy, creativity and effort of the scholars, themselves, as well as the careful guidance, support and diligence of their faculty mentors. Six very diverse topics are explored and reported in their entirety within this interdisciplinary journal. While their subject matter and journalistic styles may differ, they, along with the other McNair Scholars listed in this publication, are to be commended for their persistence and dedication to this rigorous undergraduate research experience that will benefit them greatly in their pursuits of graduate studies.

Since 1989, the McNair Program has been a University-wide effort that continues to attract students and faculty mentors from a variety of academic departments and fields of inquiry. Students have had the opportunity to learn about the importance of earning an advanced degree, while gaining the skills and tools

that will guide them through their future academic journeys. The program proudly bears the name of astronaut and scientist, Dr. Ronald E. McNair, who died in the Challenger explosion in 1986. His accomplishments and high standards set an outstanding example for these developing scholars.

I am truly honored to be associated with an initiative such as this. So many faculty, staff and administrative members of the MU community have worked to ensure a supportive and cohesive environment that prepares these exceptional students for graduate programs. We are proud to highlight the work of these talented young researchers, in this, the twentieth edition of the **MU McNair Journal**. Our best wishes go out to all of them as they continue to move along their scholastic continuum.

NaTashua Davis, PhD
Director
McNair Scholars Program

The McNair Scholars Program

BACKGROUND

College students who are considering study beyond the baccalaureate level realize their dreams through the McNair Scholars Program at the University of Missouri-Columbia (MU). MU was one of the original fourteen universities selected to develop a program established by the U.S. Department of Education and named for astronaut and Challenger crew member Ronald E. McNair. The purpose of the program is to provide enriching experiences that prepare eligible students for doctoral study.

PROGRAM ELEMENTS

One of the most exciting aspects of the McNair Scholars Program is the opportunity for junior or senior undergraduate students to participate in research experiences. McNair Scholars receive stipends to conduct research and engage in other scholarly activities with faculty mentors from the areas in which they hope to pursue graduate study. These research internships are either for the academic year or for the summer session and are under the supervision of faculty mentors. For academic year internships, students work a minimum of ten hours per week during the fall and winter semesters. Summer interns work full-time for eight weeks.

McNair Scholars also attend professional conferences with their mentors, go to graduate school fairs, prepare for graduate school entrance exams, receive guidance

through the graduate school application process and obtain information on securing fellowships, graduate assistantships, and loans. Participants learn about graduate school life, advanced library skills, and effective ways to present their work. At the completion of the research internships at MU, McNair Scholars make formal presentations of their research to faculty and peers at the McNair Scholars Conference and submit papers summarizing their work. Students who participated as juniors the previous year continue in the program during their senior year for graduate school placement and to further develop their skills.

ELIGIBILITY

Participants must meet grade point average standards; be U.S. citizens or permanent residents; and qualify as either a first generation college student with an income level established by the U.S. Department of Education, or a member of a group that is underrepresented in graduate education.

All students who wish to be involved submit an application to the program. A committee composed of faculty members and representatives from both the graduate dean's office and the McNair Scholars Program selects participants and approves faculty mentors. Research internships are offered to those students who are juniors or seniors and are identified as having the greatest potential for pursuing doctoral studies.

Rewards and Prosocial Behaviors in Nicaraguan Adolescents: The Mediating Role of Prosocial Moral Reasoning

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Antoine Culbreath is from Atlanta, Georgia and is a Families and Lifespan Development major. In addition to being the president of the Human Development and Family Studies Student Association, Antoine is also a Human Environmental Sciences Ambassador. He is the recipient of the Harold and Sharilyn Gallison Memorial Scholarship and the Elizabeth Verner Memorial Scholarship. This fall, Antoine started a Master's degree in Applied Behaviors with an emphasis in Autism at Ball State University.

ABSTRACT

Parents often encourage prosocial and moral development in children by rewarding them for good behaviors. Two types of rewards that are commonly used are social and material rewards. Participants consisted of 267 adolescents in a rural area in Nicaragua (M age=14.8 years; 50% female). Participants completed measures of social and materials rewards (Prosocial Practices Measure; Carlo et al., 2007), prosocial moral reasoning (Carlo, Eisenberg, & Knight, 2010), and six common types of prosocial behaviors: dire, emotional, public, altruistic, anonymous, and compliant (Carlo et al., 2003). Regressions were conducted to examine the relations between social and material rewards, prosocial moral reasoning, and prosocial behaviors. Material rewards positively predicted public prosocial behaviors, and prosocial moral reasoning negatively predicted public prosocial behaviors. Material rewards negatively predicted altruistic prosocial behaviors, while prosocial moral reasoning positively predicted altruistic prosocial behaviors. Social rewards positively predicted compliant prosocial behaviors, and prosocial moral reasoning was not associated with compliant prosocial behaviors. Discussion will focus on parenting practices that may foster adolescents' prosocial development.

INTRODUCTION

Parents have different types of techniques that they use to socialize their children. Some parents encourage their children when they do something positive by giving them a compliment such as good job, or keep up the good work. This type of encouragement is referred to as social rewards. Another way parents encourage their children to do positive things is by providing children with incentives such as motivation to perform a task (i.e. allowance). This type of encouragement is referred to as material rewards. Both material and social rewards are used as tools for parents that influence their children's social behaviors (Eisenberg & Murphy, 1995). These parenting practices may influence children in many ways, but one particular aspect of development that may be influenced is prosocial behaviors.

The term prosocial behavior means positive actions that are intended to benefit others (Carlo & Randall, 2002). Prosocial behaviors include helping others in various ways. Children can help when they are asked, comfort others, share with others, and perform many other behaviors that are aimed at helping others in their environments. It is important to understand how parental rewards influence prosocial behaviors because prosocial behaviors are important for children to develop. Parental rewards may either promote or reduce these positive behaviors.

Theory suggests that material rewards can reduce intrinsic motivation. When children receive objects for behaving in a

particular way, they may come to depend on those rewards for performance. This idea might apply to prosocial behaviors. The more children receive material incentives, the less likely they may to engage in helping behaviors when they are not receiving some reward for the behaviors (Bénabou & Tirole, 2004; Frey & Jegen, 2001). On the other hand, social rewards may promote prosocial behaviors. Parents can socialize their children through praise and positive expressions, which are examples of social rewards. Social rewards may teach children positive behaviors through reinforcement without reducing intrinsic motivation (Bénabou & Tirole, 2004). These rewards may teach children which behaviors are positive and then reinforce these behaviors without children depending on material rewards.

Research has demonstrated that rewards are indeed related to prosocial behaviors. Material rewards have been empirically negatively linked to lower levels of youth prosocial behaviors over time (Fabes, Eisenberg, May-Plumlee, & Christopher, 1989). In very young children, when presented with material rewards, the children are less likely help in experimental situations (Warneken & Tomasello, 2008). Other research, however, has demonstrated that material rewards are differentially related to specific types of prosocial behaviors. Material rewards have been positively linked to emotional (comforting in emotional situations) and public (helping in the presence of others) prosocial behaviors and negatively related to altruistic (selfless helping) prosocial behaviors (Carlo et al., 2007). Social rewards have been linked to greater levels of 5 different types of prosocial behaviors, altruistic, emotional, dire (helping in emergency situations), anonymous (helping in secret), and compliant (helping when asked).

The prior research on rewards and prosocial behaviors has used samples that consist of European American children. The current study will examine the links between social and material rewards and prosocial behaviors and the mediating role of prosocial moral reasoning in these relations in a sample of adolescents from rural Nicaragua.

The Mediating Role of Prosocial Moral Reasoning

Research has examined sympathy as an underlying mechanism in the relations between parental rewards and youth prosocial behaviors (Carlo et al., 2007). Other potentially important mechanisms have not been examined, however. One potentially important mediator is prosocial moral reasoning. Prosocial moral reasoning is the process of reasoning about whether or not to help another person when their own needs are pitted against the other person's needs (Carlo et al., 2010). One previous study found that social rewards predicted higher levels of moral reasoning (see Eisenberg & Murphy, 1995). This latter study suggests that prosocial moral reasoning may be impacted by parental rewards. Internalized moral reasoning has been empirically linked to prosocial behaviors in adolescents (Carlo et al., 1996). Moreover, recent scholars have demonstrated that prosocial moral reasoning predicts specific forms of prosocial behaviors. In a study of adolescents from Spain, researchers demonstrated that higher levels of prosocial moral reasoning were positively associated with altruistic and public prosocial behaviors (Carlo, Mestre, Samper, Tur, & Armenta, 2010). Among European American adolescents, higher levels of prosocial moral reasoning were associated with altruistic, anonymous, and

public prosocial behaviors but not compliant, dire or emotional prosocial behaviors (Carlo, Knight, McGinley, & Hayes, 2011). These latter findings suggest the need to investigate the types of prosocial behaviors that might be most relevant to prosocial moral reasoning.

Prosocial Behaviors

Prosocial behaviors include many different types of helping that are all aimed at benefitting another person. Carlo and Randall (2002) conducted focus groups with Mexican American adolescents and mothers. Based on these focus groups, a scale was developed to assess different types of prosocial behaviors. The results demonstrated that there were six subscales of different types of prosocial behaviors based on different situations. Altruistic prosocial behaviors are selfless behaviors. Dire prosocial behaviors include helping in emergency situations. Anonymous prosocial behaviors include helping in secret. Compliant prosocial behaviors include helping when asked. Public prosocial behaviors include helping in front of others. Finally, emotional prosocial behaviors include helping in emotional situations (Carlo & Randall, 2002). These subscales represent different ways that individuals may help others.

Research has demonstrated that these six categories are distinct from one another. For example, in one particular study sympathy predicted dire, emotional, compliant, anonymous, and public prosocial behaviors, but negatively predicted altruistic prosocial behaviors (Carlo, Knight, McGinley, & Hayes, 2011). Research suggests that these six subscales are predicted in different ways and are indeed different forms of helping (See Carlo, Knight, McGinley, Zamboanga, & Jarvis, 2010; Armenta, Knight, Carlo, & Jacobson, 2010). The current study examined prosocial behaviors as a multidimensional construct, which will contribute to the literature on parenting behaviors and prosocial behaviors in a sample of adolescents from Nicaragua.

HYPOTHESIS

The current study examined the impact of material and social rewards on six different types of prosocial behaviors, as well as the mediating role of prosocial moral reasoning.

1. Material rewards will be negatively associated with prosocial moral reasoning. Social rewards will be positively associated with prosocial moral reasoning.
2. Prosocial moral reasoning will be positively associated with all prosocial behaviors, with the exception of altruistic prosocial behaviors. Prosocial moral reasoning will be negatively associated with public prosocial behaviors.
3. Material rewards will be directly negatively associated with emotional, altruistic, dire, compliant, and anonymous prosocial behaviors and positively associated with public prosocial behaviors.
4. Social rewards will be positively associated with altruistic, dire, compliant, emotional, and anonymous prosocial behaviors and negatively associated with public prosocial behaviors.

METHODS

Participants consisted of 267 adolescents in a rural area in Nicaragua (M age=14.8 years; 50% female). Participants completed measures of social and materials rewards (Prosocial Practices Measure; Carlo et al., 2007), prosocial moral reasoning (Carlo, Eisenberg, & Knight, 2010), and six common types of prosocial behaviors [dire (helping in emergency situations), emotional (helping in emotional situations), public (helping in the presence of others), altruistic (helping when there is no benefit to the self), anonymous (helping when no one else knows), and compliant (helping when asked); Carlo et al., 2003].

Table 1 Descriptive table for participant gender, parental employment, and age.

Variable	N	Mean	Standard Deviation
Gender	267	1.63	.48
Mother Employed	267	1.52	.50
Father Employed	267	1.11	.32
Age	267	14.80	1.43

RESULTS

Descriptives and correlations among the main study variables were conducted (Table 2). The correlations demonstrated that material and social rewards were positively correlated. Both material and social rewards were also positively correlated with prosocial moral reasoning. Prosocial moral reasoning was positively correlated with dire, altruistic, and anonymous prosocial behaviors. There were also correlations among the prosocial behaviors. Public prosocial behaviors were positively correlated with emotional, dire, compliant, and anonymous prosocial behaviors and negatively correlated with altruistic prosocial behaviors. Emotional prosocial behaviors were positively correlated with dire, compliant, and anonymous prosocial behaviors and negatively correlated with altruistic prosocial behaviors. Dire prosocial behaviors were positively correlated with compliant and anonymous prosocial behaviors

and negatively correlated with altruistic prosocial behaviors. Altruistic prosocial behaviors were negatively correlated with compliant and anonymous prosocial behaviors. Compliant and anonymous prosocial behaviors were also positively correlated with one another.

Multiple regressions were conducted to examine the relations between social and material rewards, prosocial moral reasoning, and prosocial behaviors (see Table 3 for results). Because there were no significant relations between prosocial moral reasoning and emotional, compliant, and anonymous prosocial behaviors, regression analyses were not conducted for those prosocial behaviors. For dire, altruistic, and anonymous prosocial behaviors, social and material rewards were entered in step 1 and prosocial moral reasoning was entered in step 2. For dire prosocial behaviors, social rewards and prosocial moral reasoning positively predicted. For altruistic prosocial behaviors, material rewards negatively predicted public prosocial behaviors but prosocial moral reasoning positively predicted. For anonymous prosocial behaviors, prosocial moral reasoning marginally ($p < .10$ level) positively predicted. However, there was no evidence of mediation effects.

Table 3. Summary of regression analysis: Social and material rewards, and prosocial moral reasoning (PROM) predicting dire (model 1), altruistic (model 2), anonymous (model 3).

Step 1	Model 1		Model 2		Model 3	
	B	SE	B	SE	B	SE
Social	.20*	.09	.10	.08	.06	.10
Material	.06	.09	-.32**	.08	.14	.09
	$R^2 = .06^*$		$R^2 = .07^*$		$R^2 = .04^*$	
Social	.18*	.09	.07	.08	.05	.10
Material	.05	.09	-.34**	.08	.13	.09
PROM	.18*	1.24	.25**	1.10	.12 ⁺	1.31
	$R^2 \text{ change} = .03^*$		$R^2 \text{ change} = .06^*$		$R^2 \text{ change} = .01^+$	

$p < .10^+$ $p < .05^*$ $p < .001^{**}$

Table 2. Descriptive and Correlation Matrix for Rewards, Prosocial Moral Reasoning and Prosocial Behaviors

	1	2	3	4	5	6	7	8	9
1. Material Rewards									
2. Social Rewards	.65**								
3. PROM	.14*	.16*							
4. Public	.31*	.23**	-.13						
5. Emotional	.25**	.22**	.12	.51**					
6. Dire	.19*	.21**	.22**	.40**	.62**				
7. Altruistic	-.24**	-.10	.20*	-.65**	-.28**	-.20*			
8. Compliant	.13*	.18*	.09	.41**	.44**	.51**	-.27**		
9. Anonymous	.19*	.15*	.15*	.40**	.58**	.55**	-.35**	.50**	
Mean	2.56	3.68	1.83	2.79	3.42	3.49	3.46	3.14	3.00
SD	.97	.88	.05	1.12	.91	.96	.87	1.09	.99

Note: $p < .05^*$. $p < .001^{**}$

DISCUSSION

Overall, the findings showed that adolescents who receive material rewards from their parents may be oriented towards seeking the approval of others, and less likely to help others for selfless motives. The findings are in accord with previous research that suggests that the use of material rewards fosters extrinsic rather than intrinsic motivation to help others. In contrast, adolescents who receive social rewards from their parents may be more oriented towards helping in emergency situations or when asked for help. These adolescents may have more intrinsic motives and may feel a duty or responsibility to help others in times of crisis or need.

