The 2015 Midwest Cognitive Science Conference

MWCogsci-05

Mission Point Resort Conference Center
Mackinac Island, MI
May 10-11 2015

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Preface

We are excited to welcome you to the 5th Midwest Cognitive Science Conference. Looking over the program, we have close to 40 presentations by authors from more than a dozen organizations located all around the Midwest. In the true spirit of Cognitive Science, research from many allied disciplines is represented, including philosophy, psychology, human factors, neuroscience, robotics, and analytics. Mackinac Island is an exciting venue for this conference, as it has been a meeting location for residents of Midwest for more than 1000 years. We hope you enjoy the conference, and have time to explore Mackinac Island while you are here.

Shane Mueller, Michigan Technological University

Kelly Steelman, Michigan Technological University

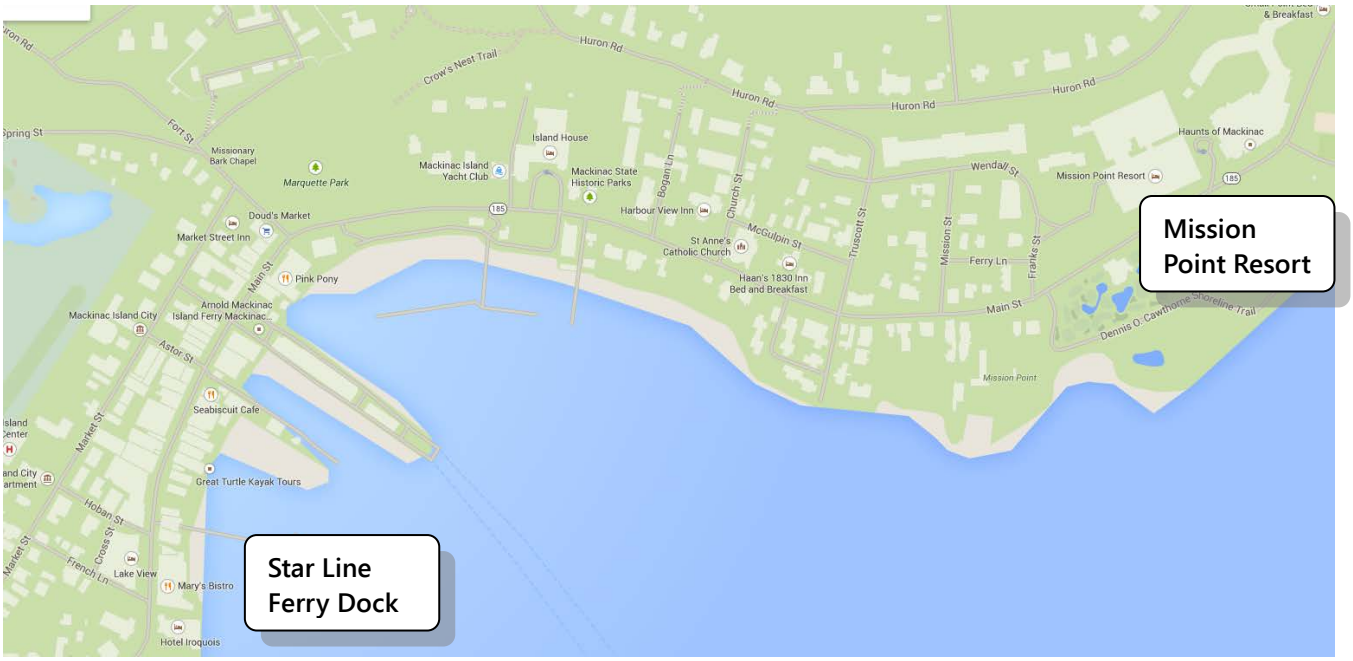
Beth Veinott, Applied Research Associates

Location

Mackinac Island can be reached via Ferry from either St. Ignace or Mackinac City. Use Star Line Ferry for a reduced rate: Code MCSC or tell them you are with the Midwest Cognitive Science Conference.

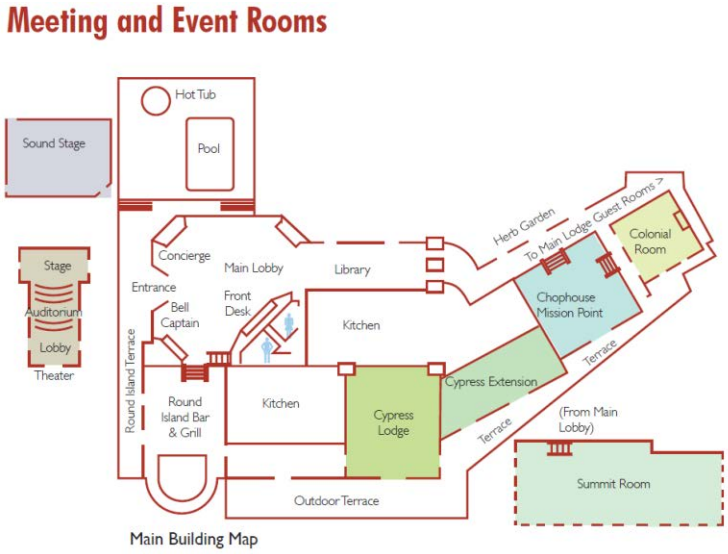
Once on the island, the Ferry dock is on the west side of town, and the Mission Point Resort is about a mile east of town on the main road. Once you arrive on the island, the Mission Point resort is about a 15 minute walk east from the dock areas (turn right when you arrive off the boats.) Hotel rates incorporate a $6 portage fee, and so your luggage will be delivered to the hotel once you arrive. Mission Point offers a shuttle from the dock.

Map courtesy http://www.worldatlas.com/aatlas/infopage/printpage/bigmac.htm

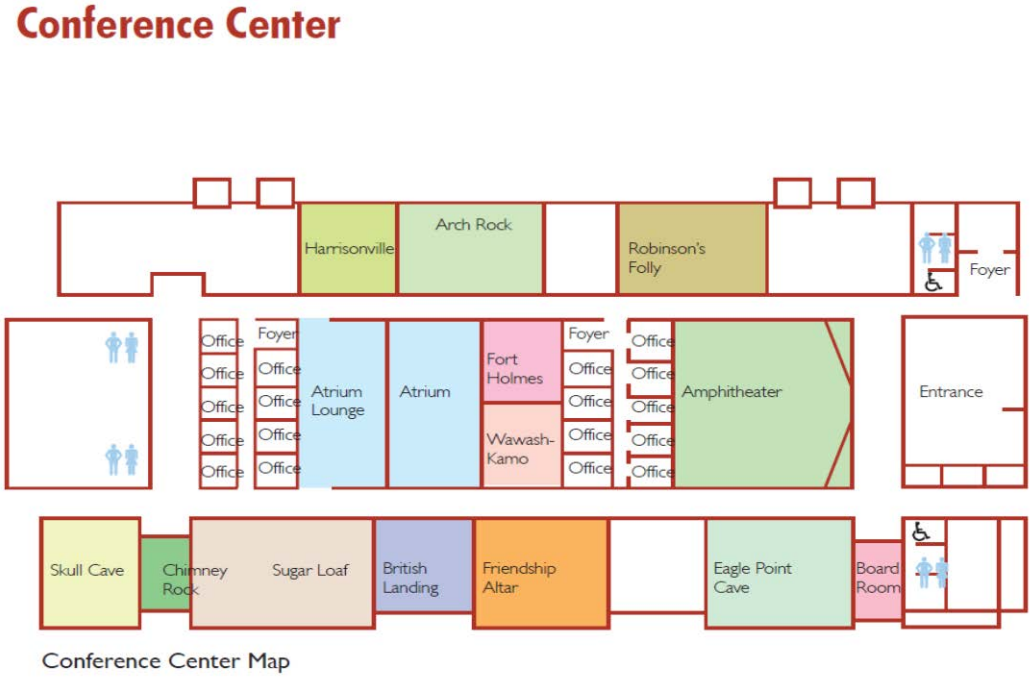


Venue

Sunday Night Poster session and Reception will take place in the Cypress Lodge area. Enter through the Round Island Bar & Grill



The presentations on Monday will take place in the Mission Point Resort Conference Center, in the Atrium Room, across the driveway from the main building.



