

# 10th Annual

## Colorado Springs Undergraduate Research Forum

April 13, 2013



Keynote Speaker  
Associate Conductor Thomas Wilson

Hosted by the University of Colorado Colorado Springs  
Open to all CC, UCCS, and USAFA Students  
Registration Deadline: **March 15**  
Register now at [www.uccs.edu/csurf](http://www.uccs.edu/csurf)



**CSURF KEYNOTE**  
Science Aud. 203 →

Poster Sessions  
Berger Hall ↑

↑ Talk Sessions  
UC and Cent. Hall →

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# JAMES C. BERGER HALL



James C. Berger Hall  
University of Colorado at Colorado Springs

The vision is shared in the  
of noble progress  
perennial growth  
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**Clyde's Common**  
Clyde's Common  
Club Events

Monday	April 8th 5-8PM
Tuesday	April 9th 5-8PM
Wednesday	April 10th 5-8PM
Thursday	April 11th 7-10PM
Friday	April 12th 7-10PM
Saturday	April 13th 7-10PM
Sunday	April 14th 7-10PM

University of Colorado Springs

**ROCKY MOUNTAIN**  
Monday  
April 8th 5-8PM

**UCSS**  
Tuesday  
April 9th 5-8PM

**UCSS**  
Thursday  
April 11th 7-10PM

**UCSS**  
Friday  
April 12th 7-10PM

**UCSS**  
Saturday  
April 13th 7-10PM

**UCSS**  
Sunday  
April 14th 7-10PM

**Upcoming EVE**

February 18	Meeting Club 5pm-8pm
February 22	Tea and Film 5pm-8pm
February 23	Faculty Dinner 5pm-8pm
February 28	Meeting Club 5pm-8pm
March 1	UCSS Welcome Night 5pm-8pm
March 2	Faculty Dinner 5pm-8pm
March 3	Meeting Club 5pm-8pm
March 4	Meeting Club 5pm-8pm
March 5	Meeting Club 5pm-8pm
March 6	Meeting Club 5pm-8pm
March 7	Meeting Club 5pm-8pm
March 8	Meeting Club 5pm-8pm
March 9	Meeting Club 5pm-8pm
March 10	Meeting Club 5pm-8pm
March 11	Meeting Club 5pm-8pm
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March 27	Meeting Club 5pm-8pm
March 28	Meeting Club 5pm-8pm
March 29	Meeting Club 5pm-8pm
March 30	Meeting Club 5pm-8pm
March 31	Meeting Club 5pm-8pm











**The Gift of Giving: Philanthropy as a Path to Self-Actualization**  
Alexander Glassman, Tomi-Ann Roberts (Advisor)  
The Colorado College, Colorado Springs, CO



**Introduction**  
Philanthropy is a complex phenomenon that has been studied by scholars from a variety of disciplines. This poster explores the psychological and social factors that influence giving behavior.

**Costly Giving is Inevitably Rewarding**  
The act of giving, especially when it is costly, is often associated with positive emotions and a sense of fulfillment. This poster discusses the psychological benefits of giving and how it can lead to personal growth and self-actualization.

**Giving as an Evolutionary Adaptation**  
The act of giving may be an evolutionary adaptation that has developed in humans as a way to build social bonds and increase the chances of survival. This poster explores the evolutionary roots of giving and how it has shaped human behavior.

**Costly Giving as a Path to Self-Actualization**  
The act of giving, especially when it is costly, can be a powerful way to achieve self-actualization. This poster discusses how giving can help individuals to realize their full potential and live a more meaningful life.

**Does Happiness come from Pleasure and Satisfaction?**  
The act of giving can be a source of happiness, but is it the act itself that brings happiness, or is it the pleasure and satisfaction that comes from giving? This poster explores the relationship between giving and happiness.

**Giving and Relationship to Flow**  
The act of giving can be a way to achieve a state of flow, a state of complete absorption in an activity. This poster discusses how giving can help individuals to reach a state of flow and experience the benefits of this state.