As expected, the findings also show that high levels of prosocial moral reasoning are associated with high levels of selfless, anonymous, and dire helping. These findings are in accord with prior research that such reasoning is relevant in predicting morally-based helping and helping that may require cost-benefit analyses (i.e., emergency situations). The fact that it was also linked to anonymous prosocial behaviors may be due to the higher-level sociocognitive skills necessary for helping anonymously (Carlo et al., 2003). Interestingly, both social and material rewards were positively related to prosocial moral reasoning. Such findings suggest that acknowledging good behaviors, regardless of whether the acknowledgement is social or material, may promote higher moral reasoning skills.

Unexpectedly, mediation analyses showed that prosocial moral reasoning did not mediate the relations between parental rewards and prosocial behaviors. These findings suggest that prosocial moral reasoning is a direct predictor of prosocial behaviors but does not explain the relations between parent's use of rewards and their youth prosocial behaviors. Carlo et al. (2007) had previously shown that sympathy does mediate such relations. Therefore, taken together, these findings demonstrate the distinct roles of sympathy and prosocial moral reasoning in understanding youth prosocial behaviors.

LIMITATIONS

There are some limitations of the present study. First, the present study relied exclusively upon self-report measures, which can be subject to self-presentational biases. Therefore, it is recommended that future researchers use experimental manipulation or observed methods to confirm the present findings. Second, the present study was a cross sectional study, which limits our ability to examine developmental changes in these behaviors and to better infer direction of causality. Future studies should employ longitudinal designs to address these issues. And third, the present study lacked adequate diversity in the sample therefore limiting our ability to generalize to all Nicaraguan adolescents. Future research should use larger, more representative samples of Nicaraguan adolescents from urban and rural regions.

This study was conducted on a sample of adolescents from Nicaragua, and therefore extends the literature on parental rewards and prosocial behaviors that has traditionally been conducted with European American samples. The results of this study could inform parents, teachers, therapists and others who work with children. If adults rely on excessive material rewards to the exclusion of social rewards, children may become dependent

on those rewards and may engage in less spontaneous, altruistic helping behaviors. Social rewards, on the other hand, may promote moral reasoning and multiple types of helping behaviors.

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The Effects of Prescribed Fire on Insect Diversity in the Missouri Ozark Highlands

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ABSTRACT

Fire has long played a role in the dynamics of the unique forest ecosystems of the Missouri Ozarks. In contemporary forests, these applied disturbances are being used to mimic the historic fire disturbances found in the area and create a more open understory in order to promote populations of wildlife, and to enhance overall diversity. Because there is little known about the effect of prescribed fire on ground dwelling arthropods in the Missouri Ozarks, we examined the effects of different prescribed fire treatments on insect diversity at Little Black Conservation Area. Pitfall traps were used to collect samples of ground-dwelling insects within three treatments: burn plots, unburned island plots and control plots. After collection, each pitfall trap was sorted and insects were identified to order and family and all other arthropods were identified to class. The specimens collected spanned across five classes: Insecta, Arachnida, Diplopoda, Chilopoda and Nematoda. Within the class, Insecta, we found 12 orders and 43 families. Regardless of treatment, each pitfall trap contained insects from two ant subfamilies, Myrmicinae and Formicinae, and other arthropods from the groups Collembola and Arachnida. Overall, arachnids were found to be more abundant in the control treatment, while insects in the order Hymenoptera were more abundant in the burn plots and island plots, and Coleopterans and Dipterans were more abundant in the island and burn plots, respectively. More research is needed to better understand the effects of prescribed fire on ground-dwelling arthropods, specifically crickets and beetles, which are a key dietary component of wild turkey.

Keywords: prescribed fire; insect; arthropod; Ozarks; pitfall trap; unburned island; refugia.

INTRODUCTION

Wildfires have long played a role in the development of many of the Missouri Ozark forest and woodland ecosystems (Cutter and Guyette, 1994). Before European settlement, Native Americans regularly burned the areas of Eastern America to facilitate hunting or to encourage grass growth for grazing (Pyne, 1982; Cutter and Guyette 1994). Following the mid-19th century, settlers of European descent began to establish agriculture-based communities within the area of the Missouri Ozarks. As a result of the change in land use and the new communities that were being established, fire suppression and prevention became important in the early 20th century (Guyette et al. 2002). This method of land management did not change until the mid-late 20th century when researchers determined that fires were a naturally occurring disturbance in the Ozark

forests. Subsequently, prescribed burning became a forest management technique that many resource foresters within the Missouri Ozarks, as well as other parts of North America, still implement today.

Since prescribed burning has become such a popular forest management technique, some researchers have become interested in how this technique has been affecting ecologically important communities of ground-dwelling arthropods that are food sources for larger animals, decomposers of organic material, soil aerators and bio-indicators of a healthy ecosystem (Harris and Whitcomb, 1974; McCullough et al., 1998; Kalisz and Powell, 2000; Buddle et al., 2006; Coleman and Rieske, 2006; Hanula et al., 2006; Martikainen et al., 2006; Pearce and Venier, 2006; Greenberg et al., 2010; Iglay et al., 2012). These studies have been completed in various locations throughout North America including Kentucky (Kalisz and Powell, 2000), Mississippi (Iglay et al., 2012), areas of the Northern Boreal Forest (McCullough et al., 1998 and Martikainen et al., 2006), even Canada (Buddle et al., 2006). Although this is just a small sample of what research efforts have accomplished, there has been very little research associated with the relationship between arthropods and prescribed fire in the lower Midwest, more specifically in the Missouri Ozark Highlands where prescribed burning is frequently used to control fuel loads, reduce the amount of invasive species, manage ecosystems for wildlife and maintain the understory aesthetics of forests and woodlands. For an area that has such a rich ecological history, it is important to fill in all of the research gaps to create a more complete picture and to ensure that there is a better understanding of the processes involved in the complex ecosystems that occur in the Missouri Ozarks.

METHODS AND MATERIALS

Site Description

To test our hypothesis that unburned islands and control areas would have a greater abundance and diversity of ground-dwelling arthropods, we used a site within Little Black Conservation Area (LBCA) [36° 45' 27.3276" N, 90° 48' 17.0964" W] that had been burned in March 2012. Little Black Conservation Area is a 1201 ha area located in Ripley County, MO that is made up of an oak-hickory and oak-pine forest type. The area that was burned and sampled is part of a 283 ha Woodland Bird Habitat Restoration Project that was initiated in 2006 to restore woodland habitat by reducing heavily stocked tree stands (Missouri Department of Conservation 2012). At the time of the burn, the forest managers set up three island plots that were to be left unburned while the area surrounding the plots was burned. The control treatment in the study was located in an adjacent cell that had not been burned in approximately seven years. In the past, timber stand improvement (TSI) techniques were implemented in the burn area, but not in the control area. Although this may affect the results of our study, we are not taking into consideration the effects of the TSI; only the effects of the burn treatment.

Field Sampling

Arthropod sampling took place in July 2012, four months after the burn. For the study we used nine plots located within the area of the burned site. Three of the plots were set up as island plots,

three were burn plots and three were control plots. Each of these nine plots contained three pitfall traps containing propylene glycol ($C_3H_8O_2$) for a total of twenty-seven samples within the entire sampling area of LBCA. The locations of the traps within the five meter by five meter plots were determined through random selection. Each plot had a two meter by two meter grid with one hundred, twenty centimeter cells (Figure 1). The smaller two meter grids within the larger five meter plot provided a buffer zone to reduce potential edge effect. Grid cell number one consistently started in the NE corner of the grid and grid cell number one hundred consistently ended in the SW corner. Three grid cells were selected using a random number generator. If two selected grid numbers were adjacent, another number was selected to maintain independence of the pitfall traps.

In order to determine the location of the burn plots, we randomly generated three numbers between one and 360° that we used as azimuths to measure twenty-five meters from the center of an island plot to the center of the corresponding burn plot (i.e.: center of island one to center of burn plot one). In order to determine where the plots were within the control area, we created a one hundred meter by one hundred meter grid over the control area with four hundred, five meter by five meter plot boxes. We determined the location of the plots using a random number generator. The procedure to find the location of the traps within the plot grid was consistent throughout the island, burn and control plots.

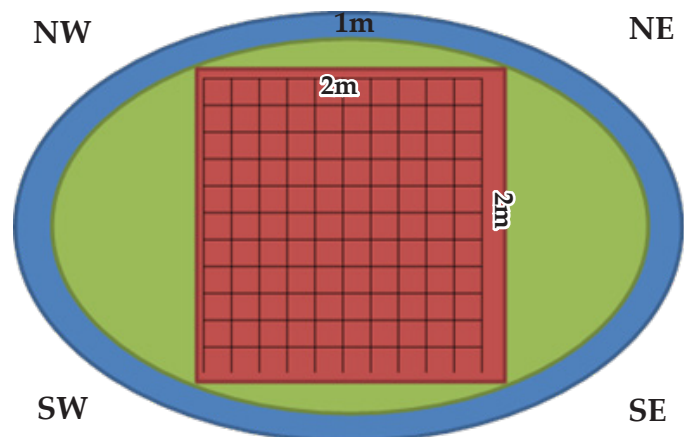


Figure 1. Diagram indicating the layout of the grid boxes within the plots (not to scale).

After determining where each plot and pitfall trap was located, we dug holes for the traps using a post-hole digger. Each trap was filled with propylene glycol and covered with a plastic plate that was held one inch above the ground using nails to allow for arthropod movement. The plates prevented larger objects, such as twigs and leaves, from falling into the traps. The traps remained on the plots for one week (seven days) in July 2012.

Lab Analysis

After collection, we took the pitfall traps to the University of Missouri for analysis. Using a dissecting microscope, one dram vials, ethanol and pins, we sorted through each pitfall trap, and identified all arthropods to taxonomic. Any organisms in the class Insecta were further identified to order, family and subfamily. Larger specimens were identified, pinned and labeled with the

scientific name and trap number which they were collected in. Smaller specimens were identified, counted and put in vials with the same type of labeling.

Once all of the pitfall traps were processed, the data was entered into Microsoft Excel and organized by treatment type (i.e.: unburned island, burn plot, control plot), as well as by each insect order, family and general arthropod class. Since three of the twenty-seven pitfall traps were empty (possibly due to raccoons), data were averaged based on the number of pitfall traps that were filled (i.e.: not empty) for each of the particular treatment types. For instance, the island treatment only had seven out of nine pitfall traps filled, while the burn treatment had eight out of nine traps filled and the control treatment had all nine traps filled. After calculating the adjusted total for each class, order, family and subfamily, we were able to compare the average abundance of each type of insect against others within the three treatment types and use Shannon's Index of Diversity (Roth et al. 1994) to calculate the diversity (H), equitability (EH) and family richness (S) for each treatment type, where:

$$H = - \sum_{j=1}^S p_i \ln p_i$$

$$E_H = \frac{H}{\ln S}$$

S = number of families

RESULTS

Insect abundance

In total, the twenty-seven (including the three empty traps) pitfall traps collected 2,433 individuals that were categorized into five classes: Arachnida, Chilopoda, Diplopoda, Insecta and Nematoda. The average abundance of two (Arachnida [n=26]; Insecta [n=278]) of the five different classes within each treatment type appears in Figure 2 along with the average total number of arthropods (Arachnida, Chilopoda, Diplopoda, Insecta and Nematoda). Arachnids were more abundant in the control plot although, overall, the island plot had the greatest abundance of arthropods and, more importantly (for this study), a greater abundance of insects. Arthropods in the class Insecta composed over 90% of the specimen biomass (2,211 individuals) and collected spanned 12 orders and 43 families with little consistency within treatment type (Figure 3).

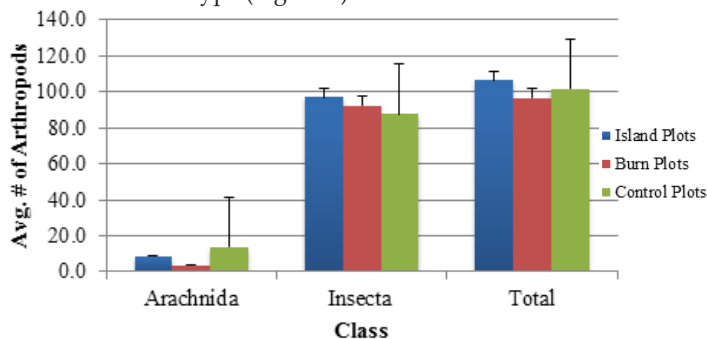


Figure 2. The average abundance of arachnids, insects and the average total number of arthropods found within each treatment type. Total number of arthropods includes Arachnida and Insecta plus Diplopoda, Chilopoda and Nematoda.

Overall, 33% of the insect orders collected occurred in the control treatments, 42% occurred in the island and 25% were found in the burn treatment. Most of the orders that dominated the control treatment (Figure 3b, 3c), such as Blattodea (cockroaches), Collembola (springtails), Orthoptera (crickets) and Psocoptera (booklice), have very limited to no flight capabilities. Orders that dominated the burn treatment (Figure 3b, 3c), such as Hemiptera (seed bugs), Neuroptera (antlions), and Diptera (flies), generally have well developed wings and, as a result, can evade the dangers of the fire and repopulate more rapidly post-burn. Moreover, they may be dispersing to the more favorable habitat. Specimens that were more abundant in the island plots (Figure 3b, 3c) included Microcoryphia (jumping bristletails), Thysanoptera (thrips), Lepidoptera (moths) and Coleoptera (beetles). Some of these orders (Microcoryphia and Thysanoptera) were associated with the unburned islands than the other treatment types, most notably the burn treatment, since, like the control treatment organisms, these two groups cannot fly and evade fire as easily as other insect organisms.

About 64% of the total insects collected were composed of Hymenoptera (ants and wasps) primarily in the family Formicidae (subfamilies Myrmicinae and Formicinae). Overall, the Hymenopterans were more abundant in the island plot (Figure 3a), but also had the second highest association with the burn plot. Although most ants (other than the queen) do not have flight capabilities, they build colonies belowground and, as a result, can easily evade the low intensity fires being administered every three to five years.