Schedule

Sunday, May 10 (Cypress Lodge)

6-8 pm	Registration
7-9 pm	Poster session and Reception (Light hors d'oeuvres)

Monday, May 11 (Conference Center Atrium Room)

7:30 – 8:20 am	Registration and Continental Breakfast
8:20-8:30	Welcome
8:30-10:00	Session 1
10:00-10:20	Morning Break
10:20-12:05	Session 2
12:05-1:30	Lunch (on your own)
1:30-3:00	Session 3
3:00-3:20	Break
3:20-4:35 pm	Session 4

6:30 PM Last Star Line Ferries leaves island

We will organize a sign-up for a group taxi leaving Mission Point at 5:30 if you plan on leaving the Island Monday night. Please sign up at the registration table if you want to take the taxi we are organizing.

Poster Session

Sunday May 10, 7-9 pm

Posters will be mounted on cardboard backing on easels; 4'x4'

Title	Authors
1. Effect of Cognitive Constraints on the Dynamics of Gait Transition	Abdolvahab, Mohammad
4. Improvement of Non-native Phonetic Perception through Interactive Digital Media	Azartash, Kaveh; Yuden, Dorjay; Sarkhar, Trina; Pemba, Dhonam
5. Casting criminals: Does fear generalize from the "criminal" face type to all other faces within a race?	Bond, Alesha; Kleider-Offutt, Heather
9. Driver Awareness at Railroad Grade Crossings: Examining the Effectiveness of Auditory and Visual Warnings to Improve Safety	Croschere, Jayde; Landry, Steven; Perelman, Brandon; Jeon, Myounghoon; Lautala, Pasi; Nelson, David
11. Effect of cannabis use on visual perception and neural synchrony	Emerick, Brandi; Busey, Tom; O'Donnell, Brian
15. The Knowledge of Brain Death Scale	Feltz, Adam; Nelson, Brittany
23. Opportunity cost and reward rate maximization	Khodadadi, Arash; Fakhari, Pegah; Townsend, James
25. An Empirical Examination of the Failure of Perceptual Separability and timed Marginal Response Invariance with Recognition Theory including Response Time (RTGRT)	Liu, Yanjun; Abdolvahab, Mohammad; Townsend, James T.
28. The Effects of Target Prevalence on Visual Search	Peltier, Chad; Becker, Mark W
27. Modeling Strategic Optimization Criteria in Spatial Combinatorial Optimization Problems	Perelman, Brandon
32. Event-related potential effects of auditory sequential learning are related to receptive vocabulary ability	Ross, Kimberly M.; Daltrozzo, Jerome; Conway, Christopher M.
34. Perception and Action Development in Toddlers: Matching Simple and Complex Objects to Openings	Street, Sandra
38. Introducing Simbrain 3.0: A Software Platform for the Visualization, Development, and Simulation of a Broad Spectrum of Artificial Neural Network Architectures	Tosi, Zach; Yoshimi, Jeff
39. Hierarchical error representation gradients in medial prefrontal cortex.	Zarr, Noah
40. Conceptual Representation and Processing Fluency during Expert Classification Learning	Zeigler, Derek; Vigo, Ronaldo

Oral Presentations: Monday May 11

Registration & Continental Breakfast		7:30-8:20
Welcome		8:20-8:30
7. Speed-Networking is an Efficacious Tool to Produce Academic Collaborations in Under-Represented Populations	Cohen, Samantha; Todd, Peter	8:30-8:45
35. Westerners, Not Easterners, Have Global Visual Attentional Advantage in a Global-Local Task	Tan, Yin-Yin; Mueller, Shane	8:45-9:00
41. The influence of trait and state anxiety on intertemporal decision making: Inhibition-driven and trait anxiety interacting with state anxiety and SES	Zhao, Jinling; Harris, Mary; Vigo, Ronaldo	9:00-9:15
26. Assessing fluent expert memory access and search in competitive crossword players: The role of orthographic and semantic information in memory search.	Mueller, Shane T.; Thanasuan, K.	9:15-9:30
2. The effects of reward structure on violations of decisional separability in a perceptual identification task	Abdolvahab, Mohammad; Liu, Yanjun; Wenger, Michael; Townsend, James	9:30-9:45
37. Training using Video Games: Lessons learned from reducing cognitive biases.	Veinott, Elizabeth	9:45-10:00
BREAK		10:00-10:20
22. A Systems Factorial Technology Approach to Modeling Faces	Jefferson, Brett; Palakal Meelia, Townsend, James T.	10:20-10:35
16. A Triple-Stopping Threshold System For a Sequential Decision Task: A Cast-Net Stopping Rule Model	Fific, Mario; Marcus, Buckmann	10:35-10:50
3. What 1/f noise says about the replication crisis	Amon, Mary Jean; Holden, John G	10:50-11:05
8. DataShopping for Performance Predictions	Michael G. Collins: Kevin A Gluck	11:05:11:20
19. F in statistics. A concept inventory for basic statistics in the behavioral sciences	Gomez, Pablo; Allbritton, David	11:20-11:35
17. Synchrony with Humans, Robots, and Computers: Where will the benefits end?	Fraune, Marlena R., Sabanovic, Selma	11:35-11:50
10. Evolutionary Self	Delzeith, William	11:50-12:05

LUNCH (Mission point restaurants and snack bar are open)		**12:05-1:30**
14. Touch as a Unisensory, Interaction-Dominant Sense	Favela, Luis H; Amon, Mary Jean	1:30-1:45
24. Tempo-Fit Heartrate App: A novel way of improving exercise efficiency via music tempo manipulation	Landry, Steven; Sun, Yuangjing; Slade, Darnishia	1:45-2:00
29. Animal ethology and physiology: is scientific research focused on animal testing neglecting the evidence?	Pistollato, Francesca; Chandrasekera P. Charukeshi; and Harnad Stevan	2:00-2:15
20. Early signatures of scene processing: A multi-faceted EEG investigation	Harel, Assaf; Groen, Iris; Kravitz, Dwight; Deouell, Leon; Baker, Chris	2:15-2:30
13. A Comparison of PFC Activity between Different Anger Induction Techniques Using Functional Near-Infrared Spectroscopy (fNIRS)	Fakhrhosseini, Maryam; Jeon, Myounghoon; Bose, Rahul	2:30-2:45
33. Relation between behavior and patterns of neural activity in medial pre-frontal cortex of freely moving rats	Reimers, Mark; Euston, David	2:45-3:00
BREAK		**3:00-3:20**
30. Measuring Contextual Focus and Executive Functions using a New Computerized Instrument: The CogFLEX	Quillien, Jean-Baptiste, Anderson, Erik, Koutstaal, Wilma	3:20-3:35
36. Using Cognitive Word Games to improve Lexical Associations and Recognitional Decision Making Processes	Thanasuan, Kejkaew; Mueller, Shane	3:35-3:50
18. Effects of training flanker and simon tasks in older adults	Gomez, Pablo; Devis, Ester; Perea, Manuel	3:50-4:05
6. The Impact of Trait and Context on Outcome and Process of Intertemporal Choice	Cheng, Jiuqing; Gonzalez-Vallejo, Claudia	4:05-4:20
21. Using Statistical Learning with the Capacity Coefficient to Explore Individual Differences	Houpt, Joseph; Blaha, Leslie	4:20-4:35

Abstracts Alphabetized by Author

1. Effect of Cognitive Constraints on the Dynamics of Gait Transition. ***Abdolvahab, Mohammad.*** *Center for the Ecological Study of Perception and Action, Department of Psychology, University of Connecticut*

When using method of limits, humans switch from one behavior to another at a higher value of the control parameter in an ascending (increasing) sequence than in a descending (decreasing) sequence. This phenomenon is known as hysteresis. Accordingly, it has been demonstrated that humans switch from walking to running at a higher speed than when they switch from running to walking on an accelerating or decelerating treadmill, respectively. Concurrent cognitive activity has been shown to exaggerate the amount of hysteresis. More difficult and more mentally engaging cognitive tasks change the transition points more prominently. Using dual-task methodology, 15 healthy participants, walked or ran on a treadmill with varying speed while solving mental arithmetic organized in two levels of difficulty (easy and hard). The amount of hysteresis, the difference between walk-to-run and run-to-walk transition speeds, increased with the difficulty of the task compared to the baseline control condition (with no concurrent mental arithmetic task). The empirical findings were described using a synergetic model of human gait transitions. Specifically, model parameters were estimated to evaluate the predictions about the experimental outcomes and the efficiency of the model for the general class of behavioral transitions.