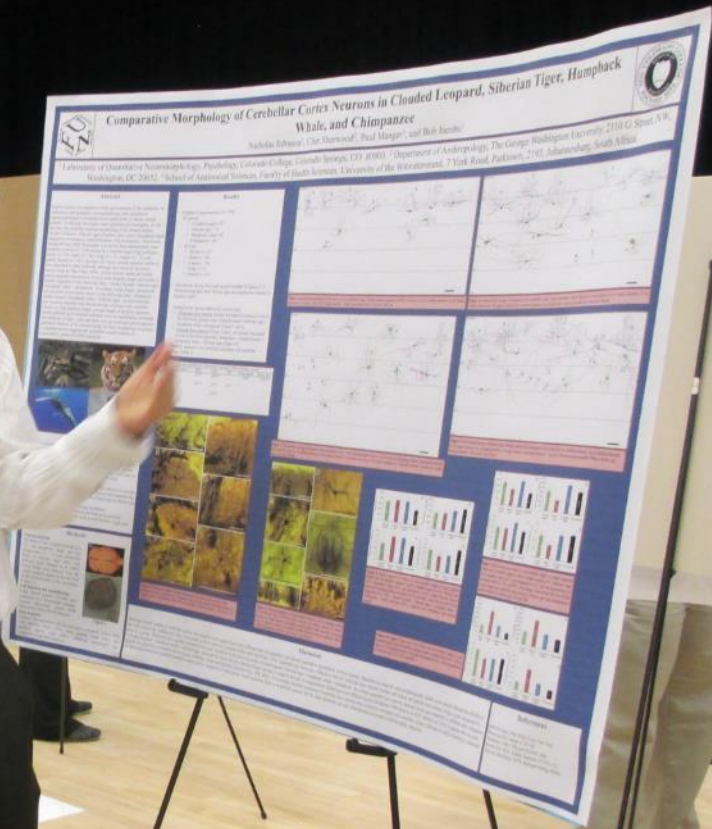
**Predicting Our Reaction to the Act of Giving**  
The act of giving can be a complex experience, and our reaction to it can vary widely. This poster discusses the factors that influence our reaction to giving and how we can predict our own and others' reactions.

**Motives for Giving, and Giving's Role in the Human Condition**  
The act of giving is a fundamental part of the human condition, and it has been studied by scholars for centuries. This poster explores the motives for giving and the role of giving in the human condition.

**How to Give Effectively**  
The act of giving can be a powerful way to make a difference in the world, but it is important to give effectively. This poster discusses the best ways to give and how to ensure that your gifts are used in the most effective way possible.

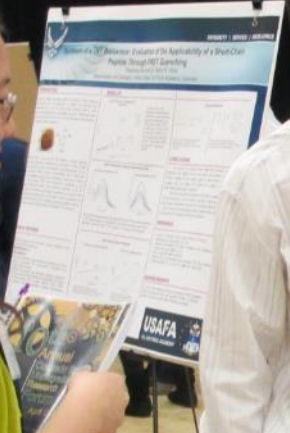






A young man in a white dress shirt and a blue and white striped tie stands next to the poster. He is pointing at a specific section of the poster with his right hand. He has a name tag that reads "EDWARD C. DE HAVENON".

A woman with long dark hair, wearing a bright yellow-green short-sleeved shirt and dark pants, is looking at the poster. She is holding a small brochure or flyer in her hands.



In the background, another person in a dark blue uniform is visible, standing near another poster.



# the infant giraffe (*Giraffa camelopardalis tippelskirchi*) and elephant (*Loxodonta africana*)

Alben Lewandowski<sup>1</sup>, John F. Roberts<sup>2</sup>, Cheri C. Sherwood<sup>3</sup>, and Hub Janby<sup>4</sup>  
<sup>1</sup>College, Colorado Springs, CO 80903. <sup>2</sup>Anthropology, Kent State University, Kent, OH 44342. <sup>3</sup>Cleveland Museum of Natural History, Cleveland, OH 44106. <sup>4</sup>Anthropology, George Washington University, Washington, DC 20052.







### The Effect of the Polybrominated Diphenyl Ether on Perceptual Attentional set Shift

Rebecca Twombly & Lori Driscoll  
The Colorado College, Colorado Springs

Colorado College Logo

#### Introduction

Highly brominated Diphenyl Ether (PBDE) congeners appear to be the most toxic and persistent of the PBDEs. PBDEs are known to be neurotoxic and have been shown to affect the development of the nervous system through their action on the endocrine system.

#### Effects of Developmental PBDE Exposure in Adult Mice

Adult mice exhibit deficits in learning and working memory, as well as in the ability to shift between tasks. These effects are associated with changes in the structure and function of the prefrontal cortex (PFC).

#### Neurophysiology and Brain Function

The effects of developmental PBDE exposure on brain function were assessed using a variety of behavioral tasks and neurophysiological recordings.

#### The PFC's Rapid Executive Cortex (PFC) Processing

The PFC is involved in the executive control of behavior, including working memory, attention, and decision-making. It is also involved in the regulation of other brain regions.

#### Conclusions

Developmental exposure to PBDEs can lead to long-term deficits in brain function, including impaired learning and working memory. These effects are associated with changes in the structure and function of the PFC.

#### Method

**Subjects and Design:** C57BL/6J mice were used. The study was a 2x2 factorial design, comparing control and PBDE-exposed mice across two tasks: a working memory task and a perceptual set shift task.

#### Apparatus

The apparatus consisted of a custom-built behavioral testing chamber with a video camera for monitoring behavior. The chamber was controlled by a computer program.

#### Testing Procedure

Subjects were trained on the tasks before data collection. The testing procedure involved a series of trials, with the order of trials randomized. The subjects were rewarded with a food pellet upon successful completion of a task.

#### Results

The PBDE-exposed mice showed significantly higher error rates compared to the control mice in both the working memory and perceptual set shift tasks. The effects of PBDE exposure were more pronounced in the perceptual set shift task.