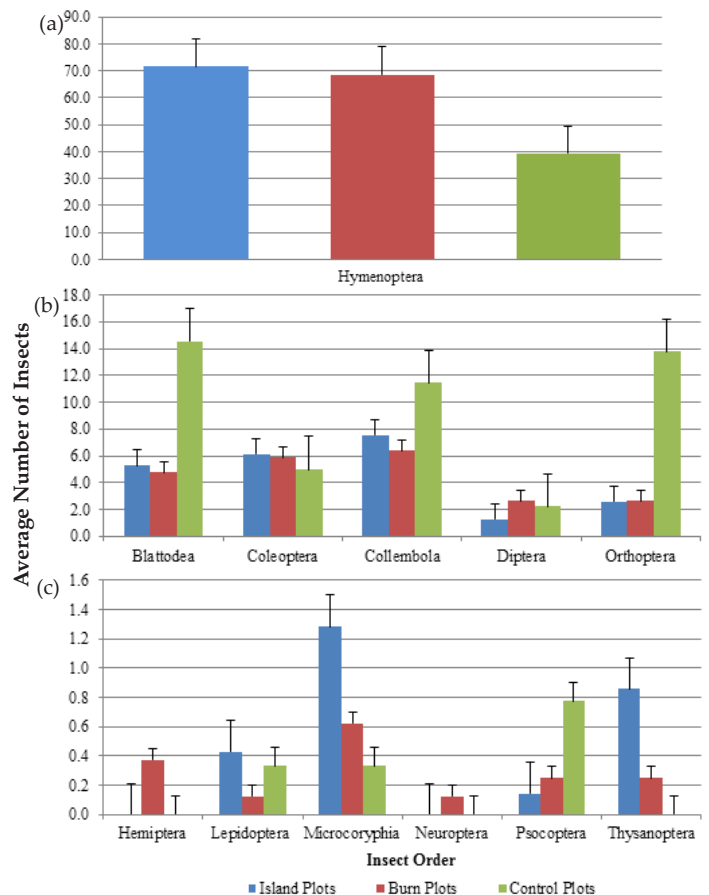


Figure 3. Average number of insects found per Order within each treatment type.

Insect diversity

An analysis of the average counts of insects using Shannon's Index of Diversity revealed that the control treatment had the highest overall diversity (H) and evenness (EH), while the island treatment had a higher level of richness (S) compared to the burn treatment (Table 1).

Table 1. A comparison of the diversity, equitability (evenness) and richness for the overall island, burn and control treatments. Equitability assumes a value between 0 and 1 with 1 being complete evenness.

Value	Island Treatment	Burn Treatment	Control Treatment
Diversity (H)	1.368	1.258	1.912
Equitability (E_H)	0.398	0.37	0.58
Richness (S)	31	30	27

DISCUSSION

Our results indicate that, overall, the island treatment had the greatest abundance of arthropods (Figure 2, Figure 3) and richness (Table 2) of insects, while the control plot had the greatest diversity and equitability (evenness) (Table 2). Other studies such as Catling et al. (2010) and Villa-Castillo and Wagner (2002) found that species richness and density was higher in burn treatments than unburned or thinned only stands, while others like Niwa and Peck (2002) found that there were not any differences in richness and diversity of carabid beetles and spiders between the burned and unburned treatments, but that, overall, both types of arthropods were more abundant in the unburned site. Still other researchers found a greater abundance, but lower diversity of insects in burned areas (Dajoz 1998). Dajoz (1998) also notes that, due to the great period of fire suppression during the 1900's, many insects that were once adapted to fire or pyrophilous (fire loving) are now not as common as they used to be.

Other post-fire assessments have determined that, at the order level, microarthropod groups such as Collembola as well as Coleoptera, Thysanoptera and Chilopoda (centipedes) were more highly correlated to unburned sites, while Psocoptera and Homoptera (Hemiptera) had distinct associations with burned sites (Broza and Izhaki, 1997). Our results are similar with the exception of Psocoptera which was found to be more abundant in the unburned areas. This could be due to a difference in the flight capabilities of the Psocopterans that were found for each study. While our specimens were wingless, there are winged Psocopterans that could evade fire easier to fare better and repopulate the areas post-burn.

Some studies of the effects of low intensity fire on ant populations indicate that burning does not affect ant richness or abundance, but it could change the types of ants that are present (Andrew et al. 2000) and affect the community organization (York 2000).

Based on the results of our research and the research of others' that indicate that unburned areas (i.e.: island and control treatments) have the greatest diversity and abundance of organisms, we would like to propose that unburned islands (manmade or natural) be implemented into management plans to promote shelter for the flightless insects. Since complete suppression of fire is not ideal due to the risk of wildfire and the negative effects suppression can have on plant regeneration

(Shang et al. 2007), we feel that including islands would provide a compromise treatment that would promote both insect and plant biodiversity. Similar studies that have looked at the influence of unburned refugia (islands) on insect diversity concur with our results in determining that the refugia was important for some insects to seek shelter during the fire (Andrew et al. 2000; Kalisz and Powell 2000; Gandhi et al. 2001; Panzer 2003; Knight and Holt 2005; Swengel and Swengel 2007). Pearce and Venier (2006) advocate that less intensively burned areas leave residual vegetation to aid in the re-colonization of open habitat, while Porter and Redak (1996) disagree, noting that small residual areas are still susceptible to high temperatures that can kill insect populations. Gandhi et al. (2001) resolves the issue by suggesting that larger residual areas be included for higher intensity fires. Future research should be completed to determine which size island is ideal for certain size fires for different ecosystem types around the world. Villa-Castillo and Wagner (2002) suggest that, over time, the unburned islands will help repopulate the burned areas and more species may be observed in burned than unburned areas as the vegetation responds years after the fire, further promoting the use of fire, but also supporting the use of unburned refugia within the burn area.

CONCLUSION

As the results of other studies demonstrate, different levels of disturbance (burning vs. no burning) can have varying effects on insect diversity and abundance. If our management objective is to preserve wildlife and plant biodiversity in forested areas, it is essential that we understand how different forms of biomass removal can affect insect diversity and abundance (Catling et al. 2010), since insects are one of the basic building blocks for healthy forest ecosystems.

The results of this study must be used with caution, in part because of the co-occurring summer 2012 drought and that potential influence on insect activity. Despite this, the research can serve as a base line for related projects in the future. The Missouri Ozark Highlands remains a highly diverse area of the country that can provide many opportunities for research projects. Future related projects should sample pre- and post-burn, as well as during years without drought to get a comparative data set. Other projects could include different sized islands to determine which size works best for the low-moderate intensity fires that are frequently seen in the Ozarks. Sampling methods could also include belowground litter bags in addition to pitfall samples to evaluate belowground diversity.

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AUTHOR CONTRIBUTIONS

Ashley N. Schulz, Lizzie W. Wright and Rose-Marie Muzika designed the research project, Ashley Schulz and Lizzie Wright set up the field experiments, Ashley Schulz performed the lab analysis, Ashley Schulz and Rose-Marie Muzika analyzed the data, Ashley Schulz wrote and Rose-Marie Muzika edited the paper.

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Empirically Derived Profiles of Teacher Stress, Burnout, and Self-efficacy and Associated Student Outcomes

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ABSTRACT

Understanding how teacher stress, burnout, and self-efficacy are inter-related and how they impact student outcomes such as disruptive behaviors and academic achievement can inform intervention development and implementation. Participants in this study were 121 teachers and 1,818 students in grades kindergarten to fourth grade. The participants were from six elementary schools in an urban Midwestern school district. Latent Profile Analysis was used to determine the number and characteristics of teachers' experiences with burnout, stress, efficacy, and confidence. These profiles were then linked to student behavioral and academic outcomes. Findings indicated that four classes of teacher adjustment were specified, including one class demonstrating high stress and burnout, and low coping, a second class with high stress and burnout and higher coping, a third class with average stress, low burnout, and higher coping, and a well-adjusted class experience low stress and burnout. Teachers in the high stress, high burnout, and low coping were associated with the poorest student outcomes. These established profiles and results could be used to reinforce the importance of developing and implementing interventions that increase teachers' ability to cope with the stresses of their jobs.

INTRODUCTION

Teachers play an important role in the lives of children, as they hold the responsibility of educating societies' youth. Decades of societal changes have led to a change in educational systems, thereby causing increased demands on teachers. Esteve (2000) articulates that the role of teaching no longer solely pertains to enhancing cognitive abilities, but now includes cultivating pro-social behaviors, providing sexual education, and fostering healthy psychological well being, among other duties. These new pressures created by a changing educational system are pushing more and more teachers out of the profession. For instance, in their 2007 report, Marvel et al. reported that 65% public school teachers and 51% of private school teachers, that left the education field, said that their current jobs were more manageable than teaching. Furthermore, about half of teachers leave the field within their first five years (Pas, Bradshaw, & Hershfeldt, 2012), costing the public school systems over 7 billion dollars a year (NCTAF, 2007). This illustrates the need for further research into the causes related to the decreased retention.

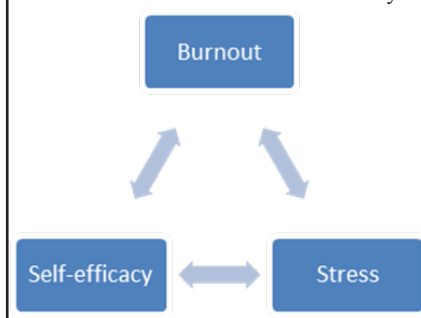
A host of research has been conducted to understand how the teachers experience the work that they do. For instance, researchers have investigated how stress, burnout, and self-efficacy are related to teacher and student outcomes

(see Pas, et al., 2012). However, associations between teacher stress, burnout, and self-efficacy and student outcomes have been evaluated separately. To date, researchers have not yet evaluated how these teacher characteristics in tandem are related to student outcomes. Understanding how teacher stress, burnout, and self-efficacy are inter-related and how they impact student outcomes such as disruptive behaviors and academic achievement can inform intervention development and implementation. Knowing teacher profiles of stress, burnout, and efficacy could assist in tailoring interventions to support teachers accordingly.

How do teacher stress, burnout, and low efficacy arise?

There is a reality-shock phenomenon, in the teaching profession, which may help shed light on the frustration that teachers experience. Friedman (2000) suggests that it is a difficult transition into the profession, because of the lack of training that teachers receive on how to deal with disruptive behavior. Emotional exhaustion is a response to an overwhelming amount of demand from one's job (Maslach et al., 2001). Burnout is the accumulation of responses to extended stressors caused by one's job; characteristics of burnout are emotional exhaustion, cynicism (depersonalization), and low levels of self-efficacy (Maslach, Schaufeli, & Leiter, 2001). The depersonalization aspect of burnout arises from the need to protect oneself from the negative emotional stressors on the job that can negatively affect job-performance (Maslach et al., 2001). So, the person becomes distant and uninvolved, and causes them to respond harshly to others. Inefficacy comes from too much demand and not enough resources to meet those demands; it is feelings of ineffectiveness (Maslach et al., 2001). The transactional model of stress proposes that when an individual has a negative appraisal between the demands placed upon them and their abilities to sufficiently manage those demands a stress response occurs (Spalovsky, 1998). Thus, teacher burnout, stress, and self-efficacy are likely inter-related and bi-directional (See Figure 1). This figure shows that the relationship between the three constructs is not a linear interaction, but can occur in tandem.

Figure 1. Relationship between Burnout Stress and Self-efficacy



In a study on the academic gains made in a school year of primary school students, Muijs & Reynolds (2002) found that academic achievement and yearly gains was best predicted by teacher behavior. Additionally, they gathered that teacher self-efficacy and subject knowledge greatly impacted teacher behavior, thereby creating an indirect relationship to student academic achievement. Self-efficacy is an important construct, in the sense that it is a fair predictor of future behavior. Self-efficacy theory suggests that if someone perceives success on a task, then they are likely to believe that they will be successful again in that task (Tschannen-Moran & Hoy, 2007). Conversely, if a teacher perceives that

they are not proficient in the academic achievement of their students, then the teacher will be less driven to attempt to further impact their students' achievement.

In Richards' (2012) survey study that examined the sources, manifestations, and coping strategies for stress, it was found that one of the top sources of stress was feeling a lack of control over school decisions that affect the teachers and their own students. Furthermore, the study found that the top two indicators of stress were constant feelings of exhaustion and loss of enthusiasm and idealism for teaching.

How does it impact Behavioral outcomes?

Pas et al. (2010) found that teachers with low efficacy were less likely to make referrals for their students. These findings suggest that teachers low in efficacy may be less inclined to seek the services for students in need of additional supports. It is important to note that a smaller number of referrals does not indicate a lesser number of occurrences for disruptive behaviors.

A recent study, tested whether three dimensions (disrespect, lack of attentiveness, and lack of sociability) of student classroom behavior were fair predictors of burnout in teachers, and found that they were. More specifically, lack of sociability predicted depersonalization and personal accomplishment burnout, and disrespectful behavior predicted emotional exhaustion and depersonalization burnout (Hastings & Bham, 2003). Before this, an Israeli study, found that disrespect is the student behavior can be used to best predict teacher burnout, but all three dimensions were found to account for 22% of burnout in teachers (Friedman, 1995). Hastings et al. (2003) suggest that it is possible that interventions targeted at dealing with classroom disruptive behavior could help in reduction of teacher burnout. These studies show that student misbehavior only accounts for a small amount of the variance in burnout, which leaves to the question of what other factors influence burnout. In contrast to these previous studies, this study aims to use burnout as an indicator and possible predictor of student classroom behavior.

The purpose of this study is to investigate how teacher stress, burnout, and self-efficacy co-occur for teachers and how these profiles are associated with student academic and behavioral outcomes. This study has the potential to inform interventions that will support teachers. Understanding how teacher stress, burnout, and self-efficacy co-occur for teachers has implications for tailoring interventions that meet the needs of these teacher profiles. Further, understanding teacher perceptions of stress, burnout, and efficacy, how they inter-relate, and how they impact student outcomes will expand the current extant literature. We hypothesized that several classes of teacher adjustment would emerge with regard to their levels of burnout, stress, confidence, efficacy, and coping. We anticipated a class in which teachers reported high levels of stress, burnout, and low levels of confidence, efficacy, and coping. We also expected a class with average levels of stress, burnout, confidence, efficacy, and coping. Lastly, we expected a well-adjusted class with low burnout and stress, and high levels of confidence, efficacy, and coping. In relation to student outcomes, we expect that well-adjusted teachers would report fewer behavior problems and have student in their classrooms that

have higher academic achievement. Whereas, the class with high burnout and stress would report having students with higher rates of behavior problems and students would have lower academic achievement.

METHODS

Participants

The data used for this study is from data collected from a larger ongoing randomized efficacy trial evaluating a teacher classroom management training program. Participants in this study were 121 teachers and 1,818 students in grades kindergarten to fourth grade. The participants were from six elementary schools in an urban Midwestern school district. Qualifications for teacher participation were based on whether they taught grades K-4 and whether they provided written consent. Students from grades K-4 whose parents signed a consent form participated in this study. Student assent was also obtained. Of the 121 teacher participants, 95% were female and 5% were male. The racial demographics of the teachers are 22% African American, 1% Asian, 76% Caucasian, 1% Hispanic, and 1% is listed as other. The percentage of teachers that taught each grade were 23% kindergarten, 25% first grade, 23% second grade, 18% third grade, and 11% fourth grade; 1% of the sample has missing data for this variable. 74% of the teachers were between the ages of 20-41, while 26% were above that age of 41. Student participants are predominantly African-American from low-income backgrounds.