2. The effects of reward structure on violations of decisional separability in a perceptual identification task ***Abdolvahab [1,2], Mohammad; Liu[1], Yanjun; Wenger[2], Michael; Townsend[1], James*** *1 Department of Psychological and Brain Sciences, Indiana Univ. Bloomington 2 Department of Psychology, Univ. of Oklahoma*

General recognition theory (GRT) has been historically employed in several contexts to provide answers to the question of perceptual independence in multi-dimensional perception. GRT, that mainly applies to response frequencies, at its core, deals with types of independence and separability (e.g. perceptual separability or decisional separability). Of particular importance, within the GRT framework, are the tests for Marginal Response Invariance (MRI) and Report Independence (RI). In the original development of the theory, it was shown that, in a complete identification paradigm, if decisional separability and perceptual separability both hold, together they imply that MRI will hold. Also, the presence of perceptual independence and decisional separability together implies RI. In the present study, using a complete identification task of location and saturation as two reasonable perceptually separable dimensions, we aim at inducing violation of decisional separability by manipulating the reward structure. We then perform the tests of MRI and RI over the individual subjects data. Additionally, a diffusion model instantiating complete independence (with no cross talk across processes resulting in perceptual independence and separability) aimed at studying the effects of violation of decisional separability is developed. Using this model, we simulate a violation of decisional separability by changing decisional bounds (response thresholds) to bias toward specific responses. The model predictions are compared to empirical findings.

3. What 1/f noise says about the replication crisis. ***Amon, Mary Jean[1]; Holden, John G.[1]*** *1. Center for Cognition, Action, and Perception, Department of Psychology, University of Cincinnati, Cincinnati, OH, United States*

Correll (2008) was the first published application of fractal analysis in social psychological research, demonstrating 1/f noise varied based on stereotypes during a racial priming task. Madurski and LaBel (2014) outlined and subsequently ruled out reasons for two replication failures of Correll 2008, raising questions as to the legitimacy of using fractal analysis in social tasks. Given these failed replications, we compared an exact replication to a conceptual replication that implemented empirically supported practices in fractal analysis. The present study introduced a new type of replication study; one that utilizes improved experimental design to better test hypotheses of original studies. Findings demonstrated the conceptual replication method was superior in uncovering fractal dynamics, as compared to that used in previous studies. The meaning of failed replications has been increasingly questioned, with some arguing that replication studies should be abandoned altogether. This debate is symptomatic of a larger issue, where systems are assumed to be static and variability is seen as the result of unsystematic influences. Many systems, including cognitive ones, are highly adaptive. Thus, study outcomes may be altered by seemingly minor contextual factors. The nature of these systems may be better explained by quantum theory, where variability helps characterize a system and single samples may give rise to a set of outcomes, rather than a single central tendency.

4. Improvement of Non-native Phonetic Perception through Interactive Digital Media. ***Azartash, Kaveh*[1], Yuden, Dorjay[2], Sarkhar, Trina[3], Pemba, Dhonam[1]*** *(1) Kadho Inc., Irvine, CA USA (2) University of California, Los Angeles, CA USA (3) Stanford University, Stanford, CA USA*

Previous research studies demonstrate a decline in non-native phonetic perception between 6 and 12 months of age. Many studies have argued that perceptual narrowing of phonetic sounds can only be prevented through live interaction. With the introduction of the mobile tablet however, digital media is now more interactive, responsive and adaptive to a child's actions. We examined whether 4 hours of interactive play that exposes children to foreign sounds over an 8-week period (24 sessions, each lasting 8 minutes) can reverse the loss of non-native phonetic contrasts. 24-month-old Mandarin- and English-speaking infants were tested for discrimination between two phonetic contrasts in Mandarin that do not exist in English. We show that training through interactive digital media improves performance for English-speaking infants, and performance is similar to untrained Mandarin infants. These results indicate that phonetic learning is possible if media is interactive.

5. Casting criminals: Does fear generalize from the "criminal" face type to all other faces within a race? ***Bond, Alesha; Kleider-Offutt, Heather,*** *Cognitive Sciences, Psychology, Georgia State University*

Research shows that stereotypically Black facial features (e.g. broad nose, full lips) are associated with criminality and violence more so than atypical Black features. These fears and stereotypical associations influence jury decisions, eyewitness identification, and voter opinions (Blair, Judd, & Chapleau, 2004; Eberhardt, Goff, Purdie, & Davies, 2004; Kleider, Cavrak, & Knuycky, 2012; Knuycky, Kleider, & Cavrak, 2014). Research shows that fear of objects (e.g. crow vs. penguin) generalizes from prototypical to atypical members of a category (Dunsmoor & Murphy, 2014). It follows that associated fear across category members would hold true for faces and criminality. This present study investigates whether priming individuals with 'criminal type' Black faces will heighten the association between criminality and all black faces leading to biased judgments for atypical Black faces. This was done by analyzing how believable the actor would be if cast in a particular role (Drug Dealer, Teacher, or Artist) as well as a speed task analyzing whether a face is considered to be dangerous or not. A 4 (Prime Condition: Black stereotypical faces, Black atypical faces, White stereotypical faces, White atypical faces) X 2 (Target Face: Stereotypical faces vs Atypical faces) ANOVA will be conducted, with prime condition as a between-subjects variable and target faces as a within-subjects variable. Results will have theoretical implications for whether the processes for categorization and the generalization of fear within categories operate in the same way for faces as for other stimuli.

6. The Impact of Trait and Context on Outcome and Process of Intertemporal Choice. ***Cheng, Jiuqing Gonzalez-Vallejo, Claudia*** *Department of Psychology, Ohio University*

In intertemporal choice, people usually make decisions between receiving a small gain sooner and a large gain later. The impact of other traits, particularly in the loss domain, has received far less research. Further, past studies have overwhelmingly concentrated on the outcomes of intertemporal choice; the process remains unclear. The study investigated the impact of trait (impulsivity and procrastination) and context (defined by sign and magnitude of the reinforcement) on both outcome and process of intertemporal choice. Response time was employed to index decision process. It was found that participants were more likely to choose the long-term advantageous option in loss and large magnitude contexts, when compared to gain and small magnitude contexts, respectively. Whereas greater impulsivity was associated with more short-term oriented choices in both gain and loss domains, procrastination was only positively related with such choices in loss. As for process, participants exhibited a longer response time in loss than in gain, in small than in large magnitude contexts, and when the choices were closer to the indifference point. No difference in response time was detected when making different choices. No relationship was found between response time either trait, suggesting traditional psychological scales might not be able to capture decision process. The relationship between response time and action dynamic measures based on cursor or figure movement is also discussed.

