Program

June 5 – 7, 2014

Miami University

Organized by:

L. James Smart, Henry Cook IV, and Justin Hassebrock
Conference Schedule – At a Glance

Thursday

Welcome Reception Psychology Bldg atrium 5 – 7pm

Friday

Continental Breakfast Psychology Bldg atrium 8 – 9 am

Morning Symposium I: Psychology Bldg 125 9:15 am – 11:45 am

“Mace-height” scaled Perception and Action: What’s next for Ecological Psychology
Participants: Dr. Geoff Bingham, Dr. Jay Smart, Dr. Rik Warren, Dr. Micheal Turvey, and Dr. Bill Mace

Morning Break Psychology Bldg atrium 10:30 am

Poster session I/ Lunch Marcum Center 180-4-6 12pm – 2pm

Afternoon Open Session I Psychology Bldg 125 2:15 pm – 4:45 pm

Afternoon Break Psychology Bldg atrium 3:30 pm

Conference Banquet Marcum Center 154-8 6:30 pm

Social Activities Uptown Oxford 9 pm (ish)

Saturday

Continental Breakfast Psychology Bldg atrium 8 – 9 am

Morning Symposium II: Psychology Bldg 125 9:15 am – 11:45 am
Exploring the Complexities of Len Marks's Affordances: Evolution of the Concept

Participants: Dr. Jeff Wagman, Dr. Tom Stoffregen, Dr. Marvin Dainoff, Dr. Claire Micheals, and Dr. Len Mark

Morning Break: Psychology Bldg 10:30 am
Poster session II/ Lunch: Marcum Center 180-4-6 12pm–2pm
Afternoon Open Session II: Psychology Bldg 125 2:15 pm–4:45 pm
Afternoon Break: Psychology Bldg Atrium 3:30 pm
Departures: After 5pm or Sunday morning
Morning Symposium I – 9:15am – 11:45am

“Mace-height” scaled Perception and Action: What’s next for Ecological Psychology

1. Dr. L. James Smart* co-authors: Henry E. Cook, & Eric. M. Littman
   “WM”: Studies in behavioral adaptation to perception-action distortions

2. Dr. Geoff Bingham* co-author: Jing Samantha Pan
   Bill Mace: Stability and Perception

3. Dr. Rik Warren
   The ecological context of perception

4. Dr. Michael Turvey
   Mace’s (1977) admirable admonition: “Ask not what’s inside your head but what your head’s inside of.”

5. Dr. William Mace
   TBA

Poster Abstracts – Session I (alphabetical order) – 12pm – 2pm

Postural dynamics of motion sickness in elite adolescent male boxers
   Yi-Chou Chen*, T. C. Tseng, T. H. Hung, and T. A. Stoffregen
   University of Minnesota

In past decade, head trauma (including sub-concussive) in sports has gained much attention among adolescents. Researches have shown the serious consequences of repeated head trauma in early athletic careers, might be related to neurodegenerative disease later in life. On the other hand, through advanced technologies, the measurements of the concussive symptoms are now accessible by different research laboratories, which might be benefit for more evidence-based data to be used. Rationale: Head trauma often is followed by motion sickness-like symptoms, by changes in cognitive performance, and by changes in standing body sway. Methods: We evaluated elite national level male boxers (including four international level who
participated in 2012 world youth boxing championships) who did and did not report motion sickness and concussive symptoms after a single bout and another same day second bouts. We asked whether pre-bout and post-bout body sway would differ between boxers who experienced post-bout motion sickness like symptoms and those who did not. In addition, we asked whether pre-bout, post-bout, and same day second bout cognitive performance would differ between non-boxers and boxers with and without post-bout motion sickness. Statistics: Mann-Whitney Tests were used for nonparametric subjective symptoms reports; 2x3x3 ANOVAs were used to analyze data on standing body sway, with three factors: task (letter search, and inspection), warm-up (before, after warm-up and after bout), and groups (Well, Sick and Control). A nonlinear analysis Detrended Fluctuation Analysis, DFA, were used to analyze temporal dynamics of postural activity. Graded Symptoms Checklist (GSC) was used to access concussive symptoms, pre and after bout. Results: Six of twelve boxers reported motion sickness, and concussive symptoms after a first bout. Pre-bout measures of cognitive performance, symptom severity were not different, but postural sway differed between boxers who reported post-bout motion sickness than and boxers without post-bout sickness, or controls. The results suggest that susceptibility to motion sickness-like symptoms in elite male boxers may be measured through sway patterns and cognitive performance. It may be useful to use pre-bout data to predict susceptibility to post-bout symptoms, even when athletes have no subjective symptoms before competition.