Procedures

Teacher participants were recruited for the study across a period of three years. Some teachers were recruited to be part of the efficacy trial. Whereas other teachers were recruited to participate because student participants for whom one year follow-up data were being gathered as part of the larger efficacy trial were in their classroom. All teachers completed a packet of measures for each consented student in their class. Teachers in this study also completed self-report measures on their levels of burnout, stress, efficacy, confidence, and coping. This information was collected at the end of October for one cohort of teachers and at the beginning of May for the remaining teachers. Academic achievement, specifically reading and math, was assessed using the Woodcock-Johnson III NU Test of Achievement (WJ III ACH), a standardized measure of reading and math achievement. Student assent was obtained by trained assessment examiners. Undergraduate and graduate students from a university were trained in administering the WJ III ACH and passed a competency exam before working with the student participants. Following the completion of the WJ III ACH, the examiner provided the student with a small reward for participating and returned them to their classroom (e.g., fun pencil, eraser, pencil sharpener). The academic assessment was conducted at the same time point as the teacher self-report measures.

Measures

Teacher Burnout. The *Maslach Burnout Inventory* (MBI) was completed by all teachers to measure their levels of burnout. Burnout is described as emotional exhaustion, cynicism, and reduced feelings of accomplishment (Maslach, Jackson, &

Leiter, 1996). The MBI uses three subscales to measure three aspects of burnout, "emotional exhaustion, depersonalization, and lack of person accomplishment" (Maslach, Jackson, & Leiter, 1996, pg. 4). Scores on each scale are considered separately. Respondents answer on a seven-point scale from 0 "never" to 6 "every day". The emotional exhaustion subscale was utilized in this study.

Teacher Stress. Two questions were asked of teachers to measure the level of stress that they were currently experiencing. One question asked, "How stressful is your job?" The other question asked, "How well are you coping with stress of your job right now?" Question 1 was answered on a ten point Likert-type scale from 0 "not stressful" to 10 "very stressful". Question 2 was answered on a ten point Likert-type scale from 0 "not well" to 10 "very well".

Teacher Confidence in Classroom Management. Teachers were asked, "How confident are you in managing current problems in your classrooms?" The question was answered on a seven point Likert-type scale from 1 "very unconfident" to 7 "very confident".

Teachers Sense of Efficacy Scale. The Ohio State teacher efficacy scale (OSTES) was completed by all teachers as a measure of teacher self-efficacy (Tschannen-Moran, & Woolfolk Hoy, 2001). The OSTES has a long and short form to measure teacher efficacy in student engagement, instructional strategies and classroom management. For this study, the eight items on the subscales of teacher self-efficacy of classroom management were given to teachers to answer. Teachers responded to each item by indicating the amount they can do regarding each item, from "nothing" (0) to "a great deal" (9).

Teacher Report of Student Behavior. The Teacher Observation of Classroom Adaptation Checklist (TOCA-C) was completed by all teachers for each student (Koth, Bradshaw, & Leaf, 2009). The TOCA-C includes seven subscales, concentration problems, disruptive behavior, prosocial behavior, emotional regulation, internalizing problems, family problems, and family involvement. For the prosocial behavioral and family involvement subscales, higher scores indicate more positive outcomes; whereas higher scores for the other subscales indicate more problems. Each item is rated on a six point scale, with 1 "never" to 6 "almost always". For the purposes of this study the disruptive behavior, prosocial behavior, emotional regulation, and internalizing problems subscales were utilized. Student scores on each measure were aggregated at the classroom level for each teacher.

Student Academic Achievement. The Woodcock-Johnson III Tests of Achievement (WJIII ACH, Mather & Woodcock, 2001) was used to evaluate student achievement. Six subtests of the WJIII ACH were administered to all of the students in the fall and spring. The broad reading and broad math subscales were utilized for this study. Student scores were aggregated at the classroom level for each teacher.

Analysis

Latent profile analysis (LPA) was used to examine patterns of five indicators of teacher adjustment, emotional exhaustion, stress, confidence, coping, and self-efficacy (Nylund et al., 2005). The basis of LPA is that within each class the behaviors are locally independent. For this study, this means that teacher adjustment can be explained by an underlying

classification of teachers into subclasses with similar patterns of burnout, stress, efficacy, confidence, and coping. Overall, the goal of LPA is to identify the smallest number of classes that accurately describes the association between the teacher adjustment indicators. The results for the characteristics for identified latent profiles are expressed in mean levels of stress, burnout, confidence, coping, and self-efficacy and the prevalence or proportion of teachers in each class.

All analyses were conducted using MPlus 6.0 (Muthén & Muthén, 1998-2010). In LPA, a combination of statistical considerations and substantive theory are used to decide on the best fitting model. To determine the relative fit of the models, we compared models with differing numbers of classes using the Akaike information criterion (AIC; Akaike, 1987), the Bayesian information criterion

(BIC; Schwartz, 1978), and the sample-size adjusted Bayesian information criterion (aBIC; Sclove, 1987). In these analyses, more weight was given to the Bayesian Information Criterion (BIC; Schwartz, 1978) because simulation studies suggest that the BIC provides the most reliable indicators of true model fit (Nylund et al., 2005). Typically, the smaller the information criteria, the better the model fit to the data. Further, we used a likelihood difference test, the Vuong-Lo-Mendall-Rubin (VLMR; Vuong, 1989; Lo, Mendall, & Rubin, 2001), which assesses the fit between two nested models that differ by one class and provides a p value that indicates which model fits best. In addition, we evaluated the classification precision as indicated by estimated posterior class probabilities, summarized by the entropy measure (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993). Entropy values close to 1.0 indicate higher classification precision. Lastly, a bootstrapped parametric likelihood ratio test (BLRT) procedure was used to confirm the best fitting model once other model fit indicators, class prevalence and interpretability were examined (see McLachlan, 1987; Nylund, Asparouhov, & Muthén, 2007).

Once the best solution was identified, profiles were examined to determine if they could be differentiated from one another using student behavior and academic achievement. This step is important, as it provides evidence that the profiles represent meaningful subsamples of the population as opposed to data patterns. To accomplish this, the Mplus Auxiliary function (Muthén & Muthén, 2010) was used for all continuous external variables while controlling for intervention status. This method derives profile membership based on the observed risk factor scores and uses the posterior probabilities to compute means for each external variable (emotional regulation problems, concentration problems, internalizing problems, disruptive behavior, prosocial behavior, reading, and math achievement). Some teacher had received the teacher classroom management training and other had not. Intervention was not a significant predictor of the teacher profiles. Differences between these mean scores were then tested for statistical significance. In all analyses, standard errors were corrected to reflect the fact that children were clustered within classrooms (Reboussin, Song, Shrestha, Lohman, & Wolfson, et al., 2006). To accommodate for

missing data, Mplus software uses full information maximum likelihood with the assumption that the data are missing at random (Little, 1995), a common approach employed within this analysis method (Schafer & Graham, 2002).

RESULTS

Teacher report of stress, burnout, self-efficacy, coping, and confidence were utilized to determine the optimal number of profiles for teacher adjustment. The four-class solution emerged as the best class solution for the data, because it indicates the lowest BIC score. LPA fit indices for class solutions are summarized in Table 1.

Table 1. Model Fit Indices for 1-4 Class solutions of Teacher Stress Profiles

	AIC	BIC	Adj BIC	VLMR LRT	Entropy
2 class solution	2033.61	2078.34	2027.75	0.004	0.91
3 class solution	1983.27	2044.77	1975.22	0.22	0.90
4 class solution	1951.64	2029.92	1941.39	0.17	0.85

Note. LC = Latent class; AIC = Akaike information criterion; BIC = Bayesian information criterion; aBIC = adjusted Bayesian information criterion. Bold indicates best fit: The three-class solution had the lowest BIC and the VLMR LRT and the Bootstrap LRT indicated the 3-class solution provided a better fit than the 4-class solution. All entropy ratings indicate acceptable fit. Entropy values close to 1.0 indicate higher classification precision.

Figure 2. Mean Scores for the Four Class Solution

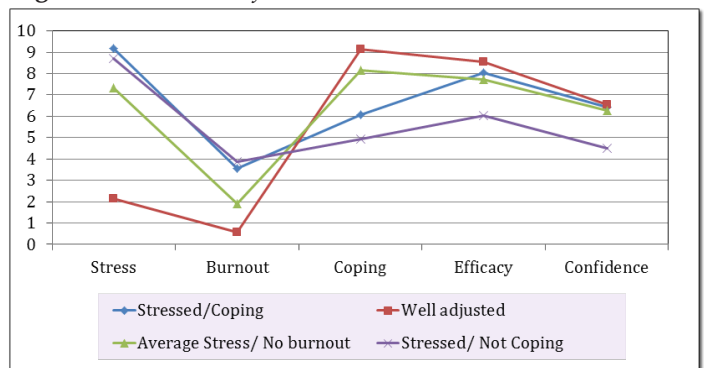


Figure 2 provides the mean score and illustrates the characteristics of each of the four classes of teacher adjustment. With 17% of the participants (n=21), Class 1 is described as the High Stress/Not coping class provided that this group had mean scores higher than the average level of stress and burnout and lower than average levels of coping, confidence and self-efficacy. Class 2 was characterized as the Well Adjusted class and included the smallest number of participants (7%; n=8). This class had lower than average mean scores of stress and burnout and higher than average scores of coping, confidence, and self-efficacy. Class 3, with 19% of the participants, is described as High Stress/Coping class (n = 23). This class is characterized by higher than average stress and burnout, but considered to be coping, efficacious and confident. Finally, average scores on all measures characterize Class 4, which is described as the Average Stress and Coping and No Burnout class (57%; n=69).

Student Outcomes

Descriptive statistics for student outcome variables by teacher classes are specified in Table 2. Findings indicate that across all outcomes, the High Stress/Not Coping class demonstrated the highest rates of student behavior problems and lowest academic achievement. Statistically significant differences were observed between the four classes of teacher adjustment in terms of teacher-reported student prosocial behavior and other behavioral problems.

Table 2. Means, Standard Error, & Equality Tests across Teacher Profiles of Stress, Burnout, Confidence, & Efficacy (n=121)

	Class 1: High Stress and Not Coping (n=21)	Class 2: Well Adjusted (n=8)	Class 3: High Stress and Coping (n=23)	Class 4: Average Stress and Coping and No Burnout (n=69)	Overall Test of Significance	Significant Class Comparisons
Teacher Report						
Emotional Regulation	2.55 (.08)	1.97 (.27)	2.33 (.11)	2.24 (.09)	7.24	Class 1 vs. 2* Class 1 vs. 4**
Concentration	3.10 (.09)	2.19 (.30)	2.70 (.10)	2.70 (.08)	15.10**	Class 1 vs. 2** Class 1 vs. 3** Class 1 vs. 4**
Internalizing problems	2.00 (.10)	1.43 (.15)	1.81 (.10)	1.70 (.06)	9.33*	Class 1 vs. 2** Class 1 vs. 4** Class 2 vs. 3*
Disruptive Behavior	2.17 (.07)	1.57 (.15)	1.90 (.08)	1.86 (.06)	16.39**	Class 1 vs. 2*** Class 1 vs. 3*** Class 1 vs. 4***
Prosocial Behavior	4.30 (.07)	5.22 (.20)	4.79 (.12)	4.73 (.09)	25.18***	Class 1 vs. 2*** Class 1 vs. 3*** Class 1 vs. 4*** Class 2 vs. 4*
Student Achievement						
WJ Reading	95.98 (1.47)	99.49 (2.09)	99.21 (1.34)	98.61 (.75)	3.19	-----
WJ Math	93.03 (1.13)	96.58 (2.09)	97.90 (1.68)	96.97 (.97)	7.30	Class 1 vs. 3* Class 1 vs. 4**

Note: Chi-square *p*-values: * *p* < .05 ** *p* < .01 *** *p* < .001

The overall test of significance was considered significant for prosocial behavior (*p* < .001). The High stress/Not coping class had significantly lower mean scores on prosocial behavior (*M* = 4.30) than the Well Adjusted class (*M* = 5.22; $\chi^2 = 18.54$, *p* < .001), High stress/Coping (*M* = 4.79; $\chi^2 = 14.77$, *p* < .001), and the Average Stress class (*M* = 4.73; $\chi^2 = 12.69$, *p* < .001). The Well Adjusted class had higher mean scores for prosocial behavior (*M* = 5.22) than the Average Stress class (*M* = 4.73; $\chi^2 = 4.85$, *p* < .05).

Although, the overall test was found not found to be significant for emotional regulation, there were some significant class differences. The High stress/Not coping class had significantly higher mean scores (*M* = 2.55) and was significantly different from the Well Adjusted class (*M* = 1.97; $\chi^2 = 4.28$, *p* < .05), and the Average Stress class (*M* = 2.24; $\chi^2 = 7.27$, *p* < .01). The overall test for internalizing problems was significant (*p* < .05). In addition, the High stress/Not coping class had higher mean scores (*M* = 2.00) than the Well Adjusted class (1.43; $\chi^2 = 10.21$, *p* < .01), and the Average Stress class (*M* = 1.70; $\chi^2 = 6.84$, *p* < .01). The Well Adjusted class had lower mean scores for internalizing problems (*M* = 1.43) than the High stress/Coping class (*M* = 1.81; $\chi^2 = 4.55$, *p* < .05).

The overall tests of significance were considered significant for disruptive behavior (*p* < .01) and concentration problems (*p* < .01). The High stress/Not coping class

(*M* = 2.17) had significantly higher disruptive behavior mean scores than the Well Adjusted class (*M* = 1.57; $\chi^2 = 13.02$, *p* < .001), High stress/Coping (*M* = 1.90; $\chi^2 = 6.91$, *p* < .01), and the Average Stress class (*M* = 1.86; $\chi^2 = 13.09$, *p* < .001). For concentration problems, The High stress/Not coping class had the highest mean scores for concentration problems (*M* = 3.10) and was significantly different from the Well Adjusted class (*M* = 2.19; $\chi^2 = 8.53$, *p* < .01), the High Stress/Coping class (*M* = 2.70; $\chi^2 = 10.48$, *p* < .01), and the Average Stress and Coping and No Burnout class (*M* = 2.70; $\chi^2 = 8.54$, *p* < .01).

With *p*-values greater than .05, the overall significant tests for WJ reading and math did not yield statistically

significant results. There were no significant class comparisons for student reading achievement. However, there were significant class differences for student math. The students in the High stress/Not coping had lower mean scores (*M* = 93.03) than the students in the High Stress/Coping (*M* = 97.90; $\chi^2 = 5.76$, *p* < .05), and the Average Stress (*M* = 96.97; $\chi^2 = 6.89$, *p* < .01) classes.

DISCUSSION

The purpose of this study was to determine the number of teacher profiles for teacher adjustment across indicators of burnout, stress, efficacy, and confidence. In addition, the associations between student behavior and academic outcomes and the teacher adjustment profiles was investigated. As hypothesized, there were distinct profiles of teacher

stress, burnout, and self-efficacy. In addition, there were significant associations with student behavior outcomes. Interestingly, four teacher adjustment profiles emerged with the lowest prevalence of teacher falling into the Well-adjusted profile (n=8). This indicates that in general most teachers experience some levels of stress and burnout. The main distinguishing feature of teacher classes was the level of teacher reporting coping or level of burnout. For instance, one class had average levels of stress and coping, but lower levels of burnout. In addition, two other classes were almost identical with regard to the level so stress and burnout, but one class demonstrated higher levels of coping. These are important distinction in that interventions to support teachers would vary on the profiles. Specifically, teachers who demonstrated the highest stress and low coping would likely benefit from supports that teach coping strategies in conjunction with building skills toward effective classroom management.