7. Speed-Networking is an Efficacious Tool to Produce Academic Collaborations in Under-Represented Populations. ***Cohen, Samantha; Todd, Peter.*** *Indiana University, Psychological and Brain Sciences*

For organizations and universities attempting to improve workplace dynamics for individuals who are under-represented, new, or isolated within the organization, few tools are available to change entrenched social structures and their outcomes are unknown. Efforts to foster professional relationships range from highly complex measures of network analysis and monetary incentives to simple tools such as speed-networking. The authors developed and examined the efficacy of a computationally-paired speed-networking paradigm, aimed at producing novel academic collaborations between faculty members at a large research university. In the most recent experiment, individuals received partner matches according to a revised algorithm using weighted feature matches based on feature weights generated in a regression model of features that maximized predicted collaborations in previous work. Each individual met the partners that maximized the algorithm across all pairs, including their three best-matching partners. Results were contrasted against a control event where individuals met each individual in attendance. In total, 8 of 26 participants collaborated across both events, with no significant difference in collaboration rates between events. When compared to previous computationally-matched and non-experimental speed-networking events, results demonstrate that computational matching and high-effort methods may be less critical to collaborative success of individuals than structured networking as a whole. Practical implementations are discussed.

8. DataShopping for Performance Predictions. ***Collins, Michael G. & Gluck, Kevin A.*** *Air Force Research Laboratory .*

Mathematical models of learning attempt to capitalize on the regularities that are seen when individuals acquire new skills. One such mathematical model is the Predictive Performance Equation (PPE), which is a hybrid model of learning and forgetting that calibrates to an individual or sampleâ€™s previous instances of performance in order to generate a prediction of their future performance. It is the intent that the PPE will be used to inform real-world education and training decisions, by informing optimal scheduling for continuing education and refresher training specified to the individual. However, a majority of the data available from the published literature on learning and retention report data only at a sample level of aggregation and are seldom reported at an individual level of performance. This is the sort of niche intended to be filled by online data repositories, such as DataShop, created by the National Science Foundation-funded Pittsburgh Science of Learning Center. DataShop holds a large set of growing publicly available data recorded at a fine level of granularity. We have conducted a case study with data from thirteen different classroom tutoring studies exported from DataShop, mimicking how PPE can be used within an applied domain to predict future performance based on previous instances of performance, in order to examine the affects of the level of aggregation and number of previous events PPE calibrated to has on the accuracy of its predictions. We also hope to use this case study to show other how to utilize the data available on DataShop.

9. Driver Awareness at Railroad Grade Crossings: Examining the Effectiveness of Auditory and Visual Warnings to Improve Safety[1]. *Croschere, Jayde; Landry, Steven; Perelman, Brandon; Jeon, Myounghoon; [2] Lautala, Pasi; Nelson, David [1]**Michigan Technological University, Department of Cognitive and Learning Sciences, Houghton, MI 2- Michigan Technological University, Department of Civil and Environmental Engineering.*

Despite consistent efforts, there were still 2,087 collisions involving trains and motorists in 2013. Driver misunderstanding of warning signals and other human errors account for many of these collisions. There are two types of grade crossings. Active crossings are designed to warn drivers of approaching trains using visual and auditory signals. Passive crossings use signs and pavement markings to communicate upcoming crossings but do not actively warn drivers of trains. The goals of this research are twofold; first, to examine the suitability of various auditory stimuli for use as in-vehicle warnings to alert motorists of approaching trains; second, to evaluate the effectiveness of different signage at grade crossings. The first study gathered feedback on various auditory cues. Participants were presented with 31 auditory cues and asked to rate their discriminability, meaning, urgency, natural response, annoyance, startle effects, and overall effectiveness for use as in-vehicle warnings. Results showed earcons had higher ratings than speech or auditory icons on nearly all dimensions. The next experiment which will use these cues in a driving simulator featuring railroad crossings to gather quantitative performance data. The second study looked at driver behavior when a STOP or YIELD sign was implemented at passive railroad grade crossings. Driving behavior is measured using a mid-fidelity driving simulator and eye-tracker to see driver speed, compliance, and eye gaze among other variables. The results will assist decision-making regarding passive rail crossings.

10. Evolutionary Self. *Delzeith, William.* *University of Toledo Philosophy Department.*

If we are to adopt a physicalist philosophy, all of our perceptions, thoughts, and mental processes can be represented as a physical process or function of the brain. A causal relationship exists between the environment, our knowledge, and our resulting actions. However, it does not seem to be a linear path. The causal relationships represented by a physicalist theory seem to be a causal spiral, where one leads to the other, which leads to another, ad infinitum, or more dramatically, until our spiral runs out of coil. If this is a depiction accurate of physicalism, is self seemingly left out of the loop? The Theory of Evolution maintains that life is the result of a process that began with the simplest of single-cell organisms and its time line has led to human beings. From a physicalist position, intelligence and cognition are the end result of evolution and humanity is the sole benefactor. Is this the final page in the evolutionary photo album? I argue that restricting ourselves to physicalist accounts, we are certainly at the end of that photo album, thus limiting our concept of self. Why would we restrict ourselves when there is another album that has yet to be discovered? Using epiphenomenalism, qualia, and evolution, I will outline a position forward for those of us that feel trapped by our big, heavy, encumbered brains. I will argue for the idea of self as a picture at the beginning of a new story in the evolutionary photo album.

11. Effect of cannabis use on visual perception and neural synchrony. E*merick, Brandi; Busey, Tom; O'Donnell, Brian.* *Indiana Univ., Dept. of Psychological and Brain Sciences*

This project is currently collecting behavioral, demographic, and neurophysiological data from 3 types of participants (current cannabis users, former users, and non-users). There will be 20 participants in each group, for a total of 60 participants. Neurophysiological data will be recorded using electroencephalography (EEG) while participants perform visual tasks. Data analysis will include measures of power and phase-locking at frequencies of interest. These measures will reflect neural synchrony and attention to stimuli. Results will be compared to factors such as age of onset and duration of cannabis use (for former and current users). Expected differences across groups include attention to signal, suppression of noise, and strength of neural synchrony. Previous research suggests deficits will be greater for individuals who began using cannabis at an earlier age. Former users will be compared to current users and non-users to determine potential for recovery on the selected measures. Knowledge about how neural circuitry is affected by chronic cannabis use could be used to identify individuals with increased susceptibility to adverse effects, measure how long residual deficits persist after cessation, and enable more effective treatment for those suffering negative consequences of cannabis use. This research could also help characterize the link previous research has suggested between psychosis and cannabis use, as both involve distortions of visual perception.

13. A Comparison of PFC Activity between Different Anger Induction Techniques Using Functional Near-Infrared Spectroscopy (fNIRS). *Fakhrhosseini, Maryam; Jeon, Myounghoon; Bose, Rahul.* *Department of Cognitive and Learning Science andDepartment of Mechanical Engineering-Engineering Mechanics, Michigan Technological University*

As research on emotions, interests in affect induction techniques and measures have increased. In this study, we compare well-known affect induction techniques: watching video clips and writing past experiences with an introduction of a relatively new measurement tool, Functional Near-infrared Spectroscopy. fNIRS is a technique that can be used to measure hemodynamic changes in the brain that plot the temporal course of the changes. Using fNIRS we have recorded participants' prefrontal cortex (PFC) activation during anger induction, which is being done through two different emotion induction techniques. To this end, we have two groups with 20 participants in each: In the first group participants induce anger by watching the validated anger induction videos and in the second group participants induce anger by writing about an angry experience they could vividly remember. To assess gender differences in cerebral activation, male and female participants are evenly distributed across the two conditions. To record PFC activation, we have a pre-stimulus two minute local baseline and *on* and *off* segments of data, referring to fNIRS Oxy-Hb levels while stimulation is presented and after the presentation. Results are discussed with the course and intensity of PFC activation produced by different affective stimuli and gender differences. The comparison of these affect induction techniques will help us identify the strength of each method and how long they can activate PFC especially in the *off* period, considering gender differences.