Detecting structure in activity sequences: Exploring the hot hand phenomenon

Jeh Cooper*, Taleri Hammack, Lucas Lemasters and John Flach

Wright Patterson Air Force Base

Can humans discriminate whether strings of events (e.g., shooting success in basketball) were generated by a random or constrained process (e.g., hot and cold streaks)? Conventional wisdom suggests that humans are not good at this discrimination. For example, Kahneman (2011) writes that “the hot hand is entirely in the eye of the beholders, who are consistently too quick to perceive order and causality in randomness. The hot hand is a massive and widespread cognitive illusion” (p. 117). A series of Monte Carlo simulations and empirical experiments examined the abilities of both humans and statistical tests (Wald-Wolfowitz Runs Test and 1/f) to detect specific constraints that are representative of plausible factors that might influence the performance of athletes (e.g., learning, nonstationary task constraints).

Transfer of attunement in dynamic touch

Simon de Vries* and R.G. Withagen

University of Groningen, Human movement sciences

Over the last decades, several studies have addressed transfer of calibration, demonstrating that calibration is often not confined to the trained limb. The present study tests whether attunement transfers between limbs. That is, if one limb is trained to detect a more useful informational variable, do the other limbs attune to this variable as well. Four experiments were conducted in the dynamic touch paradigm—participants were trained to perceive length with one their limbs and we tested for transfer of learning to the other untrained limbs. We found that attunement is not confined to the limb that was trained, although the transfer was
asymmetrical. Training one of the feet resulted in an improvement of the other foot and both hands; whereas training of one of hands gave rise to a greater improvement of length perception in the other hand than in the feet. However, large individual differences were found.

**Perception of maximum sitting height from photographic stimuli in a classroom setting**

Eric Haaland*, Justin Munafo, and Thomas A Stoffregen

*University of Minnesota*

Warren (1984) presented photographs of staircases to groups of participants and asked them to indicate, yes or no, whether they could climb each one. Participants were also asked to provide ratings of how confident they were in their answers. The results indicated that participants’ yes/no judgments were powerfully related to the ratio between the height of the staircase in the photo and the length of each participants’ leg. Moreover, participants’ confidence in their judgment changed as a function of this ratio as well. Each of the photos that Warren presented contained a wooden desk chair which was also present in the room while participants made their judgments. In a classroom setting, we asked groups of participants to view photos of an experimental chair apparatus (Mark, 1987), and to judge their ability to sit on seat pans of different heights. Photographs were presented via a projection video system. Participants also indicated their confidence in each judgment using a Likert scale. Adjacent to the chair in each photo was a standard office stool. During data collection, the same stool was placed in the front of the classroom as participants made their judgments. Participants’ judgments switched from yes to no at a constant ratio of seat pan height to leg length, replicating Warren’s (1984) findings and extending them to the context of maximum sitting height (Mark, 1987). By contrast, participants’ confidence in their judgments varied only slightly across the range of stimuli. Our results suggest that it may be possible to study the informational basis for affordance perception using photographic stimuli in a classroom setting.

**Haptic perception of distance-to-break for compliant tissues during unidirectional forward movement in a surgical simulator**

Leah Hartman*, Bliss Altenhoff, Irfan Kil, Kumar Prateek, Karla Romero, Chris Pagano, Tim Burg, and Joseph Singapogu

*Clemson University*

In minimally invasive surgery (MIS), it is critical to have the ability to accurately interpret haptic information and apply appropriate force magnitudes onto soft tissue in order to minimize tissue trauma. The surgeon’s administration of force onto tissue reveals useful perceptual information which guides further haptic interaction making the force perception in MIS a dynamic process. In previous research it was found that the compliant nature of soft tissue during force application provides biomechanical information denoting impending tissue failure. Specifically, the relationship between applied force and material deformation rate specifies the distance remaining until the tissue will fail, which has been term distance-to-break (DTB). The proposed experiment changes the free exploratory task from previous experiments and restrains it to only a forward trajectory movement. This task allows for us to further investigate haptic DTB.
Sexual dimorphism contributes to sex differences in susceptibility to motion sickness

Frank C. Koslucher*, Eric Haaland, and Thomas A. Stoffregen

University of Minnesota

Motion sickness plagues millions of people every year. One common feature of motion sickness is that women are more susceptible than men, a phenomenon typically blamed on sex or gender roles, or on sex differences in hormones. These explanations are not parsimonious with traditional theories of motion sickness etiology; for example, the claim that motion sickness is caused by a mismatch of information gathered from the different perceptual modalities. An alternative theory relates motion sickness to the control of bodily movement. Recent research has shown that the predisposition toward motion sickness is related to characteristic patterns of subtle body movement in the control of posture; these differences exist before people are exposed to motion stimuli that are associated with motion sickness. This effect motivates research into factors that can influence individual differences in body sway, such as biomechanical characteristics. Men and women are sexually dimorphic, meaning that they tend to have different physical structures. For example, men and women tend to differ in height, and in the vertical distribution of mass. If these physical differences affect body sway, then they might underlie the well-known sex difference in susceptibility while being consistent with the postural instability theory of motion sickness etiology. We collected anthropometric data from 114 healthy young adults (44 men, 70 women) before exposing each to a potentially nauseogenic visual stimulus. Consistent with previous research, motion sickness incidence was greater in women (37%) than in men (7%). In addition, motion sickness incidence showed significant negative correlations with the height of the body’s center of mass (-.184), with overall height when controlling for weight (-.199), and with the height of the center of mass when controlling for weight (-.201). These results support a qualitatively new understanding of sex differences in susceptibility to motion sickness.