Interestingly, the teacher class with lowest performing student outcomes was the class with high stress and low coping. Furthermore, teachers in this class (high stress/low coping) performed significantly worse on behavioral outcomes and math than the other classes. Intervening with these teachers early would be important to support optimal outcomes for students.

LIMITATIONS

All results from this study cannot establish a causal relationship, based on this being a correlational study. It can only be concluded that there are existing relationships. As mentioned before, teachers were involved in the study at different time points. So it is possible that different parts of the year affect teacher adjustment differently, and could account for differences in teacher reports. Pre and post-tests were not performed for teacher adjustment or student outcomes. Regardless, the findings from this study enhance our current knowledge of how stress, efficacy, and burnout among teachers interplay and may impact student outcomes.

The current research on teacher burnout and efficacy indicate that teachers would benefit from additional supports in classroom management and other areas to avoid them leaving the field early in their career. This study demonstrates that not all teacher experience stress and burnout in the same fashion. Thus, determining the specific needs of teachers when building supports could optimize outcomes for both teachers and students. In particular, those teachers not coping well and experiencing high levels of stress and burnout demonstrated higher rates of student behavioral challenges and lower academic achievement. Thus, targeting intervention supports to these teachers may be most beneficial. Teacher stress and burnout are significant problems impacting our schools. Finding innovative and impactful ways to improve outcomes for students by supporting teachers would make a significant contribution to society.

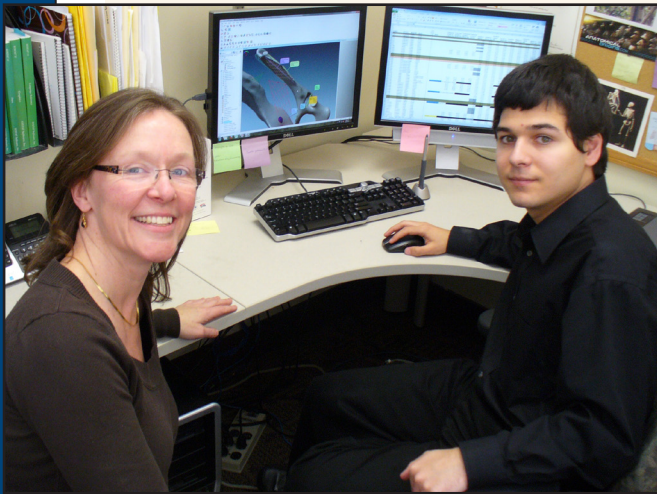
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Iliac Orientation and Locomotor Evolution of Anthropoid Primates

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ABSTRACT

Suspensory locomotor behaviors are the hallmark of all living ape species, and identifying when the earliest apes made the transition from above-branch quadrupedalism to below-branch suspension is key to understanding ape and human evolution. Pelvic anatomy is thought to reflect biomechanical differences in suspensory vs. quadrupedal behaviors, and might provide clues as to when suspensory behaviors evolved. Iliac blade orientation, in particular, should mirror shape differences in the ribcage associated with suspensory or non-suspensory locomotor behaviors. Unfortunately, iliac orientation is difficult to quantify on isolated (disarticulated) bones, limiting our ability to interpret isolated fossil hipbones. To address this issue, we measured iliac orientation in hipbones digitally articulated relative to the midline, testing the hypothesis that this feature using both os coxa (properly defining the midline of the organisms) reflects locomotor capabilities (Figure 1). This has been measured in humans, who have shown to have sagittally facing ilia relative to their midline (Lovejoy, 1988). We attempt to find if the ilium is oriented differently in suspensory and quadrupedal primates. Based on thoracic structure, we predicted that humans would have a sagittally ilium, suspensory primates would have a coronally oriented ilium, and because they are also bipedal, that humans would have the most sagittally oriented ilium of all. As predicted, suspensory primates were found to generally have a more coronally oriented iliac blade than non-suspensory primates. However, the orientation of the medial portion of the iliac blade did not differ between these locomotor groups, suggesting certain aspects of iliac morphology might be more informative than others. Our results demonstrate a relationship between locomotion and pelvic anatomy, forming the beginnings of an anatomical framework for which fossil locomotor behaviors can be reconstructed.

INTRODUCTION

Shifts in locomotor behavior underlie key transitions in the evolution of apes and humans. The hallmark of all great apes (hominoids) is their unique locomotor adaptation, which involves moving through trees by hanging below branches, rather than walking above them like most other primates. Understanding when and how this transition occurred is the key to deciphering why and how apes evolved, and to reconstructing the ancestral condition from which our ancestors evolved. Similarly, the transition to terrestrial bipedal gait was the key feature that distinguished early hominins from their ape forbears.

This unique form of locomotion has shaped the anatomy

of all living apes. Not only do they have long upper limbs with long curved fingers and short lower limbs, their entire torsos are shaped differently from those of other, quadrupedal primates (Figure 1). Monkeys have narrow rib cages with scapulae (shoulder blades) that lie on the side of the rib cage with the shoulder joint facing the ground, which facilitates limb movements in flexion-extension such as occurs during quadrupedal walking. Apes, on the other hand, have broadened the rib cage and reoriented their scapulae so that the shoulder joint face coronally and the muscles that run between the torso and upper limb are positioned not just to move the limbs forward and backward, but to pull them up from a hanging position (Schultz 1961) (Figure 1). The pelvis is thought to reflect this torso reorganization, such that monkeys have narrow, almost sagittally oriented upper pelves, or iliac blades, whereas those of apes are hypothesized to be wider and rotated so that their external surfaces face coronally (Ward., 1993; Waterman 1929; Benton 1974).

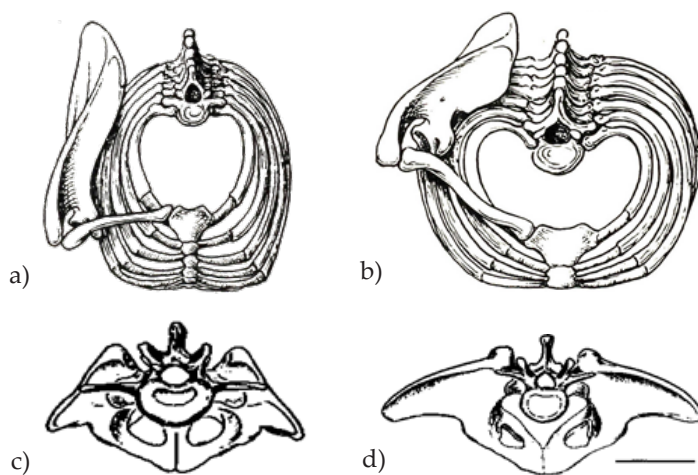


Figure 1. Anatomy of the thorax of an ape and a monkey, adapted from Schultz (1961). In a cranial view, a) upper thorax of a monkey b) upper thorax of an ape c) pelvis of a monkey d) pelvis of an ape.

This presumed difference has been used to interpret locomotor adaptation in fossil hominoids. The oldest fossil ape pelvis is attributed to *Proconsul nyanzae* from Kenya, dated to about 18 million years ago (Ward, 1993). Based partly on the fact that its iliac blades were sagittally oriented more like that of monkeys and not modern apes, Ward (1993) interpreted this animal to have been an above branch quadruped. This suggested then that modern apes evolved suspensory adaptations some time more recently.

Furthermore, iliac orientation is related to the evolution of human locomotion. Hominins differ even from apes because of our unique bipedal gait and posture. To balance side to side when on a single supporting limb, as occurs during normal walking and running, *Homo sapiens*, and our fossil relatives such as *Australopithecus afarensis* have iliac blades that are highly rotated so that their external surfaces face laterally, positioning the lesser gluteal musculature in a position to effect this balance (Lovejoy, 1988)

Therefore, iliac blade orientation in primates has been

hypothesized to reflect locomotor adaptation. Despite the potential utility of this trait for understanding fossil primates, the association between iliac orientation and the body's midline or median plane has never been tested. Because the pelvis is formed of three bones, two os coxae and the sacrum, three dimensional anatomy of the bony pelvis has been difficult to quantify using traditional methodologies. The advent of laser scanning technology provides the ability to capture a virtual 3D image of a hipbone. The ability to capture 3D landmarks enables us to register these images to the midline plane, and then measure the orientation of various parts of the pelvis. This research uses registered 3D polygonal models of hipbones from a variety of primates to test the hypothesis that iliac orientation is correlated with locomotor adaptation in anthropoid primates. Specifically, suspensory apes should have ilia that are more coronally oriented than those of nonsuspensory quadrupedal taxa. In addition, humans should have the most sagittally oriented ilia among all anthropoids.

Suspensory locomotion allows a large animal to distribute its weight over multiple supports in the canopy to reach fruit, which is the staple diet of most primates and is located on the small terminal branches. This enables apes to remain arboreal even with large body size. Monkeys, in contrast, can walk quadrupedally above branches partly because of their small size. This provides insight into how anatomical trends can reflect behavioral adaptations (Temerin and Cant 1983).

MATERIALS AND METHODS

Sample

Microscribe landmark data and laser scans were collected for the pelves of 250 extant anthropoid primates (Table 1). The sample used in this project is comparable in size and diversity to other laser scan projects (Tocheri et al., 2005; Marzke et al., 2010). All species groups in the sample were grouped by general locomotor adaptation and phylogenetic relationship. These groups are modern humans (*Homo sapiens*), Asian apes (*Pongo pygmaeus*, *Pongo abelii*, *Hylobates lar*, *Symphalangus syndactylus*), African apes (*Pan troglodytes*, *Pan paniscus*, *Gorilla gorilla*, *Gorilla beringei*), colobines (*Colobus guereza*, *Nasalis roxellanae*), cercopithecines (*Cercopithecus mitis*, *Erythrocebus patas*, *Macaca fascicularis*, *Macaca nemestrina*, *Papio anubis*, *Papio cynocephalus*, *Theropithecus gelada*), platyrrhines (*Alouatta caraya*, *Ateles geoffroyi*, *Ateles paniscus*, *Cebus apella*), and atelines (*Ateles fusciceps*).

All specimens were fully matured as determined by physeal fusion, wild shot, and free of apparent pathologies. Scan data were collected from specimens at the United States National Museum (USNM), Museum of Comparative Zoology at Harvard (MCZH), Cleveland Museum of Natural History (CMNH), American Museum of Natural History (AMNH), Naturalis Leiden (ZMA), Bavarian State Zoological Collections (ZSM), and the National Museums of Kenya (KNM), Royal Museum for Central Africa (MRAC), University of Zurich (UZIA), and the Powell Cotton Museum (PCM).

Taxon	♂ ♀	Museum
platyrrhines (n=33)		
<i>Alouatta caraya</i>	6 3	AMNH
<i>Ateles fusciceps</i>	1 0	USNM
<i>Ateles geoffroyi</i>	0 3	USNM
<i>Ateles paniscus</i>	3 0	ZMA, AMNH
<i>Cebus apella</i>	2 5	USNM, ZMA
colobines (n=52)		
<i>Colobus guereza</i>	2 2	USNM, KNM
<i>Nasalis larvatus</i>	8 9	ZSM, MCZH, USNM
<i>Procolobus badius</i>	0 4	PCM
<i>Pygathrix nemaeus</i>	3 0	MCZH, AMNH, USNM
<i>Rhinopithecus roxellana</i>	0 2	USNM, AMNH
<i>Trachypithecus cristatus</i>	8 8	ZSM, MCZH, USNM, ZMA
cercopithecines (n=55)		
<i>Cercopithecus mitis</i>	4 4	USNM
<i>Erythrocebus patas</i>	3 2	AMNH, USNM, ZSM
<i>Macaca fascicularis</i>	4 6	MCZH, USNM
<i>Macaca nemestrina</i>	1 5	MCZH
<i>Papio anubis</i>	4 5	USNM
<i>Papio cynocephalus</i>	1 7	USNM, KNM
<i>Theropithecus gelada</i>	3 6	ZMA, USNM, UZIA
hominoids (n=129)		
<i>Gorilla beringei</i>	3 3	USNM
<i>Gorilla gorilla</i>	10 8	CMNH, USNM
<i>Homo sapiens</i>	9 11	USNM, CMNH
<i>Hylobates lar</i>	6 10	ZSM, MCZH
<i>Pan paniscus</i>	5 6	MRAC
<i>Pan troglodytes</i>	8 10	CMNH, USNM
<i>Pongo abelii</i>	3 3	MCZH, USNM
<i>Pongo pygmaeus</i>	4 9	CMNH, ZMA, MCZH, USNM
<i>Symphalangus syndactylus</i>	7 11	ZSM, USNM, AMNH

Table 1. Extant laser scan and microscribe landmark sample (n=250)

Laser Scan Data Methods

The left hipbone was scanned for each specimen. Scan data were collected with a Next Engine Desktop 3D Scanner (Next Engine, Malibu, CA, USA) or a Konica-Minolta Vivid 9i (Konica-Minolta, Tokyo, Japan). For each hipbone, a polygonal model of the bone's surface was digitally assembled. The polygonal model of each hipbone was then imported into the IMEdit module of PolyWorks software (InnovMetric, Québec, Canada) for final processing and cleaning by visual inspection.

Microscribe Landmark Methods

Microscribe landmark data eliminates the need to laser scan both halves of the pelvis and sacrum by providing 3D landmarks that can be used to align the hipbone in the PolyWorks virtual environment.

First, the left and right hipbones and sacrum were articulated using putty and rubberbands. The thickness of the putty at the pubic symphysis and sacroiliac joints is approximately 3mm, following Li (2002) and Ward (2009). The microscribe data supplies 5 landmark coordinates of the left os coxa (anterior superior iliac spine (ASIS), posterior inferior iliac spine (PIIS), dorsal border of the acetabulum, center of acetabular fossa, and

ischial spine) and 5 midline points used to establish the midline plane (Figure 2). Microscribe landmark data were then collected on the articulated pelvis using a Microscribe 2Gx.

Digital Alignment Methods

For each specimen, the laser scanned os coxa was aligned to its matching microscribe landmark coordinates in the PolyWorks IMInspect module. First, the microscribe x, y, z landmark coordinate data were saved as tabular data in text files (.txt) and imported into the IMInspect workspace. The PolyWorks virtual environment also works within an x, y, z system and can recognize the numeric data as coordinates within its environment. Landmarks were manually identified as point objects, one of the PolyWorks geometrical primitives, giving the landmarks a three-dimensional anchor in the virtual environment. The midline plane was then established using these point objects. (Figure 2) A best-fit plane was established to point objects created from landmarks 6-10, corresponding to the pubic symphysis and sacral midline.