14. Touch as a Unisensory, Interaction-Dominant Sense. ***Favela, Luis H.[1,2]; Amon, Mary Jean[1]*** *1 Center for Cognition, Action, and Perception, Department of Psychology, University of Cincinnati; 2 Department of Philosophy, University of Cincinnati.*

Following recent theoretical and empirical work on unisensory touch and haptic experiences, we offer a novel account of touch as a unisensory experience in light of its being an interaction-dominant sensory system. Systems are interaction-dominant (ID) when the properties of the interactions among the parts supersede the properties the parts would have separately. ID systems contrast with component-dominant systems where the properties of components override system-level properties that could arise due to interactions among the components. In this way, the phenomenology of touch results from ID dynamics that combine cutaneous, kinesthetic, and proprioceptive experiences into novel, unisensory experiences that are irreducible to the properties taken in isolation. First, we present theoretical reasons for treating touch as a unisensory (as opposed to multisensory), ID sense. Second, we discuss empirical research on metamers (i.e., when multiple combinations of physical properties give rise to the same perceptual experience), which demonstrates that haptic perception references higher-order variables that arise from an interaction of parts. Finally, we defend the claim that not only is our theory consistent with previous research, but it has implications for defining variables of interest and subsequent research design. Specifically, if touch is a unisensory, ID sense, then touch and haptic perception research ought to focus on the study of higher-order variables.

15. The Knowledge of Brain Death Scale. ***Feltz, Adam; Nelson, Brittany*** *Michigan Technological University,*

Do you think the average American knows enough about brain death to make informed decisions about end of life care? Previous work has shown that there is diversity in definitions of death, and that some conceptions may be at least partially a result of error (Feltz & Nelson, submitted). Ensuring that definitions of death are not a result of error is vital for informed decision making which respects patient autonomy. By increasing knowledge of brain death it will likely decrease unnecessary stress for family members, physicians and hospitals that could otherwise be avoided. Further, understanding of brain death has been shown to be significantly associated with other real-world decisions such as organ donation (Simpkin et al., 2009). Previous attempts have been made to measure knowledge of brain death but have largely been inadequate, either showing conceptual or empirical problems. A better instrument would be conceptually and empirically sound, providing a more representative picture of an individual's knowledge of brain death. Through 3 experiments using item response theory (IRT) and exploratory factor analytic techniques we accomplished just that. Experiment 1 (N=257) tested a comprehensive dichotomous scale of 30 items, the best 9 indicator items were extracted for further analyses. Experiments 2 (N = 225) and 3 (N = 323) reduced the number of items and gathered convergent, discriminant and criterion validity. The final instrument is a six item validated scale.

16. A Triple-Stopping Threshold System For a Sequential Decision Task: A Cast-Net Stopping Rule Model. ***Fific, Mario [1] Marcus, Buckmann[2]*** *1Department of Psychology, Grand Valley State University, Michigan; 2Max Planck Institute for Human Development, Center for Adaptive Behavior and Cognition, Berlin*

In this study compared single stopping rules models to the Cast-Net stopping rule model. The Cast-Net model assumes that several stopping rules can be used simultaneously to determine the stopping p+oint to stop information search and to proceed to making a final decision. We analyzed whether the Cast-net model would pay the price for being more complex when compare to single stopping rule models (critical difference, fixed-sample size and runs). The models were compared under different decision making conditions (time pressure and validity of recommendations). The model fitting was conducted on the full data stopping-value distributions, by simultaneously fitting the correct and incorrect responses. Across variety of experimental conditions, the general results supported the validity of the Cast-Net model. These results challenge many decision making models that utilize only one type of a stopping rule, and may provide a new direction in the exploration of cognitive computational models.

17. Synchrony with Humans, Robots, and Computers: Where will the benefits end? ***Fraune, Marlena R[1,2]; Sabanovic, Selma[1,3].*** *Indiana University 1. Cognitive Science Department 2. Psychological and Brain Sciences 3. Informatics*

Between robots like Roomba, Big Dog, Dragonbot, and Asimo, humans will soon come into contact with robots in their daily lives (e.g., for education, help in labs); however, for many people, robots prompt fears such as the possibility of losing a job. People are less likely to interact and cooperate with those whom they have negative attitudes toward, and in the case of robots, negative attitudes may keep people from using robots to their full potential. In human-human interaction, synchrony increases liking, and the same may be true for human-robot interaction â€“ but synchrony with robots has not yet been systematically examined. In this study, we seek to determine if synchrony enhances relationships with robots like it does with humans, and if robots that synchronize with humans gain any benefits above what computers might gain. To do so, we manipulate interaction (synchronous, alternating) and the participants' interaction partner (human, humanoid robot, computer). Participants and the partner first read words (in synchrony or alternating). Then, participants complete behavioral and survey measures of attitudes toward the partner, including perceived similarity and liking. The results of this study can assist in understanding what characteristics of a partner drive the benefits of synchrony. Results can also provide design recommendations for how to create and introduce robots to maximize positive interactions with them.

18. Effects of training flanker and Simon tasks in older adults. ***Gomez, Pablo[1] Devis, Ester[2] [3] Perea, Manuel[2]*** *[1]DePaul University [2]Universitat de Valencia [3]BCBL*

We present a Delta plot analysis of training of older adults in executive control tasks. We found that training in different tasks affect the delta plots differently; namely, training in a Simon task did not transfer to testing in flanker task, but training in a speeded categorization task did speed up the longer responses in the flanker task in the post test. Our results show that training, at least in the short term does not generalize well.

19. F in statistics. A concept inventory for basic statistics in the behavioral sciences ***Gomez, Pablo; Allbritton, David.*** *DePaul University, Psychology Department*

A concept inventory, the DePaul Statistics Inventory (DPSI), is presented for assessing conceptual understanding of elementary statistics. A concept inventory is a criterion-referenced test designed to evaluate working knowledge of a specific set of concepts. Perhaps the best known example is the Force Concept Inventory (FCI) (Halloun & Hestenes, 1985) used to identify misconceptions about mechanics. A surprising finding from assessments using the FCI was that the gains after taking a course in Physics were rather modest and only marginally related to the students' grades. We wished to know whether students taking statistics courses in psychology would demonstrate an increase in conceptual understanding of probability and statistics, as measured by the DPSI. The DPSI is a multiple choice test of basic statistics concepts that does not require the use of formulas, equations, or statistical software. In contrast to previous statistics inventories (e.g., Allen, 2006, PhD dissertation), the DPSI avoids the use of technical terms and does not depend on studentsâ€™ ability to remember definitions. Thus we were able to test studentsâ€™ intuitions before taking any courses in statistics as well as after one or more courses. We present the results of an assessment using the DPSI, along with an R based explanation of all answers.

20. Early signatures of scene processing: A multi-faceted EEG investigation. ***Harel, Assaf[1]; Groen, Iris[2] Kravitz, Dwight[3]; Deouell, Leon[4]; & Baker, Chris[2]*** *1 Department of Psychology, Wright State University, Dayton OH 2 Laboratory of Brain and Cognition, NIMH, Bethesda, MD 3 Department of Psychology, The George Washington University, DC 4 Department of Psychology, Hebrew University, Jerusalem, Israel*

Humans are extremely adept at recognizing complex visual scenes, an ability supported by a network of scene-selective cortical regions. In spite of growing knowledge about the functional properties of these regions, much less is known about the temporal dynamics underlying scene processing. Here, we report a series of EEG studies aimed at identifying the earliest electrophysiological markers of scene processing. First, adopting an event-related potential (ERP) approach, we found that the first ERP component to evidence scene selectivity was the posterior-lateral P2, peaking around 200 ms post-stimulus onset, with highest amplitude to scenes relative to objects and faces. Next, to investigate what scene properties are represented by the scene-selective P2, we presented the same participants with a set of 96 diverse real-world scenes spanning three stimulus dimensions: spatial layout (open/closed), relative distance (near/far), and naturalness (man-made/natural). Consistent with its putative role in scene processing, P2 was sensitive to the spatial layout of the scene and its naturalness. Finally, to evaluate how information contained in individual scene images is processed, we applied a single trial analysis that revealed that summary statistics shown to be diagnostic of global scene recognition modulate EEG activity at a similar time window as the P2. These results demonstrate how multiple scene properties influence the processing of scenes, further suggesting that P2 can be used as an index of scene processing.