Subjective reports and postural performance among elderly passengers on a sea voyage

Justin Munafo*, Thomas Stoffregen, and Mike Wade

University of Minnesota

A ship at sea is subjected to the pitch, roll, and yaw of the water. Passengers onboard the ship adapt to this unique circumstance in a process known as “getting sea legs”. We investigated this development in an elderly population utilizing a survey. 115 participants were asked on a luxury cruise how stable they felt on their feet (bodily stability), how aware of ship motion they were, and completed a Romberg test facing fore-aft and athwart (Romberg, 1853). We found subjective stability scores fell from the first day while the ship was docked to the second day when the ship was at sea. Scores did not increase significantly on the third day. Additionally we found a weak correlation between bodily stability scores and Romberg test duration.
Effect of posture on a head repositioning and ‘head still’ task

Dean Smith*, Kelsey Venis, Rebecca Feczer, Mark Walsh, Matthew Haug, Eric Slattery, and Susan Blasi

Miami University

Perception of the orientation of our head in space as well as on the trunk demands not only the contribution of vestibular and visual cues but also proprioceptive information from the neck and likely from other bodily regions. Tests of cervical spine position sense often focus on the accuracy of repositioning to the natural (neutral) head posture. Some factors shown to reduce the accuracy of neck proprioception include fatigue, increased attentional demands, and pathology such as whiplash and neck pain. One factor that has not been well studied is the contribution of different bodily postures to the accuracy of neck proprioception. Eleven healthy college students completed a head repositioning task as well as a ‘head still’ task while standing, kneeling, sitting, and sitting with stabilization. For the head repositioning task, blindfolded participants wearing a laser mounted headpiece attempted to reposition their head to a neutral reference head position with maximum accuracy. The head still task required the participant to maintain the laser dot on a fixed point (at neutral head posture) for 30 seconds under eyes open and closed conditions. Video capture of the laser dot coordinates on a projection screen were obtained to examine the accuracy of the two tasks. Results of the head still task showed that there was a significant effect of both posture and eye condition for both vertical and horizontal head movements. Standing and kneeling generated more variable head movement than sitting with or without stabilization. Results of the head repositioning task showed that posture did not significantly affect cervical spine proprioception. For healthy young adults, clinicians and researchers need to be concerned with postural influences on tasks that involve head/cervical spine stabilization, but not head repositioning.

Postural effects of interpersonal visual contact sea

Thomas Stoffregen*, Manuel Varlet, Fu-Chen Chen, Cristina Alcantara, and Benoit G. Bardy

University of Minnesota

In stance, physical displacement of the body requires active compensation; at sea, passengers routinely compensate for oscillatory ship motion on the order of meters. In laboratory research, postural activity is responsive to subtle social factors: When two people interact with each other there is spontaneous coordination of their postural sway. During physical displacement of the body the influence of social constraints on interpersonal coordination is unknown. We asked whether visual contact between people could improve interpersonal postural coordination on a ship at sea. During an ocean voyage, pairs of participants faced toward or away from each other. Interpersonal coordination of body sway was stronger when participants faced each other than when they faced apart. In addition, overall body movement was reduced when individuals faced together, suggesting that the sight of another person improved individual postural stability. These findings provide the first evidence that the “soft” constraint of interpersonal visual contact can influence interpersonal postural coordination as people
simultaneously adjust postural sway in response to powerful mechanical (i.e., “hard”) constraints arising from vehicular motion.

**Characterizing temporal patterns in team communication in a large-scale air-combat simulation training exercise**

Adam Strang*, Christopher Best, Gregory Funke, and Sheldon Russell

*Wright Patterson Air Force Base*

Verbal communication is a primary means through which military teams interact, and researchers commonly use communication analysis to draw inferences about team coordination and cognition. However, at present team communication studies have mostly employed only descriptive measures of communication (e.g., frequency counts). This approach ignores temporal patterns in team communication, which have recently been shown to exhibit association with shifts in team state (e.g., task load, cross training). Sample entropy (SEn) is a nonlinear measure that can be used to characterize the degree of temporal complexity (high versus low) in team communication. The goal of this experiment was to use SEn in order to, a) confirm the existence of semi-deterministic temporal patterning in the communication of teams of enlisted airmen performing a high-fidelity air-combat simulation, b) identify the minimum number of communications that are necessary to detect this patterning, and c) assess whether increases in task load effect the degree of temporal complexity in team communication. Results confirmed the existence of semi-deterministic patterning within local team communication, as well as across a multi-team communication platform. For all team types, relatively few communications (x ≈ 50) were necessary to detect deterministic patterning. Finally, increases in task load were associated with a decrease in communication temporal complexity, a result that is consistent with our previous laboratory findings. Collectively, these results substantiate the use of SEn for characterizing temporal complexity in team communication with high resolution, and indicate that it is a useful and unobtrusive tool for determining team task load shifts in high-fidelity air battle management operations.