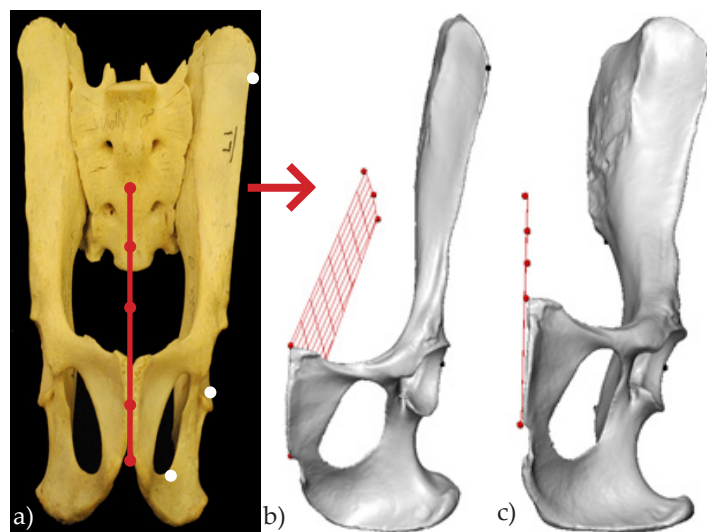


Figure 2. Aligning the hipbone to the midline plane. A hipbone is laser scanned and microscribe landmarks are collected from the articulated pelvis (landmarks are superimposed on the pelvis shown). a) A monkey pelvis from a ventral view, b) A monkey os coxa from a ventral view, and c) A monkey os coxa from a lateral view showing the midline plane in red.

The polygonal model of the matching os coxa was then imported into the IMInspect workspace. The model loads with 3D coordinates assigned by the scanner and so it must be aligned to the landmark coordinate data manually. Points on the pelvis model were anchored at the anterior superior iliac spine, posterior inferior iliac spine, center of the acetabular fossa, ischial spine, and dorsal border of the acetabulum, in the same locations as microscribe landmarks 1-5 collected on the original specimen. The IMInspect center point alignment operation was then used to align the 5 points on the polygonal model to the points established from the landmark data, dragging the polygonal model into alignment along the midline plane in the process.

Methods for Measuring Iliac Orientation

Iliac orientation was defined by setting three planes fit to different aspects of the ilium in the IMInspect module of PolyWorks. The Lateral Iliac Surface plane was derived from data points selected between the laterally facing section of the iliac blade cranial to its narrowest point (Figure 3a). This plane reflects the orientation of the gluteal musculature. The Medial Iliac Surface plane was fit to the internal surface of the ilium anterior to the sacroiliac joint and adjacent surface cranial to its narrowest point, and represents the origin of the iliacus muscle (Figure 3b). The Whole Iliac Plane was defined using all on all sides of the ilium cranial to its narrowest point, and represents overall orientation of the ilium and iliac crest (Figure 3c).

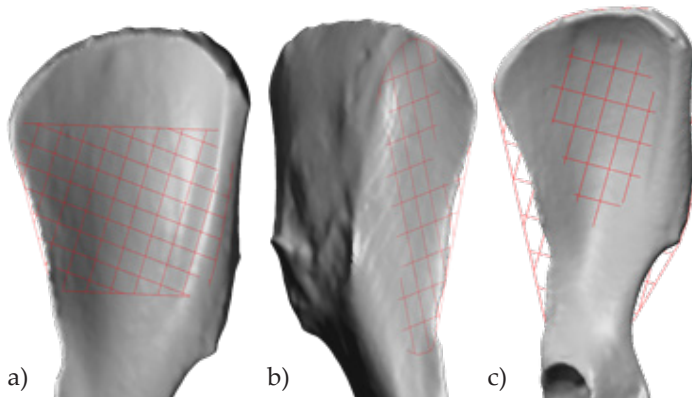


Figure 3. The ilium of a *Papio anubis*, showing creation of iliac planes. For each, data points were selected and a best-fit plane created. a) lateral iliac surface plane b) medial iliac surface plane c) whole iliac plane.

Angles were measured between the Medial Iliac Surface Plane, Lateral Iliac Surface Plane, Whole Iliac Plane, and the midline plane using the IMInspect module of PolyWorks. Groups were compared using ANOVA (significant $p < 0.05$) and with Tukey post-hoc tests (significant $p < 0.05$).

RESULTS

An error study was performed to quantify the accuracy of the measurements.

The error study sample included *Ateles* (n=2), *Hylobates* (n=2), *Pan* (n=2), *Papio* (n=2), *Pongo* (n=2), and *Trachypithecus* (n=2). A total of 12 individuals were measured 3 times for all 3 measurements, except for Whole Iliac Plane to Midline, which excluded *Hylobates* from the error study sample. Error was calculated as the percent difference between the repeated trials and was found to be very low in all measurements taken (Table 5).

	Medial Iliac Surface to Midline Plane	Lateral Iliac Surface to Midline Plane	Whole Iliac to Midline Plane
Max Error	1.77	2.69	0.32
Average Error	0.48	0.69	0.09

Table 2. Results of the error study of measurements taken on ilia.

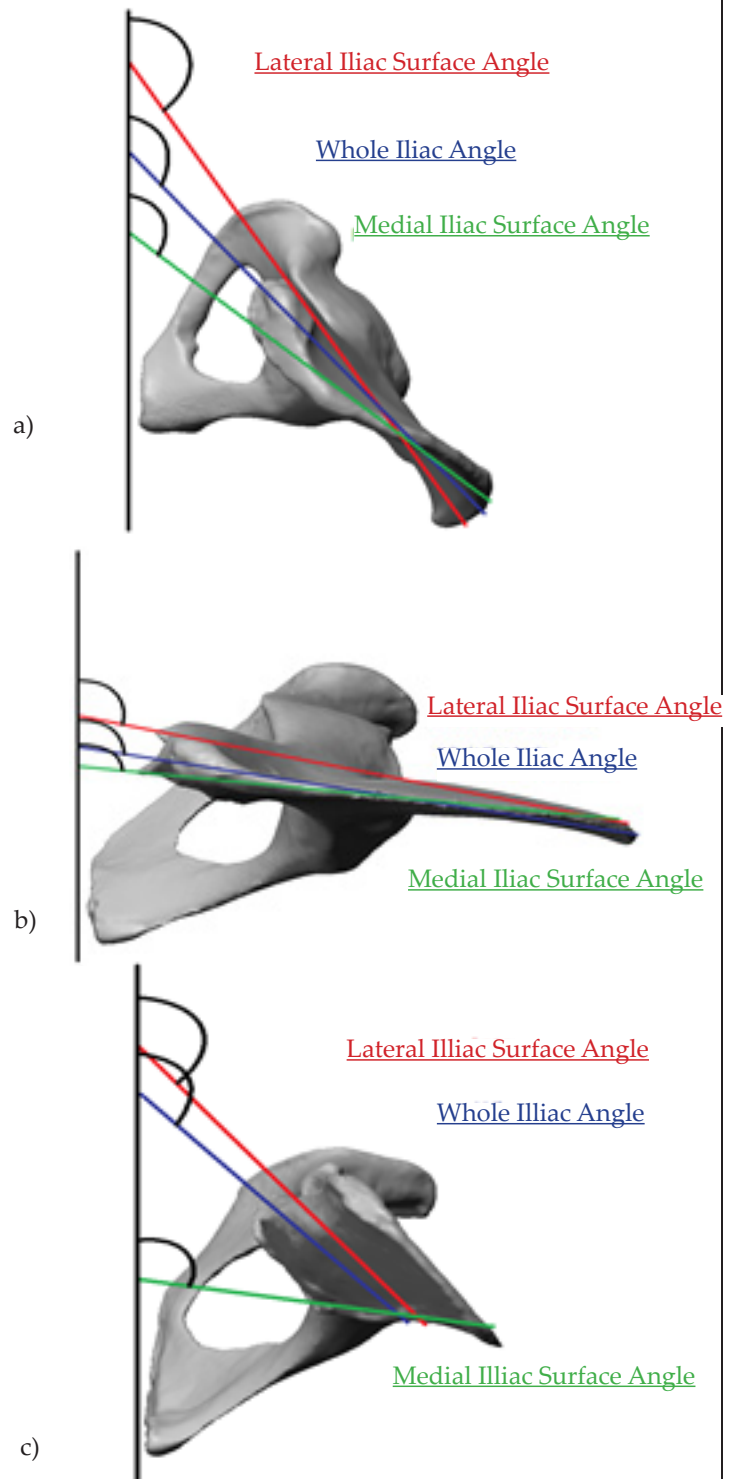


Figure 4. All angles measured against the midline in cranial view. a) Human os coxa. b) Chimpanzee os coxa. c) Cercopithecus os coxa.

	Humans	Asian apes	African apes	colobines	cercopithecines	<i>Alouatta</i> and <i>Cebus</i>	Atelines
Humans	1.00	-	-	-	-	-	-
Asian apes	0.00	1.00	-	-	-	-	-
African apes	0.00	0.99	1.00	-	-	-	-
colobines	0.00	0.00	0.00	1.00	-	-	-
cercopithecines	0.00	0.00	0.00	0.98	1.00	-	-
<i>Alouatta</i> and <i>Cebus</i>	0.00	0.00	0.00	1.00	1.00	1.00	-
Atelines	0.00	0.00	0.01	0.21	0.07	0.32	1.00

Table 3a. Results of Tukey post-hoc tests for differences in among group means, p values. Values from lateral iliac surface plane to midline plane orientation. $p \leq 0.05$ = significant

Humans have a more sagittally facing lateral iliac surface of all anthropoids in the sample ($p < 0.01$) (Table 6a and Figure 4a). All apes (*Homo sapiens*, *Pan troglodytes*, *Pan paniscus*, *Gorilla gorilla*, *Gorilla beringei*, *Pongo pygmaeus*, *Pongo abelii*, *Hylobates lar*, *Symphalangus syndactylus*) share the same orientation to each other ($p = 0.99$), with the most coronally oriented ilia in the sample. Monkeys are also all equivalent to each other ($p > 0.06$), with more sagittally oriented ilia than apes, but not to the same degree as humans ($p < 0.02$)

The Medial Iliac Plane shows a somewhat different pattern (Table 6b and Figure 4c). Humans are still the most sagittally oriented, differing from all other taxa ($p < 0.01$). Monkeys and Asian apes (*Pongo*, *Symphalangus* and *Hylobates*) have more coronally oriented medial iliac surfaces than do humans, and are not significantly different. African apes have even more coronal orientations than the other taxa ($p < 0.05$).

	Humans	Asian apes	African apes	colobines	cercopithecines	<i>Alouatta</i> and <i>Cebus</i>	Atelines
Humans	1.00	-	-	-	-	-	-
Asian apes	0.00	1.00	-	-	-	-	-
African apes	0.00	0.99	1.00	-	-	-	-
colobines	0.00	0.00	0.00	1.00	-	-	-
cercopithecines	0.00	0.00	0.00	0.98	1.00	-	-
<i>Alouatta</i> and <i>Cebus</i>	0.00	0.00	0.00	1.00	1.00	1.00	-
Atelines	0.00	0.03	0.07	0.035	0.01	0.064	1.00

Table 3b. Results of Tukey post-hoc tests for differences in among group means, p values. Values from whole iliac plane to midline plane orientation.

The whole iliac angle showed a similar pattern (Table 6c and Figure 4b) show that humans again have a statistically greater difference from the other groups, with their whole iliac plane orientated sagittally to the midline ($p < 0.01$). Apes again share the same trend in orientation as for Lateral Iliac Angle with a whole iliac plane to the midline ($p = 0.99$). Colobines, cercopithecines, and *Alouatta* and *Cebus* all shared similar orientations ($p > 0.97$), having angles between humans and apes. Ateles had a whole iliac orientation between the other monkeys and apes, but still significantly different from both ($p = 0.07$).

DISCUSSION

The analysis presented here generally supported the hypothesis that suspensory primates have more coronally oriented iliac blades than nonsuspensory taxa, and confirmed that humans have very sagittally oriented iliac blades compared to all other anthropoids. Lateral iliac plane relative to the midline discriminates suspensory apes from all monkeys, although it should be noted that the mean for semi-suspensory atelines is closer to the values for apes than the other monkeys. In the whole iliac plane to midline, we see a trend nearly identical to the one seen in the lateral iliac plane, reflecting

	Humans	Asian apes	African apes	colobines	cercopithecines	<i>Alouatta</i> and <i>Cebus</i>	Atelines
Humans	1.00	-	-	-	-	-	-
Asian apes	0.00	1.00	-	-	-	-	-
African apes	0.00	0.00	1.00	-	-	-	-
colobines	0.00	0.79	0.00	1.00	-	-	-
cercopithecines	0.00	0.12	0.05	0.946	1.00	-	-
<i>Alouatta</i> and <i>Cebus</i>	0.00	0.99	0.00	0.58	0.14	1.00	-
Atelines	0.00	0.42	0.00	0.10	0.02	0.86	1.00

Table 3c. Results of Tukey post-hoc tests for differences in among group means, p values. Values from medial iliac surface plane to midline plane orientation.

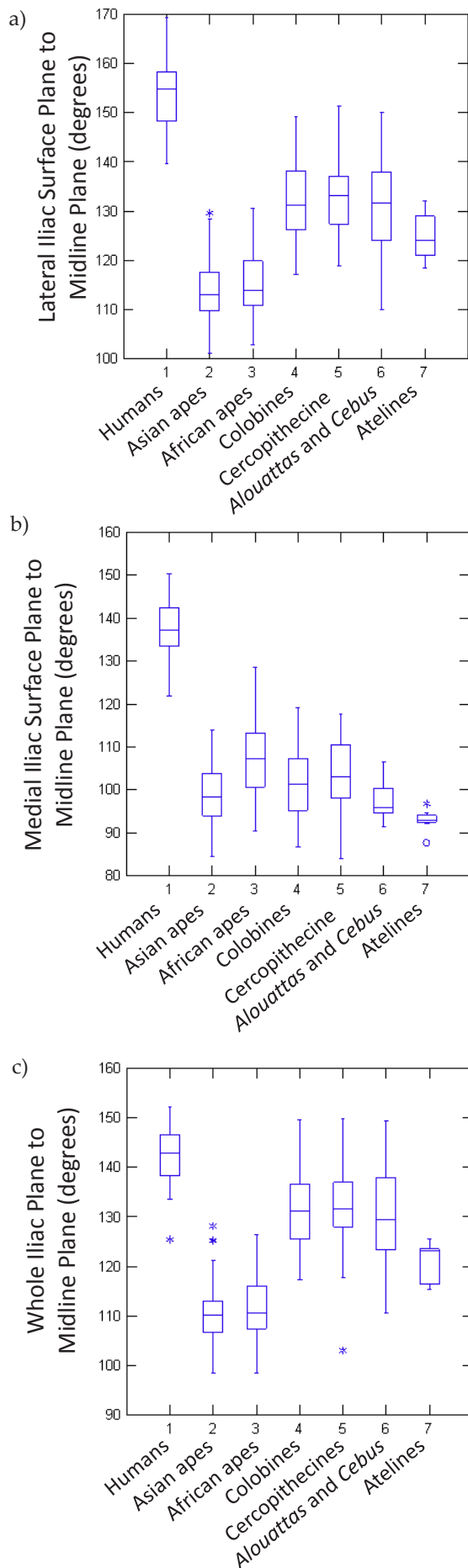


Figure 5. Angles of ilium relative to midline plane. a) lateral iliac surface plane to midline plane b) medial iliac surface plane to midline plane c) whole iliac plane to midline plane.

the same differences between locomotor types. In whole iliac plane relative to the midline, semi-suspensory ateline monkeys are clearly intermediate between the other monkeys and apes, suggesting that the differences found here are in fact related to locomotor behaviors.