21. Using Statistical Learning with the Capacity Coefficient to Explore Individual Differences. ***Houpt, Joseph [1]; Blaha, Leslie [2]*** *1 - Department of Psychology, Wright State University, Dayton, OH 2 - United States Air Force Research Laboratory, Dayton, OH*

The capacity coefficient is a well-established, model-based measure that compares performance with multiple sources of information together to performance with each of those information sources in isolation. The measure is a function across time and hence, can potentially carry a large amount of information about a participant. In many applications, this information has been ignored, either by using qualitative assessment of the function or by using a statistic that summarizes the function across time. Recent work has demonstrated the efficacy of dimensional reduction, particularly functional principal components analysis, for extracting important information about the capacity function. We extend this work by applying additional techniques from statistical learning, including k-means clustering and hierarchical clustering. We will also demonstrate the approach for recovering individual differences in various datasets.

22. A Systems Factorial Technology Approach to Modeling Faces. ***Jefferson, Brett; Palakal Meelia. Townsend, James T.*** *Indiana University*

The theory driven methodology of Systems Factorial Technology (SFT) has been an instrumental approach to understanding the architecture, stopping rule, workload capacity, and independence of judgments related to two sources of information (Townsend & Nozawa, 1995; Johnson et. al., 2010). The classic paradigm employed to use this methodology is the Double Factorial Paradigm (DFP) where two potential targets are designated with a salience (high, low, and absent) manipulation for each target. This paradigm has the advantage of allowing experimenters to analyze participant performance with each source of information presented independently and together. However, with face stimuli, there is evidence that people attend to irrelevant information (such as face shape or skin tint) when making decisions that logically only require one source of information (Balas & Nelson, 2010). In this experiment, we ask participants to judge one dimension (face shape or skin tint) as we systematically vary the second. We model response times using SFT, marking the first time that SFT has been used without DFP. Theoretically, the Survivor Interaction Contrast function should be constant. Early pilot data suggest that the SIC is not constant. This is also the first time SFT has been used with face shape and skin tint. This approach serves as one of the fundamental steps in modeling face perception.

23. Opportunity cost and reward rate maximization. ***Khodadadi, Arash Fakhari, Pegah Townsend, James T.*** *Department of Psychological and Brain Sciences, Indiana University, Bloomington, IN.*

In many real life situations the animals face the problem of how much time they should spend on a decision. By deliberating more on each decision, the accuracy increases. However, if the total time for making a number of decisions is limited, by spending more time on one decision less remains for other decisions. Recently, we

proposed a theoretical and experimental framework for investigating the behavior of a rational agent in such situations (Khodadadi, Fakhari and Busemeyer, 2014). Each session of the proposed experiment consists of a number of blocks with fixed duration (for example one minute). The number of trials in a block depends on the time that the subject spends on average on each trial. Crucially, each trial can come from one of the several possible ``conditions''. A condition specifies the difficulty of the trial, the reward, the penalty and so on. A cue associated with each condition is presented at the beginning of each trial. We showed that to maximize the expected reward during a block, the subject should set a separate value of decision threshold for each condition. The aim of the current study is to investigate the predictions of the proposed computational framework. Specifically, we conducted an experiment in which the aforementioned experimental factors are chosen such that to maximize the reward, the subject should set a large decision threshold in one condition and small threshold in another. Surprisingly, our results show that most subjects set the same decision threshold for both conditions.

24. Tempo-Fit Heartrate App: A novel way of improving exercise efficiency via music tempo manipulation ***Landry, Steven; Sun, Yuangjing; Slade, Darnishia*** *Michigan Technological University Applied Cognitive Science and Human Factors, Mind Music Machine Lab*

Physical inactivity is a worldwide issue causing a wide variety of health problems. Exploring novel ways to encourage people to engage in physical activity is a topic at the forefront of research for countless fitness companies, health organization, physicians, and even concerned family and friends. Based upon a review of the literature, observations, surveys, and empirical studies with user feedback, we propose an app prototype that utilizes music tempo manipulation to guide users into a target heart rate zone during an exercise session. Phase I of the study consisted of a user analysis online survey with 281 subjects to collect exercise habits and sources of motivation for exercise. In phase II a study was conducted with 26 participants in a fifteen-minute cycling session using different sonification strategies and combinations of auditory and visual feedback based on the user's current heart rate. Results, prototype recommendations and experimental feedback are discussed. A "guiding" sonification strategy (music tempo decreases when user's heart rate increases) was considered more appropriate for physical activities that require a consistent level of physical exertion (jogging, cycling, etc), while a "reporting" sonification strategy (music tempo decreases to reflect a decrease in the user's heart rate) was considered appropriate for dynamic activities (sprinting, weight lifting, etc.).

25. An Empirical Examination of the Failure of Perceptual Separability and timed Marginal Response Invariance with Recognition Theory including Response Time (RTGRT). ***Liu, Yanjun; Abdolvahab, Mohammad; Townsend, James T.*** *Psychological and Brain Science Department, Indiana University*

General Recognition Theory including response time (RTGRT; Townsend, Houpt & Silbert, 2012) is a stochastic multidimensional theory of classification , which extends General Recognition Theory (GRT; Ashby & Townsend, 1986). RTGRT has an implicated methodology for testing the Timed Marginal Response Invariance (TMRI) which states that the probability of reporting one level of a certain dimension does not depend on the stimulus level of the other dimension and processing time is less than some arbitrary value *eta*. Theoretically, either failure of decisional separability or perceptual separability can lead to a violation of TMRI. The current study aims to empirically examine if the RTGRT can capture the causal relationship between the failure of the perceptual separability and the violation of TMRI. In the present study, one experimental condition employs dimensions usually thought to be perceptual integral while the other experimental condition uses dimensions conventionally accepted as perceptual separable. Our hypothesis is that the violation of TMRI should only occur in the perceptual integral condition. In addition, if there is a violation in TMRI, the static MRI should be violated as well, according to a theorem in Townsend, Houpt & Silbert (2012).

26. Assessing fluent expert memory access and search in competitive crossword players: The roe of orthographic and semantic information in memory search. ***Mueller, Shane T.; Thanasuan, K.*** *Michigan Technological University, Department of Cognitive and Learning Sciences*

Crossword play requires memory along two routes (semantic and orthographic) that provide complementary cues and constraints. The process can be understood as a memory search problem in which candidates are generated via memory retrieval, and then checked against the constraints to determine whether the candidate is satisfactory. It remains an open question whether this memory search can happen simultaneously along both routes, or must happen for orthographic and semantic routes separately. We report the results of experimentation and a computational model that show the best explanation, for both novices and experts, is that memory search occurs with one type of cue at a time. This suggests that compound cues are typically not used to search memory in crossword play. Furthermore, these results, together with a computational model of crossword play, indicate that expert players may be especially adept at memory access via semantic (clue-answer) associations. This suggests an association-based account of knowledge expertise wherein recognitional decisions are constrained mainly be fluent memory retrieval rather than a more traditional decision process involving the ability to compare and weigh between options.

27. Modeling Strategic Optimization Criteria in Spatial Combinatorial Optimization Problems. ***Perelman, Brandon.*** *Michigan Technological University, Department of Cognitive and Learning Sciences*

In many real-world route planning and search tasks, humans must solve a combinatorial optimization problem that holds many similarities to the Euclidean Traveling Salesman Problem (TSP). The problem spaces used in real-world tasks differ most starkly from traditional TSP in terms of optimization criteria. Whereas the traditional TSP asks participants to connect all of the nodes to produce the solution that minimizes overall path length, real-world search tasks are often conducted with the goal of minimizing the duration of time required to find the target (i.e., the average distance between nodes). Traditional modeling approaches to TSP assume that humans solve these problems using intrinsic characteristics of the brain and perceptual system (e.g., hierarchical structure

in the visual system). A consequence of these approaches is that they are not robust to strategic changes in the aforementioned optimization criteria during path planning. We discuss an experiment in which participants were capable of strategically adapting optimization criteria based on instruction alone, and computational models developed to produce optimization criteria-specific solutions to these combinatorial optimization problems using strategic optimization parameters.