#### Discussion

The results of this study suggest that developmental exposure to PBDEs can lead to long-term deficits in brain function, including impaired learning and working memory. These effects are associated with changes in the structure and function of the PFC.







# The Developmental Relationship Between Theory of Mind and the Understanding of Emotions in Children with High Functioning Autism

Elizabeth Loree Crow-Burns and Tricia Waters  
The Colorado College, Colorado Springs, CO



## Introduction

Children with high-functioning autism spectrum disorder (ASD) often exhibit strengths in verbal abilities and rote memory, but struggle with social interactions and understanding the underlying emotions of others. Theory of Mind (ToM) refers to the ability to understand and predict the behavior of others based on their feelings, intentions, and desires. This ability is crucial for successful social interactions and is often impaired in children with ASD.

## Methods

The current study was designed to explore the developmental relationship between ToM and emotion understanding in children with high-functioning ASD. The study included 30 children with high-functioning ASD, aged 8-12 years, and 30 typically developing (TD) children of the same age. All children were administered a battery of standardized tests to measure their ToM skills and their understanding of various emotions.

## Results

The results of the study revealed a significant positive correlation between ToM skills and emotion understanding in both the ASD and TD groups. Specifically, children with higher ToM scores demonstrated a greater ability to identify and describe the underlying emotions of others. These findings suggest that ToM skills play a critical role in the development of emotion understanding, even in children with high-functioning ASD.

## Conclusion

The findings of this study have important implications for the assessment and intervention of children with high-functioning ASD. By focusing on the development of ToM skills, educators and clinicians can help these children improve their social interactions and overall quality of life. Further research is needed to explore the underlying mechanisms of this relationship and to develop targeted interventions.

## Discussion

The current study provides evidence for the developmental relationship between ToM and emotion understanding in children with high-functioning ASD. The findings suggest that ToM skills are a key component of emotion understanding and that children with higher ToM skills are better able to understand the underlying emotions of others. This relationship is particularly important for children with ASD, as it is a core deficit in their social interactions.

## Limitations

There are several limitations to the current study. First, the study was cross-sectional, which means that it cannot establish a causal relationship between ToM skills and emotion understanding. Second, the study only included children with high-functioning ASD, which may limit the generalizability of the findings to children with lower levels of ASD.

## Future Research

Future research should focus on exploring the underlying mechanisms of the relationship between ToM and emotion understanding. This could include studies that examine the role of specific ToM skills, such as understanding false-beliefs, in emotion understanding. Additionally, it would be beneficial to investigate the effectiveness of interventions that target ToM skills in children with high-functioning ASD.

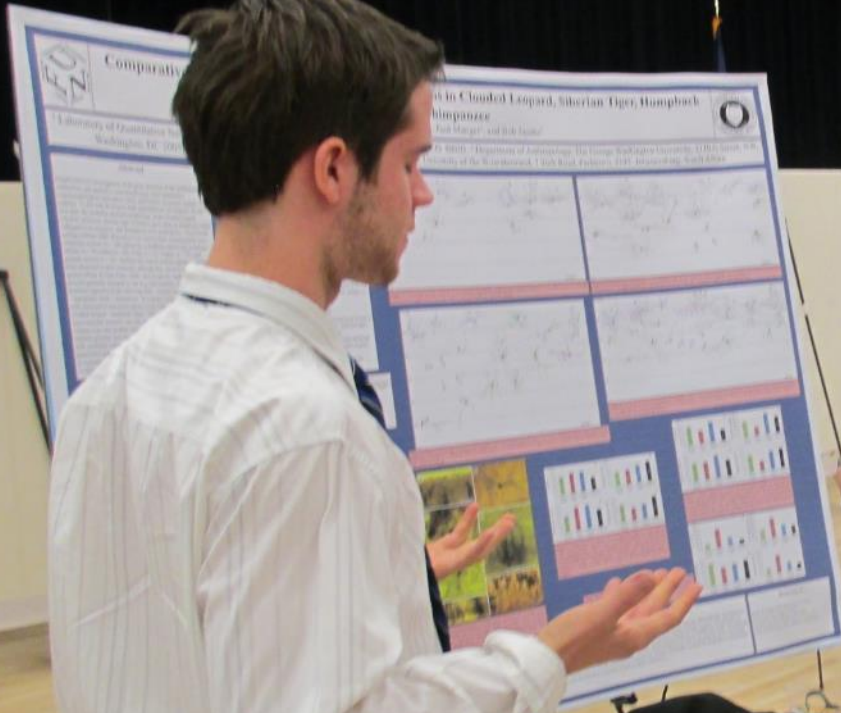
## References

Baron-Cohen, S., Golan, O., & Ashwin, E. (2009). Social cognition: Exploring the development of theory of mind. *Journal of Child Psychology and Psychiatry*, 50(10), 1163-1170.