However, contrary to expectations, apes and monkeys did not differ substantially in the orientation of the medial portion of the iliac blade. The apparent disparity between the medial iliac surface plane angle and the other angles can be largely explained by pelvic geometry. In apes, the sacroiliac portion of the ilium is reduced (more narrow) but the lateral (iliac) portion is expanded. Even if the medial iliac portion is oriented similarly among taxa, this geometric change would result in larger lateral and whole iliac surface angles.

The medial iliac surface differentiated the nonhuman taxa less clearly, but humans still remained distinct. This could reflect the mediolaterally wider ilia of the great apes, pushing the lateral iliac plane into a different orientation.

Monkeys all share a sagittally oriented ilium, but not to the degree humans show. This reflects their narrow body form and adaptation to moving the limbs in flexion and extension during quadrupedal gait. Ateles were like other monkeys in all aspects of the ilia, but slightly more ape-like in iliac orientation, likely reflecting their semi-suspensory locomotor mode. This finding further reinforces that we are seeing a reflection of locomotor adaptations.

LIMITATIONS

An aspect to take into consideration is in the measurement of curved, uneven surfaces via a flat plane. Although these planes provide an average for the feature, some accuracy in the reflection of morphological relationships to locomotion may be weakened.

FUTURE WORK

This study suggests that a geometric rearrangement is responsible for iliac differences in the iliac orientation between locomotor types, rather than a twisting of the whole bone. This work provides a more precise basis for evaluating the iliac anatomy of fossil anthropoids. We plan to expand this research to find methods applicable to isolated hipbones. As this study relies on the ability to determine the midline of an organism by using full pelvises, we will attempt to find alternate methods that have applications to the fossil record, where often only a lone hipbone is recovered. This work will be particularly important for understanding when fossil ape species made the transition from arboreal quadrupedalism to a reliance on suspensory behaviors.

This can help build our understanding of the rate of transition in locomotor types in the evolutionary history of primates, and with the hypothesized environments of these species in mind, create a more holistic evolutionary framework on ape evolution.

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Perceptions of Parental Psychological Control, but Not Mild Guilt Induction, are Similarly Associated with Perceptions of Parental Warmth and Negativity Across Cultures

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ABSTRACT

Many researchers have discovered parental psychological control to be negatively associated with children's well-being across cultures, while others have discovered attenuated associations in collectivist, as compared to individualist groups. Rudy et al. (2012) attempted to reconcile the findings by arguing that these results depend on the measures used. They found that a commonly used measure of harsh psychological control was consistently associated with lower self-esteem in undergraduates from the USA and India. However, mild guilt induction, a form of psychological control, was associated with lower self-esteem in the USA, but not India. Rudy et al (2012). argued that in the USA, parental negative emotions and a lack of warmth might be associated with guilt induction and harsh psychological control, but in India, only the latter variable might be associated with this pattern of emotions. This study directly examined these arguments in undergraduates from the USA and India. We assessed participants' perceptions of their parents' use of harsh psychological control, mild guilt induction, and expression of warmth and negativity toward children. We conducted regression analyses predicting parental warmth and negativity using 1) terms for group, harsh psychological control, and their interactions as predictors and 2) parallel analyses substituting guilt induction for psychological control. Results indicated that undergraduates from the USA and India perceived harsh parental psychological control to reflect parents' negative affect and lack of warmth. U.S. participants also perceived mild guilt induction in this manner. However, Indians perceived mild guilt induction to reflect higher levels of parental warmth, and associations between mild guilt induction and parental negativity were non-significant.

INTRODUCTION

Parental psychological control refers to parents indirectly influencing children's behavior by manipulating their thoughts and emotions (Barber 1996; Bean et al., 2006; Kincaid et al., 2010; Rudy et al., 2012). In general, researchers have found parental psychological control to function as an important predictor of children's adjustment (see Soenens & Vansteenkiste, 2010 for a review). In fact, extending on Schaefer (1965) and Steinberg's (1990; Steinberg, Elmen, & Mounts) work, Barber (1996) found psychological control to be a salient factor in predicting internalizing problems and problem behaviors among pre-adolescents and young adolescents in the USA. These findings were important as they provided a new measure of psychological control for the "Psychological Control Scale—Youth Self Report" (PCS-YSR; Barber, 1996), and also revived empirical interest in the construct.

Since 1996, an extensive body of research has used the PCS-YSR to assess psychological control among youth in non-western cultural groups. Using this common eight-item measure, youth report their perceptions of parenting behaviors distinctive of each parent, which may include such practices as: constraining verbal expression, invalidating feelings, personal attacks on the child, and love withdrawal. Specifically, an example of this behavior includes: "My parent is a person who blames me for other family members' problems." Items that reflect either guilt induction emphasizing parental obligations or erratic emotional control are not included in this measure (Rudy et al., 2012).

Studies that have used the PCS-YSR with diverse cultural groups have consistently found positive associations between high levels of psychological control and undesirable characteristics (e.g., internalizing behaviors, depression), and negative associations with desirable characteristics (e.g., self-esteem) among youth (Rudy et al., 2012). For instance, psychological control was associated with higher levels of both internal and external psychosocial adjustment problems and risky behavior among African American 11-16-year olds (Kincaid, Jones, Cuellar, & Gonzalez, 2011); higher self-reports of self-criticism, depressive symptoms, and dependency for 14-18-year old Jordanian youth (Ahmand & Soenens, 2010); and lower levels of self-reported self-esteem among 11-16-year old Latino youth (Bean & Northrup, 2009).

However, other studies have also found inconsistent or attenuated associations among collectivist, but not individualist groups (e.g., Rudy & Halgunseth, 2005). In studies where these associations differ, researchers have generally assessed psychological control using the 10-item Child-Rearing Practices Behavior Inventory (CRPBI) scale, which includes milder items, such as guilt induction emphasizing familial obligations (e.g., "...says, if I really cared for her/him, I would not do things that cause her/him to worry") (CRPBI; Schuldermann & Schuldermann, 1988; see Barber, 1996, for the scale).

For instance, when assessing a sample of preschoolers and their mothers from the USA, Russia, and China, Olsen et al. (2002) found maternal psychological control to be associated with externalizing and internalizing problem behaviors among the U.S. sample, and externalizing problems—but not internalizing problems—in the Russian sample. Moreover, psychological control was not related to either type of problem behavior in the Chinese sample. Within this study, psychological control was assessed using Olsen et al.'s (2002) own measure, which consisted of items that assessed guilt induction, such as "reminding child of things we have done for him or her."

Although Olsen et al. (2002) examined a sample of parents and preschoolers, inconsistent and contradictory results among non-Western samples have also been discovered using the CRPBI measure within older children. Specifically, Krishnakumar, Beuhler, and Barber (2003) analyzed whether psychological control mediated relationships between interparental conflict and adolescent behavior problems in both European American and African American families. Results indicated that this mediating relationship existed for only intact European American families. In a Latino sample, Walker-Barnes and Mason, (2001) found parental psychological control to be associated with negative (delinquency) and positive (decreases

in gang involvement) child characteristics in the 9th grade. Kim and Dembo (2000) discovered that Chinese college students' reports of parental psychological control were associated with a fear of academic failure, but not with academic self-efficacy. Finally, Rudy et al. (2012) found that mild guilt induction was associated with lower levels of self-esteem for undergraduates from the USA, but not in those from India.

One explanation for these contradictory findings is that the results may depend on the measures used. Specifically, Rudy et al. (2012) argued that the PCS-YSR reflects relatively harsh practices, such as personal attacks on the child and invalidating their feelings (Barber, 1996). Studies that have used this measure tend to find results that are consistent across cultures. Conversely, attenuated associations between psychological control and children's outcomes in collectivist, as compared to individualist groups, tend to be found with studies that have assessed psychological control with more mild practices, such as guilt induction (e.g. the CRPBI).

Rudy et al. (2012) argued that the differential associations between mild parental guilt induction and children's outcomes might be based on cultural differences regarding individualism and collectivism; that is, mild guilt induction, which emphasizes familial obligations (but not psychological control), might be used for different purposes in the two groups, and thus reflect different patterns of parental emotions. For instance, in individualist groups, such as European American groups, individuals use their own wants and needs as the source of their action (Markus & Kitayama, 1991). Because mild guilt induction emphasizes children's familial obligations, it detracts from the development of these qualities valued by an independent culture. Therefore, in more independent cultures, mild guilt induction is most likely used when children's best interests are not held in mild. Here, mild guilt induction might be more strongly associated with parental negativity and harsh psychological control, as well as lower levels of parental warmth and lower levels of self-esteem in children (Fung, 1999).

Among collectivist groups (such as those of Asian or Latino origin), however, interpersonal obligations and consideration of other's viewpoints are culturally desired qualities (Markus & Kitayama, 1991; Oyserman, Coon, & Kimmelmeier, 2002). Thus, guilt induction that emphasizes children's familial and parental obligations (see Barber, 1996, and Aunola & Nurmi, 2004, for items from guilt induction subscales), might at times be used in order to promote these cultural values, reflecting parental concern. As a result, in collectivist groups, mild guilt induction should have attenuated associations with parental negativity, lack of warmth, and harsh psychological control, and reflect lower levels of well-being in children (Rudy et al., 2012).

Rudy et al. (2012) also closely examined measures of harsh psychological control and mild guilt induction that emphasized children's familial obligations. University undergraduates from both India (a collectivistic culture) and the USA (an individualistic culture) reported on their parents' use of mild guilt induction as well as on their own levels of self-esteem. The following hypotheses were proposed: 1) reports of harsh psychological control would be more strongly associated than mild guilt induction with lower levels of reported self-esteem across groups; 2) reports of mild guilt induction and harsh

psychological control would be more strongly associated in the USA than in India; 3) reports of parental mild guilt induction would be more strongly associated with lower levels of self-esteem in the USA than in India; and 4) the negative associations between mild guilt induction and self-esteem for students from the USA would become non-significant when controlling for harsh parental psychological control. Support was found for all four hypotheses. However, in the Indian group, mild guilt induction was positively associated with self-esteem once controlling for levels of harsh psychological control.

These results suggest that mild parental guilt induction might not be problematic in any culture; rather, it may predict less optimal well-being for students from the USA because it generally co-occurs with more harsh psychological control (Rudy et al., 2012). A possible explanation for this differential association might be that children in the Indian group may perceive their parents as caring for them (i.e., are warm) and do not feel negatively toward them whenever guilt induction is used; whereas, children in the U.S. group may perceive that their parents do not care for them and feel negatively toward them whenever guilt induction is used.

Supporting this assumption (but using only one item from the CRPBI), Mason et al. (2004) found that African American and Latino 13-18-year old children reported that they would feel more loved and cared for than they would feel hurt and angry, or controlled and manipulated, if their mother or primary caregiver were to use mild guilt induction ("Says if I really cared for her, I would not do things that cause her to worry"). On the other hand, European Americans also reported equal levels of these three emotional responses in regard to mild guilt induction. These results suggest that for children in different cultures, mild guilt induction can hold differing meanings (Rudy et al., 2012).

Specifically, Rudy et al. (2012) argued that guilt induction may have had negative associations with children's self-esteem in the sample from the USA, but not India, because children in the USA, but not India, perceived parents who used guilt induction to have lower levels of parental warmth, and higher levels of parental negativity. The present study directly tests that argument. We propose the following hypotheses: 1) perceptions of parental mild guilt induction should be more strongly associated with perceptions of higher levels of parental negativity and lower levels of parental warmth among students from the USA, as compared to students from India and 2) perceptions of parental harsh psychological control should be associated with perceptions of higher levels of parental negativity and lower levels of parental warmth similarly across groups.

METHODS

Sample

We examined the data sample used by Rudy et al. (2012) of 169 Indian undergraduates (68 female, 100 male, and one student who did not report gender) from India and 230 U.S. undergraduates (136 female, 86 male; 8 who did not report gender). Although differences between groups were not large, the students from the USA were significantly older than those from India, $F(1, 388) = 25.62, p < .0001, \eta^2 = 0.18$ ($M = 20.42,$

$SD = 2.07$; and $M = 21.75, SD = 2.81$). In addition, data regarding parental education (1 = less than high school diploma, 2 = high school diploma or equivalent; polytechnic degree, 3 = college degree or equivalent, 4 = postgraduate or professional degree) revealed that the Indian sample had lower scores for maternal and paternal education than the U.S. sample (for maternal education, means and standard deviations for India and the USA, respectively, were $M = 2.04, SD = 0.91$ and $M = 2.83, SD = 0.78, F(1, 397) = 87.92, p < .0001, \eta^2 = 0.18$; the corresponding values for paternal education for India and the USA, respectively, were $M = 2.59, SD = 0.93$ and $M = 2.81, SD = 0.89, F(1, 397) = 6.24, p < .05$).

Measures

All measures were administered together in a booklet form in English. Participants reported separately on perceptions of their parents' use of harsh psychological control, mild guilt induction, and expression of warmth and negativity toward children.

We assessed parental warmth with the Open Expression of Affect subscale, adapted from the Child-Rearing Practices Report (CRPR, Block, 1981). For conceptual reasons, one item from this measure was removed because it measured anger expression. All other items on the scale reflected warmth, such as "My parent and I had warm, intimate times together." Chronbach's alphas were .78 for students from India and .80 for students from the USA. Parental negative affect was assessed with a three-item Negative Affect Toward the Child subscale, adapted from the CRPR, e.g. "My parent often felt angry with me." Chronbach's alphas were .79 for students from India, and .87 for students from the USA.

To assess mild parental guilt induction, we used three items from the Control by Guilt Induction scale from the Child-Rearing Practices Report (CRPR, Block, 1981), and two guilt induction items from the Child Reports of Parental Behavior Inventory (CRPBI), as presented in Barber (1996) Appendix A, Study 1. Specific items assessed from the scale included: "My parent expected me to be grateful and appreciate all the advantages I had," "My parent let me know how ashamed and disappointed (s)he was when I misbehaved," and "My parent believed that I should be aware of how much (s)he sacrificed for me." On the other hand, items from Barber (1996) were: "As I was growing up, my parent told me of all the things (s)he had done for me," and "As I was growing up, my parent said that if I really cared for her/him, I would not do things that caused him/her to worry." Chronbach's alphas were .73 for students from India and .82 for students from the USA.

We assessed levels of relatively harsh parental psychological control with Barber's PCS-YSR. With this measure, items reflected such behaviors as: "My parent was less friendly with me if I did not see things her/his way," and "Blames me for other family members' problems." Chronbach's alphas were .89 for students from India and .93 for students from the USA.