28. The Effects of Target Prevalence on Visual Search. ***Peltier, Chad; Becker, Mark W.*** *Michigan State University*

Observers are more likely to miss rare than common targets in visual search tasks. Wolfe and Van Wert (2010) suggest that low target prevalence lowers a quitting threshold that results in incomplete searches and a shift in the decision criterion for the evaluation of items that are inspected. Fleck and Mitroff (2007) suggest that low prevalence results in a prepotent target absent motor response, and miss errors are execution errors that can be avoided if observers are required to make a second confirming button press. To evaluate these claims, we tracked eye movements during search for a target T among distractor offset Ls. Target prevalence was varied (10%, 50%, 90%) over three blocks. Following a target presence judgment, observers made a second response to investigate the claim that execution errors are the cause of the low prevalence effect. There was no support for this hypothesis as accuracy was equal between the first and second responses. Comparing the percentage of trials where a target was fixated but missed shows that while low and moderate prevalence levels did not differ, the high prevalence rate blocks had lower misses of inspected targets, supporting the view that decision criterion are somewhat impacted by prevalence. The number of inspected items per trial increased significantly as prevalence level increased, supporting the hypothesis that the prevalence effect is caused by incomplete search. Overall, results suggest that alterations in quitting thresholds are the main cause of the PE with shifts of criterion playing an additional but minor role.

29. Animal ethology and physiology: is scientific research focused on animal testing neglecting the evidence? ***Pistollato, Francesca[1], Chandrasekera P. Charukeshi[1] and Harnad, Stevan[2]*** *1 Physicians Committee for Responsible Medicine (PCRM), Washington DC, USA 2 Canada Research Chair in Cognitive Sciences, University du Quebec, Montreal, Canada*

Animal models are widely used in scientific research to recreate human physiology, decipher disease mechanisms and evaluate therapeutics. However, inter-species differences between animals and human beings make these models poorly predictive of human physiology, disease and drug responses. In addition, research has shown that animals are more sensitive to stress and have more acute cognitive abilities than previously appreciated, suggesting that routine experimental conditions cause more suffering in animals than previously thought. This raises both ethical and scientific concerns regarding the use of animals in research. Currently the 3Rs principle (i.e. refinement, reduction and replacement of animal testing) is used to try to avoid, minimize and alleviate distress in laboratory animal care and use. Nevertheless, unpredictable reactions to psychological and physical stress in animals can profoundly affect a plethora of biological, epigenetic and physiological responses, compromising experimental outcomes and their relevance to humans. Providing anesthetic treatments, analgesic drugs and euthanizing procedures, in accordance with current animal welfare regulations, does not change these facts and does not improve results reliability and reproducibility. We will discuss both the ethical and the scientific issues underlying this problem, suggesting a substantial shift in research methods, from traditional tests relying on the use of animals to novel human-based approaches.

30. Measuring Contextual Focus and Executive Functions using a New Computerized Instrument: The CogFLEX. ***Quillien, Jean-Baptiste [1] Anderson, Erik 1 Koutstaal, Wilma [2].*** *1 University of Minnesota, Department of Educational Psychology 2 University of Minnesota, Department of Psychology*

We created a new computerized instrument (CogFLEX) to assess executive functions (shifting, inhibition, and updating) and their relation to problem solving. Undergraduates (N=69) completed four tasks: separately ranking animals or sums by size from larger to smaller, and vice versa (processing speed); alternating between ranking animals and sums (shifting); alternating between ranking animals and sums displayed within large or small "bubbles" (inhibition); and switching between the ranking task and an alternative memory recall task (updating). We also assessed divergent thinking (DT, RUFF figural fluency task) and convergent thinking (CT, elaborative reproduction task), and the ability to switch between these as required by changing task demands; an ability termed "contextual focus" (Gabora, 2010). The three executive functions were positively intercorrelated ($r = .53$ for shifting with inhibition; $r = .41$ for shifting with updating; $r = .39$ for inhibition and updating; all $p < .01$). Inhibition and shifting correlated with CT only ($r = .34$, and $r = .35$, $p < .01$). To assess contextual focus we computed a composite (sum) of participants' z-scores on the DT and CT tasks. This composite sum correlated with the shifting index, $r = .26$, and with the inhibition index, $r = .27$, both $p < .01$. These results provide initial conceptual validity for CogFLEX, and empirical evidence of the relations of executive capacity to comparatively analytical (CT) and associative (DT) modes of thinking.

32. Event-related potential effects of auditory sequential learning are related to receptive vocabulary ability. ***Ross, Kimberly M.; Daltrozzo, Jerome; Conway, Christopher M.*** *Georgia State University, Atlanta, Georgia, USA*

Sequential learning (SL) is thought to support language acquisition by enabling the learning of statistical regularities within temporal patterns of speech. However, the neural evidence supporting a direct relationship between SL and language performance is scarce. Here, we investigate whether the event-related potential (ERP) correlates of SL are related to language performance in healthy adults. Seventeen participants (14 females, 18-36 years) completed a measure of receptive vocabulary (the Peabody Picture Vocabulary Test, PPVT-IV) and an auditory SL task that allowed us to investigate the neurophysiological correlates of incidental pattern learning of an auditory input stream (modified from the task used in Jost, Conway, Purdy, Walk, & Hendricks, 2015). Participants were presented sequences of complex tones of varying pitch and were instructed to press a button when they heard a "target"

tone. Unknown to the participants, the target was preceded by one of three "predictor" tones that predicted the target stimulus by varying degrees of predictability (20, 50, or 80%). Results indicated that ERPs to the predictors were modulated by these probabilities and interacted with their PPVT scores [750-850ms post-predictor onset: F(8,56)=3.36, p=.013]. These findings provide evidence for a link between the neurocognitive mechanisms underlying SL and language, with language ability depending in part on the brain's ability to encode statistical regularities within auditory input patterns.

33. Relation between behavior and patterns of neural activity in medial pre-frontal cortex of freely moving rats. ***Reimers, Mark[1]; Euston, David[2] [1]*** *Neuroscience program, Michigan State University [2] University of Lethbridge*

A long-standing controversy in neuroscience concerns whether spike-timing is important for function versus spike rates. We address this controversy by analyzing recordings from freely moving rats. The medial pre-frontal cortex (mPFC) is thought to reflect value and choices. However most neurons in mPFC reflect many different aspects of a task, and it is not usually possible to decode actions from activity single neurons. We show that it is possible to decode several aspects of the animal's behavior in a complex maze-running task, from patterns of activity recorded from 50-100 neurons simultaneously. As others have found in other situations, active pyramidal cells give the most information about broad class of activity, low-spiking pyramidal cells are the most informative for specific action characteristics, while interneurons are indiscriminate. We further identify clusters of neurons that fire together much more often than expected by chance, even when conditioned on individual neuron relationships with behavior. This suggests that neural timing is playing an important role in coding behavior. Finally we show that such neural timing is very much affected by plasticity and that timing during sleep shows much greater changes predictable from contingencies during behavior, than rates of firing. We conclude that timing is indeed important in vertebrates as it has been shown for specific invertebrate systems, although the functions may differ.

34. Perception and Action Development in Toddlers: Matching Simple and Complex Objects to Openings. ***Street, Sandra.*** *University of Wisconsin-Whitewater* During the first two years, infants experience rapid changes in perception and action capabilities. The types of actions they perform include stacking, aligning, and nesting - actions that involve relating objects to other objects as well as to openings. These actions require integration of processes related to perception, action, and cognition such as object recognition, motor control, and action planning. Little is known about these developmental processes in this time period. Recent research using a paradigm derived from a common and engaging activity for toddlers, shape sorting, found 24-month-olds to have great difficulty in choosing the correct opening for a given 3D object while 30-months olds succeeded easily. To achieve success in this type of task children must recognize the shape match between a 3D object and a hole which presents only an outline of the shape. The study used fairly complex shapes. The current study builds on this finding by examining toddlers' (aged 18-30 months) ability to match object to opening using shapes of varying complexity. Results indicate the complexity of both the hole shape and the object shape are important. Openings with multiple features were very difficult for younger children as were objects with and elongated axis. These results provide additional insight into perceptual development in infancy.