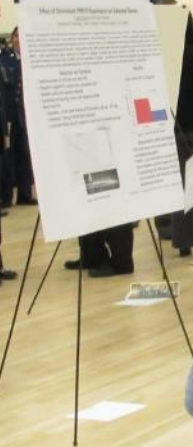


CSURF 2013  
Elizabeth Loree Crow-Burns











# the infant giraffe (*Giraffa camelopardalis tippelskirchi*) and elephant (*Loxodonta africana*)

Albert Lewandowski<sup>1</sup>, John F. Rubens<sup>2</sup>, Chel C. Shiversoff<sup>3</sup>, and Bob Isichei<sup>4</sup>  
<sup>1</sup>College, Colorado Springs, CO 80903, <sup>2</sup>Anthropology, Kent State University, Kent, OH 44240, <sup>3</sup>Central Mountain Park, Washington, DC 20008, <sup>4</sup>Anthropology, George Washington University, Washington, DC 20052

**Results: Infant Elephant (Fig. 1-1)**

Microsatellite analysis revealed a cluster of 10 alleles (Fig. 1-1) with a mean length of 100 bp. The most common allele was 100 bp. The remaining alleles were 101, 102, 103, 104, 105, 106, 107, 108, 109, and 110 bp. The observed heterozygosity was 0.45. The expected heterozygosity was 0.52. The observed heterozygosity was significantly lower than the expected heterozygosity ( $p < 0.05$ ).

**Results: Infant Giraffe (Fig. 1-2)**

Microsatellite analysis revealed a cluster of 10 alleles (Fig. 1-2) with a mean length of 100 bp. The most common allele was 100 bp. The remaining alleles were 101, 102, 103, 104, 105, 106, 107, 108, 109, and 110 bp. The observed heterozygosity was 0.45. The expected heterozygosity was 0.52. The observed heterozygosity was significantly lower than the expected heterozygosity ( $p < 0.05$ ).







# The Developmental Relationship Between Theory of Mind and the Understanding of Emotions in Children with High Functioning Autism

Elizabeth Leona Crow Burrus and \*Tricia Waters  
The Colorado College, Colorado Springs, CO



**Introduction**

**Background**

- Frederick Theory of Mind (ToM) usually develops by age 4 (Porges, Lorden, & Whalen, 1980).
- Children with High Functioning Autism (HFA) and Asperger Syndrome (AS) have been shown to struggle with higher order Theory of Mind tasks compared to typically developing children (Pispa et al., 1994).

**Importance to Understanding Self-Conscious Emotions in Children with HFA/AS** (Healey, Kover, & Capp, 2008).

- Self-conscious emotions are emotions that arise in response to behavior in a social context. Self-conscious emotions include pride, embarrassment, guilt, and shame.
- Self-conscious emotions are usually first experienced by age 4, but children do not seem to understand how their behaviors are related to these emotions until age 8-9.
- Children with HFA have been shown to have deficits in their understanding of self-conscious emotions.

**Theoretical Implications: ToM and Self-Conscious Emotions**

- Children who score higher on ToM tests also tend to have a better understanding of the external causes of emotions (Waters, Buckner, & Bullock, 2012).
- The knowledge that affects are evolving the self seems important to the understanding of emotional representations in a social context (self-consciousness arises based on social context). In everyday thought of the emotion (e.g. embarrassment), a feeling of shame is experienced as a word. As ToM begins to develop before self-consciousness emerges, it is possible that ToM is the underlying pathway through which self-conscious emotion emerges (e.g. formed). Through these two capacities, social awareness is obtained.

**Hypotheses**

- ToM and self-consciousness are related to the developmental trajectories of ToM.
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**Method**

**Participants**

- An initial sample was chosen since the prevalence of AS is much higher in males than in females, according to a 4:1 ratio of HFA to TD (Gillberg, 1991).
- Twenty male children with a diagnosis of Asperger's or HFA (age range: 8-11 years) and twenty typically developing male children (age range: 8-11 years) were recruited from various sites throughout Colorado Springs and Nevada.
- A diagnosis of either AS or HFA was accepted as most current research debates the social implications of the two diagnoses synonymously.

**Measures**

**Intelligence**

- The vocabulary subtest of the Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV) (Wechsler, 2003) was used as a control for intelligence level.

**Assessment of Understanding Self-Conscious Emotions**

- The assessment of emotional understanding was adapted from materials used in previous research (Buckner, CEC, Seher et al., 1988) following Gurin (2006).

**ToM Assessment**

- Francesca Happé's (1981, White et al., 2000) Strange Stories Test was used. The kinds of non-verbal information used in the stories were: pretend, jokes, lies, white lies, figure of speech, double bluff, sarcasm, while the figure of speech, double bluff, sarcasm, was used to test for understanding. This measure was performed in order to prevent participant fatigue, and all children were given a 10-minute break between the two tasks.