RESULTS

We conducted regression analyses predicting parental warmth and negativity using 1) terms for group, mild guilt induction, and their interactions as predictors and 2) parallel analyses substituting guilt induction for psychological control.

In our preliminary analyses, we performed analyses that tested the main and interaction effects of participant gender. We found systematic associations between gender and the other variables in this study, with males reporting higher levels of psychological control, guilt induction, and negative affect, and lower levels of parental warmth; for these variables, respectively, $F_s(1, 398) = 40.28, 30.96, 16.30$ and 20.95 , all $p_s < .0001$. There was no evidence that gender interacted with the other variables in the analyses. Thus, a term for the simple effect of gender was included in our models.

HYPOTHESES

Hypothesis 1: Perceptions of parental mild guilt induction should be more strongly associated with perceptions of higher levels of parental negativity among students from the USA, as compared to students from India.

Table 1a presents the results relevant to hypothesis 1. As expected, we found a significant group $\times$ guilt-induction interaction when predicting parental negativity (see Table 1a for t values). Simple slope analyses indicated that mild guilt induction was associated with perceptions of higher negative parental affect for U.S. participants, ($\beta = .29, t = 4.55, p < .0001$), but not for Indian participants ($\beta = .10, n.s.$), confirming hypothesis 1.

Table 1a. Perceptions of Parental Negative Emotion, Predicted by Perceptions of Guilt Induction within Cultural Group, controlling for Gender of Participant ^a

	β	t	$R^2 .20^{**}$
Group	-.32	-6.70*	
GI	.21	4.40**	
Group $\times$ GI	.09	-1.98*	
Gender	.08	1.71	

^aFor Group, India coded as 0, USA coded as 1; GI=mild parental guilt induction; for gender, females coded as 0, males coded as 1 (all simple effects then centered with a mean of zero).

* $p < .05$, ** $p < .0001$

Hypothesis 2: Perceptions of parental mild guilt induction should be more strongly associated with perceptions of lower levels of parental warmth among students from the USA, as compared to students from India.

Table 1b presents the analyses relevant to hypothesis 2. Consistent with our expectations, there was a significant group $\times$ guilt-induction interaction when predicting parental warmth. Simple slope analyses revealed that mild guilt induction was significantly negatively associated with perceptions of warmth for U.S. participants ($\beta = -.15, t = -2.20, p < .05$), but positively associated for Indians ($\beta = .32, t = 4.20, p < .0001$); thus, hypothesis 2 was supported.

Table 1b. Perceptions of Parental Warmth, Predicted by Perceptions of Guilt Induction within Cultural Group, controlling for Gender of Participant ^a

	β	t	$R^2 .12^{**}$
Group	.15	3.01*	
GI	.05	0.96	
Group $\times$ GI	-.22	-4.63**	
Gender		-.19	-3.89**

^aFor Group, India coded as 0, USA coded as 1; GI=mild parental guilt induction; for gender, females coded as 0, males coded as 1 (all simple effects then centered with a mean of zero).

* $p < .05$, ** $p < .0001$

Hypothesis 3: Perceptions of parental harsh psychological control will be associated with perceptions of higher levels of parental negativity similarly across groups.

Table 2a presents the results relevant to hypothesis 3. This hypothesis was supported, as we discovered that harsh psychological control was uniformly associated with perceptions of parental negativity across both groups, $\beta = .64, t = 14.87, p < .0001$. The group $\times$ psychological control interaction term was not significant.

Table 2a. Perceptions of Parental Negativity, Predicted by Perceptions of Parental Harsh Psychological Control and Cultural Groups, controlling for Gender of Participant ^a

	β	t	$R^2 .46^{**}$
Group	-.09	-2.11*	
PC	.64	14.89**	
Group $\times$ PC	-.01	-0.31	
Gender	-.01	-0.39	

^aFor Group, India coded as 0, USA coded as 1; PC=harsh parental psychological control; for gender, females coded as 0, males coded as 1 (all simple effects then centered with a mean of zero).

* $p < .05$, ** $p < .0001$

Hypothesis 4: Perceptions of parental harsh psychological control will be associated with perceptions of lower levels of parental warmth similarly across groups.

Table 2b presents the results relevant to hypothesis 4. As expected, harsh psychological control was negatively associated with perceptions of warmth (for India and the USA, respectively, $\beta = -.20, t = -2.75, p < .01$; $\beta = -.63, t = -9.10, p < .0001$). Unexpectedly, however, there was a significant group $\times$ harsh psychological control interaction when predicting parental warmth. The association between harsh psychological control and lower levels of warmth was much more strongly negative in the group from the U.S. than in the group from India.

Table 2b. *Perceptions of Parental Warmth, Predicted by Perceptions of Parental Harsh Psychological Control within Cultural Groups, controlling for Gender of Participant ^a*

	β	t	R ² .24**
Group	-.03	-0.59	
PC	-.45	-8.71**	
Group x PC	-.19	-4.24**	
Gender	-.11	-2.42*	

^aFor Group, India coded as 0, USA coded as 1; PC=harsh parental psychological control; for gender, females coded as 0, males coded as 1 (all simple effects then centered with a mean of zero).

*p<.05, **p<.0001

Exploratory Analyses: Why did group status interact with harsh psychological control in predicting warmth?

We were not expecting the significant interaction between group x and harsh psychological control when predicting warmth, especially as we had previously discovered similar associations between harsh psychological control and parental negativity. In fact, our working assumption had been that parental warmth and parental negativity would be negatively associated to a similar degree in both cultures. To test this assumption, we ran an analysis that used terms for group and perceptions of parental warmth to predict parental negativity. There was a significant group x negative affect interaction when predicting parental warmth. Simple slope analyses indicated that parental warmth was associated with perceptions of higher negative parental affect for U.S. participants, ($\beta = -.29$, $t = 4.55$, $p < .0001$), but not for Indian participants ($\beta = -.10$, n.s.).

DISCUSSION

This study is important because it addresses the underlying mechanisms invoked by Rudy et al. (2012), who demonstrated that both mild parental guilt induction and harsh parental psychological control are not equivalent. Specifically, our findings provide strong evidence that mild forms of parental guilt induction, particularly guilt induction emphasizing familial obligations, may reflect different parenting emotions across cultures and in turn cannot be equated with more harsh forms of psychological control. This is an important point to note, as literature often refers to harsh psychological control and mild guilt induction as interchangeable measures (e.g., Kernis, Brown, & Brody, 2000, p. 231; Walker-Barnes & Mason, 2001, p. 247).

We have argued that among collectivist cultures, mild parental guilt induction emphasizing familial obligations might at times be used in order to promote culturally desired qualities (such as interpersonal obligations and consideration of other's viewpoints), thus reflecting parental concern for their children. Within this context, mild guilt induction might be more strongly associated with lower levels of parental negativity and higher levels of parental warmth in children. However, among individualistic cultures, mild guilt induction may inhibit the development of culturally desired qualities, such as independence. Thus, in individualist contexts, mild guilt induction is most likely used when children's best interests are

not considered and might be more strongly associated with parental negativity, harsh psychological control, and lower levels of self-esteem in children (Fung, 1999).

Accordingly, we hypothesized that mild guilt induction would be more strongly positively associated with parental negativity and more strongly negatively associated with parental warmth among the U.S. sample than in those from India. The results strongly support our hypotheses, as we found that the undergraduates from the USA, but not India, perceived mild guilt induction to reflect parents' negative affect and lack of warmth. Indians actually perceived mild guilt induction to reflect higher levels of parental warmth. Moreover, we predicted that harsh psychological control would be equally positively associated with parental negative emotions in the group from the U.S. than in the group from India, and negatively associated with parental warmth in the group from the U.S. In both cases, these predictions were confirmed. However, we found an unexpected significant group x harsh psychological control interaction when predicting parental warmth. We were surprised by this result, because we had assumed that parental negativity and parental warmth would be similarly negatively associated across groups. To test this assumption, we ran an exploratory analysis using terms for group and perceptions of parental warmth to predict parental negativity. In doing so, we found that parental warmth was negatively associated with perceptions of parental negativity for the U.S., but not for India. Although unexpected, the negative associations between parental warmth and negativity in the U.S., but not in India, are consistent with prior research that has found positive and negative emotions to be more strongly negatively associated for individuals from individualistic cultures as compared to collectivist cultures (Bagozzi, Wong, & Yi, 1999).

LIMITATIONS AND FUTURE DIRECTIONS

The present study contained several limitations that can be explored in future research. To begin, the participants were university undergraduates, all of whom reported on perceptions of their parents' parenting practices. If replicated, the sample should include more variation in age and socioeconomic status, and measure parental behavior using parental self-report or observational methods. In addition, we argue that mild guilt induction may be used for different purposes in India (such as interpersonal obligations and promoting familial relationships) than in the USA (such as controlling children with little regard for their well-being). However, it is important to note that we did not assess the reasons why mild guilt induction was used nor did we assess parents' levels of valuing collectivism or interdependence, which we assumed would predict levels of mild guilt induction, at least for the Indian sample. Thus, in the future it would be beneficial to explore these variables. Lastly, it is difficult to determine cause-and-effect relationships as this study had a cross-sectional correlational design. Both longitudinal and experimental approaches would help address this issue in future studies.

Regardless of its limitations, the present study demonstrates that mild parental guilt induction and harsh psychological control are not equivalent concepts. Thus, there is a need for conceptual models of psychological control to distinguish between mild guilt induction and harsh forms of psychological

control. These findings suggest that differentiating between these constructs can help to resolve the apparently contradictory findings regarding universality of the association between parental psychological control and less adaptive youth outcomes.

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Featured Scholar



Jenny Flatt, EdD
4-H Youth Development Specialist
University of Missouri Extension

From my experiences I have found that life is a bridge, on one side of the bridge you experience the honor of people developing you. As you pass over the bridge you are given an opportunity to return the favor.

The McNair program was a bridge for me to pass from those fostering my development, to empowering me to develop myself and others. That bridge-the McNair Scholars Program-provided a stronghold for me to learn and connect to the other side.

The process for moving from undergraduate to graduate work can be daunting. Even for me, acceptance into undergraduate work was beyond my parents' knowledge base. I will never forget farmer dad walking into a college fair, making a broad announcement: "my girl wants to be a Journalist and she needs to go to Mizzou, who can help me?"

Suffice it to say, the McNair Scholars program was much needed in my life. This program helped me to develop a love for research, navigate complicated processes, and become creative with the development of my career path.

The program requirement of establishing a unique research project with a mentor became a wonderful experience that informed my future research projects. Dr. John Galliher in the Sociology Department became my mentor as I explored the world of Criminology through the lens of policing behavior. The respect and autonomy he yielded became the benchmark by which my expectations continue to remain in guided research projects.

McNair created a structure through which many academic practices manifested in my life. During my time as a McNair Scholar (2004-2005), I had the opportunity to attend the American Sociological Association Conference in San Francisco, California. This series of academic meetings was particularly compelling because it was the first time I had ever attended such a conference. I remember leaving the conference, suitcase filled with books about Public Sociology, the theme of the conference.

Ultimately, I earned a Master's and Doctoral degree in Education. While in graduate school, I was paired with advisors, encouraged to engage in research, and present these findings. All of these experiences were reminiscent of my time as a McNair Scholar. I learned to push very hard in the academic pursuit, continually learning and growing. These experiences flowed naturally into my career with the University of Missouri Extension.

The McNair bridge extended my path on the other side to the University of Missouri Extension. While my title is 4-H Youth Specialist, I am empowered by my experiences as a McNair Scholar to help impact the lives of Missouri youth. My hope for you is that you are mobilized and motivated by your previous experience to walk across that bridge.

2012-2013 Research Topics

Scholar	Major	Title	Mentor
Jeremy Clincy	Biochemistry	Effects of Antiretroviral Drugs on Human Repair DNA Polymerases: Implications in Toxicity and Cancer	Stefanos Sarafianos and Kamal Singh
Antoine Culbreath	Families & Lifespan Development	Rewards and Prosocial Behaviors in Nicaraguan Adolescents: The Mediating Role of Prosocial Moral Reasoning	Gustavo Carlo
Amber Forbis	Communication and Science Disorders	Mothers' Conversation and Pragmatic Structure when Reading to Young Children with Autism and Typically Developing Peers	Judith Goodman
Stacey Frasher	Nursing	Genome Wide Association Study (GWAS) in Post-Breast Cancer Lymphedema: Survivors' Genetic Data Collection Preferences and the Role of Electrical Impedance	Jane Armer
Meron Ghidey	Biological Sciences	The Role of The RNA-Binding Protein HUR in the Inflammatory Response in Asthma	Ulus Atasoy and Joseph McGee
Jale't Hickmon-Rosa	Psychology	Emperically Derived Profiles of Teacher Stress, Burnout and Self-efficacy and Associated Student Outcomes	Wendy Reinke
Maranda Johnson	Art History and Religious Studies	The Hindu Goddess Kali in Art & Literature	Signe Cohen
Alicia Lorio	Child Development and Education	Perceptions of Parental Psychological Control, but Not Mild Guilt Induction, are Similarly Associated with Parental Warmth and Negativity Across Cultures	Duane Rudy
Shelby Manning	Human Development & Family Studies	"Looking Back": Parenting Advice and Regrets from Empty Nest Parents	David Schramm
Carrie McKinley	Psychology	Range of Tasks Affected by Propranolol and the Effect of Sympathetic Reactivity and Anxiety in Acute Cocain Withdrawal	David Beversdorf
Paulos Mengsteab	Mechanical Engineering	Design Optimization of Attachment Device for Femoral Stem Extraction	A. Sherif El-Gizawy
Emma Rosenow	Geological Sciences	Magma Mixing in the May 2010 Strombolian Eruption of Pacaya Volcano, Guatemala	Alan Whittington
Ashley Schulz	Forestry	The Effects of Prescribed Fire on Insect Diversity in the Missouri Ozark Highlands	Rose-Marie Muzika
Stacy Stewart	Psychology and Anthropology	Desire to Aspire Evalutative Research Report	Debora Bell
Jessica Stokes	Chemistry	The Study of Calix[4]arenes Nanocapsules and Their Solution Properties	Jerry Atwood
Chad Tucker	Music Performance	Popular Music Influences in the Major Saxophone Works of William Bolcom	Leo Saguiguit
Sital Uprety	Civil & Environmental Engineering	Phosphorus Control Through Water Treatment Residual Based Soil Amendments in Bioretention Cells	Enos Inniss
Zachariah Winkler	Anthropology and Psychology	Iliac Orientation and Locomotor Evolution of Arthropod Primates	Carol V. Ward

2012-2013 McNair Scholars



Back row: Lashonda Carter-Boone (Research Instructor), Stacy Stewart, Antoine Culbreath, Emma Rosenow, Paulos Mengsteab, Jeremy Clincy, Meron Ghidey, Ashley Schulz, Jessica Stokes, Darlene Dixon (Program Assistant), Jeremy Bloss (Sr. Student Services Specialist)

Front Row: NaTashua Davis (Director), Sital Uprety, Alicia Lorio, Shelby Manning, Jale't Hickmon-Rosa, Stacey Frasher, Maranda Johnson, Amber Forbis, Chad Tucker, Zachariah Winkler