35. Westerners, Not Easterners, Have Global Visual Attentional Advantage in a Global-Local Task. ***Tan, Yin-Yin; Mueller, Shane.*** *Michigan Technological University*

Previous research suggests that Asians have global visual attentional advantage compared to Westerners (McKone et al., 2010). However, distinguishing two distinct cultures can be difficult as there are multiple factors confounded with global and local processing (e.g., interference suppression, response inhibition, and spatial uncertainty). The present study uses the PEBL global-local task (Mueller, 2014) to assess cross-cultural differences between Westerners (Americans, n = 38) and Easterners (Taiwanese, n = 66). This task incorporates both spatial uncertainty and global/local processing to examine how these separately contribute to cultural differences in perception. The results show an advantage for Westerners while perceiving large object configuration as opposed to detailed object information, which conflicts with McKone et al.'s (2010) finding that Asians are better at global processing than Westerners. However, Asians did have an advantage when information was spatially uncertain. The plausible explanations include that simply using global vs. local processing to discriminate two distinct cultures is insufficient, and that the varied task complexity might contribute to the conflicting results. These results can have application for object design, interface, and website design.

36. Using Cognitive Word Games to improve Lexical Associations and Recognitional Decision Making Processes. ***Thanasuan, Kejkaew; Mueller, Shane T.*** *Cognitive and Learning Sciences, Michigan Technological University.*

Strengthening semantic and orthographic associations among words in a lexicon may help to improve memory processes related to fluent organizing and retrieval of language. In the present study, we examined how training in several different word games impacts later retrieval access for words. Games included a word-stem completion task (orthographic), a free association task (semantic), and a crossword paradigm task (orthographic+semantic). A within-subject experiment was used to compare the relative effectiveness of these three training methods on a lexical association task performed prior to and following training. Results showed that the games were able to improve participants' decision times, and the increased fluency in the lexical association task due to the free association task was greater than the other games. We will further apply and examine this study with non-native English speakers as well as develop new computational models of memory access.

37. Training using Video Games: Lessons learned from reducing cognitive biases. ***Veinott, E.*** *Applied Research Associates, Dayton, OH.* Video games have the potential to improve player's cognitive skills. As a methodology, this approach can be challenging. We designed and produced a serious game, called Heuristica, for training participants to improve their critical thinking and decision making. Through a series of experiments, several challenges in using a video game for training were identified and addressed. This talk describes some of those challenges.

38. Introducing Simbrain 3.0: A Software Platform for the Visualization, Development, and Simulation of a Broad Spectrum of Artificial Neural Network Architectures. ***Tosi, Zach; Yoshimi, Jeff*** *Indiana University Bloomington Departments of Cognitive Science and Informatics, University of California: Merced Department of Cognitive Science*

Simbrain 3.0 (http://simbrain.net/) is a flexible and powerful tool for the visualization and simulation of neural networks across a wide variety of disciplines. Simbrain's mission is based on two primary assertions: 1) neural networks are fundamentally easy to understand, and given an appropriate representation can be brought to a much wider audience than they currently are, and 2) the majority of network, neuron, and synapse models across all the disciplines which use neural networks have an essential set of core features in common, which ought to allow their efficient coexistence and even interaction within a single program. Thus, Simbrain supports a wide array of network, neuron, and synapse models, all expressed in the same intuitive visual medium of nodes and connections. It is exceptionally rare that a single program can claim to simulate Kohonen Maps, Morris-Lear neurons, and multiple varieties of STDP out of the box. Simbrain is designed to be simple and intuitive enough to be used in educational settings, where its broad scope allows it to be deployed in many different classrooms. For researchers, Simbrain's ease of use and flexibility means that nearly any model can be designed and simulated very quickly. Simbrain 3.0 represents a major performance overhaul, and now supports networks of >10^4 neurons and >10^6 on desktop PCs and can be run in parallel. In short Simbrain seeks to maximize the synergy resulting from a streamlined interface and broad functionality for any user designing and simulating a neural network.

39. Hierarchical error representation gradients in medial prefrontal cortex. ***Zarr, Noah; Brown, Joshua.*** *Department of Psychological and Brain Sciences, Indiana University*

The medial prefrontal cortex (mPFC) is reliably activated by errors. However, it remains unknown whether error-related activity reflects a scalar error signal, or if instead there are multiple error signals for different kinds of errors. Substantial evidence shows that lateral frontal cortex (LFC) is arranged in a hierarchy of abstraction, such that more abstract concepts and rules are represented in more anterior cortical regions. Due to the close interaction between lateral and medial PFC, one might expect that mPFC would be organized along a similar rostro-caudal gradient of abstraction, such that more abstract errors are represented more anteriorly, and more concrete errors more posteriorly. Our aim was to investigate whether error-related activity in mPFC reflected a hierarchy of abstraction corresponding to a hierarchy of task rule switches. We predicted that when more abstract rules changed unexpectedly (i.e., when task environment violated participants' predictions), the error-related activity in mPFC would occur more anterior to the activity observed when less abstract rules changed. Our findings matched our prediction, providing evidence of such a hierarchy of abstraction in mPFC. Functional connectivity analysis demonstrated that more anterior regions of mPFC are preferentially connected to more anterior regions of LFC, further suggesting that regions of mPFC evaluate the rules maintained in correspondingly anterior regions of LFC.

40. Conceptual Representation and Processing Fluency during Expert Classification Learning. ***Zeigler, Derek; Vigo, Ronaldo.*** *Department of Psychology, Ohio University*

The way in which classification performance unfolds over time due to experience and training is fundamental to research on both the acquisition of perceptual skills and expert classification. Central to these areas of research is the relationship between classification accuracy and the time course of classification decisions throughout the learning process. Accordingly, we report the results of an experiment that explores the dynamic nature of conceptual representation across stages of learning. Specifically, participants took part in a classification task with multiple experimental sessions taking place over several days. Results suggest that as subjects' performance increases to perfect or near perfect levels of classification, reaction times still reveal key differences in learning difficulty that illuminate our understanding of category learning difficulty orderings and of how structural or relational information influences concept learning. In light of recent empirical support for an invariance-based account of categorization behavior (Generalized Invariance Structure Theory or GIST; Vigo, 2013, 2014), the results are interpreted using GIST's novel proposal that a process of invariance pattern detection underlies category learning. Accordingly, GIST accounts for the observed performance of groups and individuals at both the classification error rate level and the reaction time level by proposing that increased sensitivity over time to categorical invariants changes the nature of classification performance, but not the nature of concept acquisition.

41. The influence of trait and state anxiety on intertemporal decision making: Inhibition-driven and trait anxiety interacting with state anxiety and SES ***Zhao, Jinling; Harris, Mary; Vigo, Ronaldo.*** *Ohio University, Department of Psychology*

Gray's (1987) motivational theory emphasizes behavioral approach system and behavioral inhibition system are two motivational systems corresponding to two personality traits, impulsivity and anxiety. Thus, we were interested in exploring whether anxiety is inhibition-driven and whether anxiety (trait vs. state) plays roles in the decision-making process. The current study investigated the effects of trait and state anxiety on intertemporal decision making. Participants (N = 106) were randomly assigned to the anxiety condition and the control condition. Anxiety was induced by instructing participants to read an anxious paragraph and then to imagine and write what they would feel in the same condition. Music was also used to facilitate emotion induction. Though we failed to activate significantly higher anxiety in the anxiety condition than in the control condition, we found some novel and interesting results after regressing people's choice of the immediate but smaller rewards on BIS (the inhibitory motivation) scores, trait anxiety score, state anxiety score, and SES (socio economic status) scores. First, after controlling for other factors, BIS scores were negatively related to people's choice of the immediate but smaller rewards. Second, we found two significant interactions, the interaction between trait and state anxiety and the interaction between trait anxiety and SES scores. Third, we found trait anxiety mediating the relationship between state anxiety and BIS scores.