**Procedure**

- Assessment of Understanding Self-Conscious Emotions: Following administration of the WISC-IV vocabulary test, the emotion comprehension assessment was administered. The order of the emotion test is indicated in order for possible order of presentation effects.
- For each emotion, the experimenter first asked, "Can you tell me what \_\_\_\_\_ means?" (e.g. "Nasty"). If a correct answer was not given, the experimenter provided a simple definition of the word before proceeding. Next, the experimenter asked, "Can you tell me about it when you feel \_\_\_\_\_?" This method was repeated for all six emotions: Nasty, Sad, Proud, Embarrassed, Guilt, Ashamed.

**ToM Assessment**

- Participants were presented with a Notebook of drawings appropriate to each vignette and a typed version of each story with the questions that went with the vignette.
- After reading each story about the experimenter asked the participant questions (e.g. "Who did the \_\_\_\_\_?"). Finally, a justification question was asked, "Why did \_\_\_\_\_ say that?" (e.g. "Why did the \_\_\_\_\_ say that?"). Only the justification question was asked.

**Results**

An independent sample t-test comparing children with HFA/AS and typically developing children on vocabulary scores showed no significant difference between the two groups,  $t(38) = 0.12, p > .05$ . Consequently, vocabulary scores were not considered as a covariate in the remaining analyses.

**Hypotheses 1 and 2**

A 2 Age ( $< 8.5$  years,  $> 8.5$  years)  $\times$  2 Group (HFA/AS, typically developing) ANOVA was conducted on self-conscious emotion understanding. The continuous variable of age was split into two categories ( $< 8.5$  years,  $> 8.5$  years).

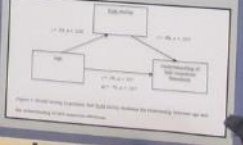
- Consistent with the hypotheses, there were significant main effects of group and age on self-conscious emotion understanding.
- There were also significant main effects of group and age on ToM ability.

**Hypotheses 3 and 4**

- To examine the relationship between ToM and the understanding of self-conscious emotions, a Pearson correlation was run. As predicted, ToM and self-conscious emotion understanding were significantly positively correlated,  $r(48) = .33, p < .001$ . Children who exhibited higher ToM ability also exhibited a higher understanding of self-conscious emotions.

ToM assessed as a mediating variable between age and understanding of self-conscious emotions.

To test for mediation, a partial correlation was conducted. With ToM removed, the relationship between age and self-conscious emotion understanding was significantly weaker in this analysis ( $r = .15, p > .327$ ) compared to the direct relationship ( $r = .38, p < .021$ ). These results indicate



ToM assessed as a mediating variable between age and understanding of self-conscious emotions.

To test for mediation, a partial correlation was conducted. With ToM removed, the relationship between group and self-conscious emotion understanding was weaker in this analysis ( $r = .17, p > .051$ ). A subsequent Sobel Test revealed that the change in the predictive power was significantly reduced by a simultaneous change in ToM ( $z = 2.36, p < .03$ ). These results indicate a significant effect.

**As all groups showed similar growth in self-conscious emotion understanding, whether or not under which of the concepts emotions is developed. This study also shows that self-conscious emotion understanding is a significant predictor of future research through other test sample.**



**Effect of the Polybrominated Diphenyl Ether Mixture DE-71 on Perceptual Attentional set Shifting in Rats**

Rebecca Twombly & Lori Driscoll  
The Colorado College, Colorado Springs, CO

**Method**

**Animals and Treatments**

- 30 female and 30 male Long-Evans
- Control, DE-71, and Isodrinacrine (IDA) treatments administered daily for 28 days (Days 0-27)
  - Control: Corn oil, water (vehicle)
  - Low-dose: 90 mg/kg DE-71 in corn oil, water
  - Low-dose and IDA: 90 mg/kg DE-71 in corn oil, 3 mg/kg IDA in water
  - High-dose: 90 mg/kg DE-71 in corn oil, water
  - High-dose and IDA: 90 mg/kg DE-71 in corn oil, 3 mg/kg IDA in water
- One week prior to testing rats were placed on a weight-maintained food restriction diet

**Apparatus**

Perceptual testing arena, with a removable door shifting the length of the hole in wall

Concrete digging boxes, differing along three dimensions:

- Texture



**Testing Procedure**

- After a habituation procedure was completed, testing began
- Each rat completed the entire task exposure in one trial (total = 3 hours in duration)
- Food + Water (spending to cause of digging in one bowl (2.4 x 4.4 cm))
- Example rats were always paired within a dimension:
  - i.e. solvent was always paired with reversed solvent
- Task set (reversal) = 8 out of 7 trials correct:
  - Control: discrimination (CD) - any dimension was correct, one of which was rewarded
  - Isodrinacrine (IDA) - task exposure of the same dimension in the CD were presented
  - Exposure to IDA - non-rewarded relevant dimension formed the correct dimension, and the most-relevant dimension became the correct dimension
  - Results (IDs) - occurred at all discrimination steps, consistent of the previously incorrect step, suggesting learning context, with either the same dimension and set of responses.

**Method Continued**

**Table of a sample testing session**

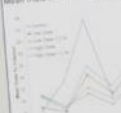
Time	Activity	Duration
0-5	Baseline	5 min
5-10	Habituation	5 min
10-15	Test 1	5 min
15-20	Rest	5 min
20-25	Test 2	5 min
25-30	Rest	5 min
30-35	Test 3	5 min
35-40	Rest	5 min
40-45	Test 4	5 min
45-50	Rest	5 min
50-55	Test 5	5 min

**Results**

**Mean trials to criterion for male rats**



**Mean trials to criterion for female rats**



**Statistical analysis**

Marginaly significant interaction between sex and treatment,  $F(4, 90) = 2.27, p = 0.075, \eta^2 = 0.114$ . Control male performed worse than all other treatment groups,  $M = 12.96$  trials to reach criterion. Reverse, low-dose, high-dose, and IDA males,  $M = 4.67, 4.52, 4.52, 4.67$ , respectively.  $F(4, 90) = 2.08, p = 0.106, \eta^2 = 0.158$  (dependent).  $F(4, 90) = 3.67, 3.07, 3.27, 4.18$ , respectively.

High-dose females took the most trials to reach criterion, low-dose, reverse, and IDA females,  $M = 12.50, 14.50, 14.50, 12.50$ , respectively.  $F(4, 90) = 2.08, p = 0.106, \eta^2 = 0.158$  (dependent).





# Comparative

Laboratory of Quantitative  
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## Cerebellar Neurons in Clouded Leopard, Siberian Tiger, Humpback Whale, and Chimpanzee

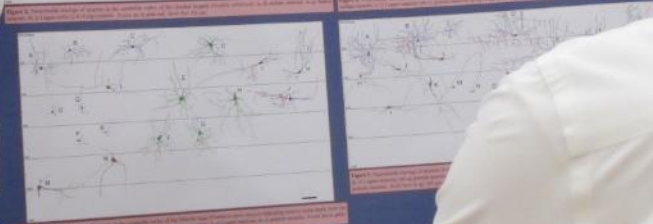
Chet Sherwood<sup>1</sup>, Paul Manger<sup>1</sup>, and Bob Jacobs<sup>2</sup>

<sup>1</sup>Colorado Springs, CO 80903. <sup>2</sup>Department of Anthropology, The George Washington University, 2110 G Street, NW, Washington, DC 20052. <sup>3</sup>University of the Witwatersrand, 7 York Road, Parktown, 2193, Johannesburg, South Africa.



### Abstract

Despite extensive investigations of the gross anatomy of the cerebellum, and qualitative neuroanatomy, little quantitative neuroanatomical information exists, particularly on species outside primates. To that end, the present study quantitatively investigated, for the first time, the cerebellar neuronal morphology of the clouded leopard (*Niplobates velveteus*), Siberian tiger (*Panthera tigris altaica*), humpback whale (*Megaptera novaeangliae*), and chimpanzee (*Pan troglodytes*). Neuroanatomical software (NIH Neuroanatomist) was used to three-dimensionally trace cerebellar neurons (N = 198) stained by a modified rapid Golgi technique (Miller et al. 1996) from four Golgi (N = 12), Equiset (N = 11), and granule neurons (N = 42). Qualitatively, traced neurons appeared similar to those identified in other mammals, although they varied in size across species (Paley & Chaptalia, 1964). Axonal species, basal cell axons generally increased in size (e.g. total dendritic length and dendritic segment) in the following order: clouded leopard < humpback whale < chimpanzee < Siberian tiger. Equiset axons were increased in size across species in the following order: clouded leopard < humpback whale < chimpanzee. Axonal species, basal cell axons were also positively correlated with total dendritic length, average length of dendritic segments, and granule layer neuronal density (e.g. total dendritic length, average length of dendritic segments, and granule layer neuronal density) with cerebellar volume. Although there were quantitative patterns in the present study, an examination of species comparisons that quantitatively observed within



**Introduction**  
The present study contributes to the understanding of the evolution of mammalian cerebellar neurons. The primary goal is to describe the general form of cerebellar neurons. It is currently little is known about the evolution of the cerebellum (Mason 1996).  
The present study compares the following:  
• There will be a positive correlation between total dendritic length and granule layer neuronal density.

**Methods**  
**Tissue processing**  
The brains of two clouded leopards (N = 2, 2.7- and 3.0-year-old), one humpback whale (N = 1, 2.7-year-old), one Siberian tiger (N = 1, 2.7-year-old), and one chimpanzee (N = 1, 2.7-year-old) were processed for Golgi-staining (Swanson et al. 1998).  
**Cell isolation and Quantification**  
High resolution images (N = 198) were obtained on a Neuroanatomist computer-aided neuroanatomical software (NIH Neuroanatomist) with a neural dissection protocol (Mason 1996).  
**Data analysis**  
Neurons were identified with Neuroanatomist software. Total dendritic length (TDL), total dendritic segment (TDS), and granule layer neuronal density (GLND) were calculated through three-dimensional

**Discussion**  
The present study contributes to the understanding of the evolution of mammalian cerebellar neurons. The primary goal is to describe the general form of cerebellar neurons. It is currently little is known about the evolution of the cerebellum (Mason 1996).  
The present study compares the following:  
• There will be a positive correlation between total dendritic length and granule layer neuronal density.



# The Gift of Giving: Philanthropy as a Path to Self-Actualization

Alexander Glassman, Tomi-Ann Roberts (Advisor)  
The Colorado College, Colorado Springs, CO



Psychology

## Introduction

Philanthropy is generally understood as a personal sacrifice that benefactors endure to the good of society. However, giving may be as beneficial to givers as it is to the recipients. Indeed, it may be an ultimate path toward self-actualization and fulfillment.

## Costly Giving is Hedonically Rewarding

- Dickson (2011) suggested that altruism is only marginally correlated with happiness, and some altruists even find that after a certain extent, it is negatively correlated. Yet, some altruists even find that after a certain extent, it is positively correlated. This may mean that, for some altruists, giving may be as beneficial to givers as it is to the recipients.
- A study by Dunn, Aknin, and Norton (2008) found that participants who gave either a \$5 or \$10 bill to a charity were happier than those who did not give. This suggests that giving is hedonically rewarding.

## There is evidence for a causal relationship between prosocial spending and happiness.

- In a study by Dunn, Aknin, and Norton (2008), participants were given either a \$5 or \$10 bill and asked to spend the money on themselves or to give it to a charity. The researchers then asked them to rate their happiness. The participants in the group that was instructed to spend that money on themselves, and the day after, were significantly happier than those who spent the money on themselves. This suggests that giving is hedonically rewarding.

## The joy which comes from giving seems to be distinct from empathy.

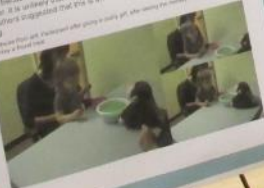
- A within-subject design study by Aknin, Miller, and Dunn (2015) investigated the effect of costly giving on the happiness of those who give. Participants were asked to give a portion of their money to a charity. The researchers found that giving was associated with a significant increase in happiness. This suggests that giving is hedonically rewarding.

## The children were significantly happier when engaging in costly giving (giving of money) on a weekly basis.

- The children were significantly happier when engaging in costly giving (giving of money) on a weekly basis. This suggests that giving is hedonically rewarding.

## Compassion is a key mediator in the relationship between giving and happiness.

- A study by Dunn, Aknin, and Norton (2008) found that participants who gave either a \$5 or \$10 bill to a charity were happier than those who did not give. This suggests that giving is hedonically rewarding.



## Giving as an Evolutionary Adaptation

Trivers (1971) suggested that altruism evolved because it is genetically beneficial to the donor. This is because the donor's genes are passed on to the recipient, and the recipient's genes are passed on to the donor's offspring. This suggests that giving is an evolutionary adaptation.



## Giving and Happiness: Evolutionary Explanations

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## Predicting Our Reaction to the Act of Giving

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## Degree of compassion

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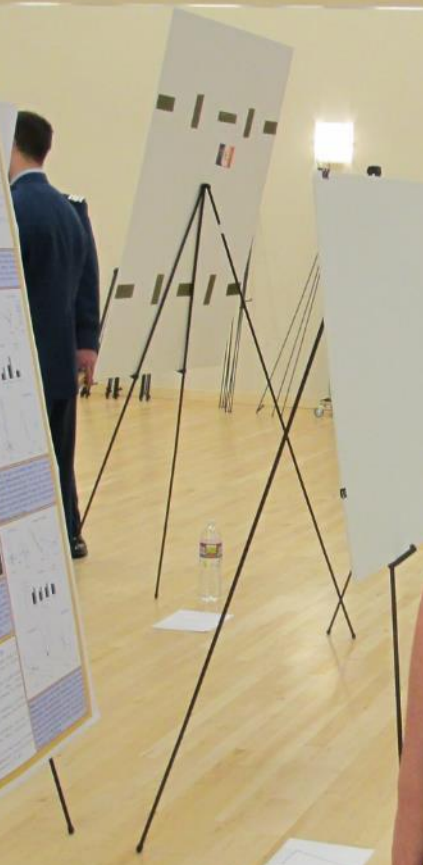
# Extinct giraffe (*Giraffa camelopardalis tippelskirchii*) and Eland (*Loxodonta africana*)

Jowowski<sup>1</sup>, John F. Roberts<sup>2</sup>, Chet C. Starace<sup>3</sup>, and Bob Jacobs  
1. Fort Collins, CO 80503; 2. Anthropology, Kent State University, Kent, OH 44242; 3. Central Research  
Institute, USGS, Washington, DC 20008; 4. Anthropology, George Washington University, Washington, DC 20052

**Results: Island Biogeography (Fig. 1-4)**  
Number of species recorded on islands of size 100-200 km<sup>2</sup> was significantly greater than on islands of size 10-100 km<sup>2</sup> (Fig. 1).  
Number of species recorded on islands of size 100-200 km<sup>2</sup> was significantly greater than on islands of size 10-100 km<sup>2</sup> (Fig. 2).  
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Number of species recorded on islands of size 100-200 km<sup>2</sup> was significantly greater than on islands of size 10-100 km<sup>2</sup> (Fig. 4).



**Discussion**  
The results of this study suggest that the extinction of the extinct giraffe and eland was influenced by island biogeography. The number of species recorded on islands of size 100-200 km<sup>2</sup> was significantly greater than on islands of size 10-100 km<sup>2</sup>. This suggests that larger islands were more likely to support a greater number of species, which may have contributed to the extinction of the extinct giraffe and eland.



Two women are engaged in a conversation. The woman on the left is wearing a bright yellow-green cardigan over a black top and glasses. She is gesturing with her hands as she speaks. The woman on the right is wearing a black jacket and is listening attentively. They are standing in a large, well-lit room with a wooden floor.

A group of people is gathered in the background. A man in a dark blue shirt and light-colored pants is looking towards the camera. Other people are engaged in conversations or looking at posters. The room is filled with scientific posters and people, suggesting a conference or meeting.



# Effect of the Polybrominated Diphenyl Ether Mixture DE-71 on Perceptual Attentional set Shifting in Rats

Rebecca Twombly & Lori Driscoll  
The Colorado College, Colorado Springs, CO

**Abstract and Introduction**

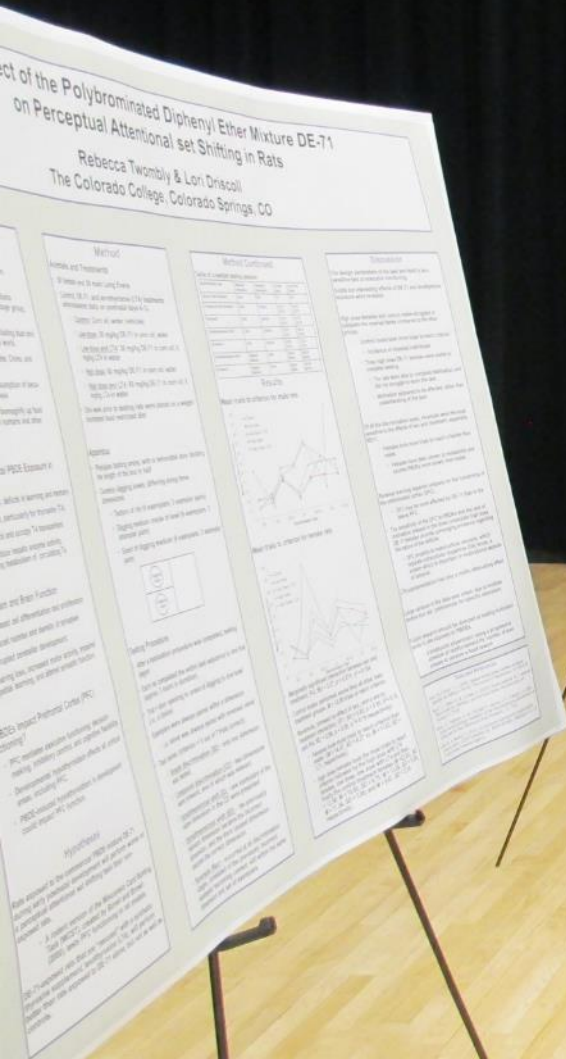
**Method**

**Results**

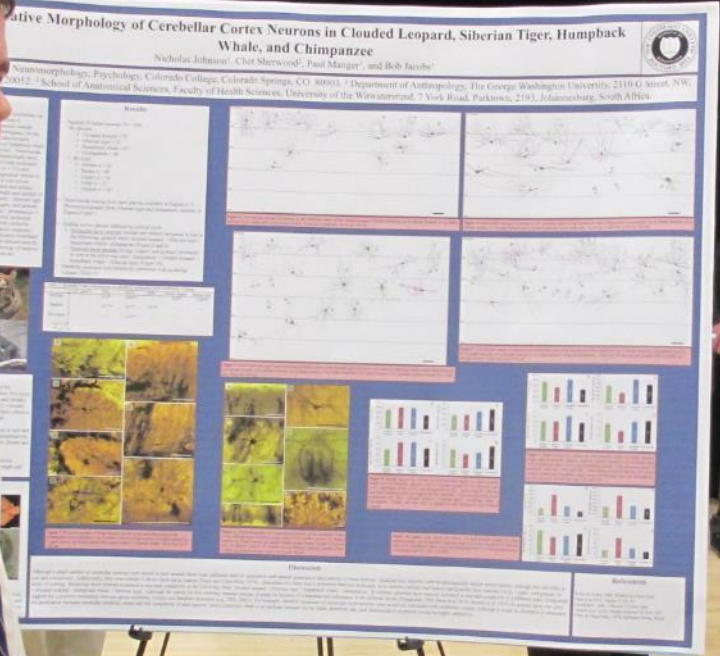
**Discussion**

**Conclusion**

**References**









**CSURF**

**2013**