**Perceived affordances for remembered objects depends on functional task constraints**

Brandon Thomas* and Michael A. Riley

*University of Cincinnati*

Affordances are opportunities for an organism to behave in its environment. Individuals are capable of perceiving affordances for remembered objects. In three experiments, memory for action capabilities with an object was underestimated while the relevant object property of length was overestimated. The results are inconsistent with an account that dissociates a remembered object from its functional context and has implications for functional approaches to memory.
Effects of linguistic constraints on interpersonal postural and syntactic coordination
Michael Tolston*, Sara Schneider, Andrew Yockey, Christal Hammons, Michael A. Riley, Michael J. Richardson, and Kevin Shockley
University of Cincinnati

Previous research has demonstrated that individuals engaged in conversation spontaneously coordinate their postural sway patterns. Prior research has also shown that individuals alter their speech patterns to be similar to those of their conversational partners. We ask whether the coordination that is evident in movement dynamics is related to the coordination of speech patterns, and whether such patterns of coordination may be affected by imposed linguistic constraints during dyadic conversation generated by working together in a joint puzzle solving task.

Global optical flow aids scene perception under conditions simulating low vision
Xiaoye Michael Wang*, Jing Samantha Pan, and Dr. Geoffrey Bingham
Indiana University

Pan and Bingham (2013) used a series of blurred natural events to demonstrate that, with the aid of motion generated optic flow, events that were unrecognizable in static images could be perceived. Such event perception normally involves a stationary observer perceiving local events (e.g. a walking person). In contrast, might scene recognition be possible using such blurred images and global optical flow generated by a moving observer? In the current study, we investigated this question and explored whether global optical flow could calibrate static images to allow subsequent scene recognition. Participants were asked to provide descriptions of eight everyday scenes appearing either in highly blurred static images, a series of such static images, or a blurred movie containing the images. Results showed that recognition accuracy increased significantly with the availability of global optical flow. However, on average, performance in this study was poorer than in Pan and Bingham (2013). This outcome was discussed in relation to the differences between global and local optical flow.

Informational constraints on perception of maximum reach-with-jump force others
Julie A. Weast*, Kevin D. Shockley, Michael A. Riley, Michael J. Richardson, and Sarah Cummins-Sebree
University of Cincinnati

Humans can perceive affordances—invariant combinations of surface/substance properties of the environment taken with reference to an animal’s action capabilities that describe possibilities for action—for themselves and others. Accurate perception of affordances for others requires perceptual information about the other’s capacity to produce force; after observing another’s walking patterns, observers improve in their perception of the other’s RWJ height, suggesting there is structure in a person’s walking kinematics which is informative about his/her ability to jump to reach an object. Athletes demonstrate a superior ability to perceive the
action capabilities of others; after basketball players observe an actor’s walking patterns, they improve in their perception of RWJ for the actor more so than controls. This implicates movement kinematics as the fundamental information provided by walking motion, and suggests basketball players are more sensitive to the structure available in the kinematics that allows accurate affordance perception; however, the nature of this structure remains unclear. A technique for identifying the structure in movement that is relevant to action is the use of principal components analysis (PCA), which extracts relevant information from high-dimensional data sets by identifying hidden structure that best explains the variance of the data set. This analysis may be a useful tool for identifying information in walking kinematics that specifies characteristics of the walker. The current research used PCA to identify information in human walking kinematics that specifies the RWJ affordance, and to determine whether athletes are more sensitive than controls to the structure in question. Kinematic data during treadmill walking was collected from 14 models using an Optotrak motion-capture system. PCA was performed on the motion data of all models to obtain the loading values for all input variables (i.e. the time series of each marker movement in the x and y directions) of the first principal component of each model. The recorded kinematics of point-light walkers were manipulated using the PCA loading values obtained to determine how changes in body-segment movements impact perception of RWJ, as well as the impact of sports experience on sensitivity to these changes. The results suggest that perceivers rely on the global movements of the body (or some relation among all major segments) rather than the movements of individual body segments when anticipating the action capabilities of others, and athletes may be more sensitive than non-athletes to the dynamic spatiotemporal organization of the moving body.

**Open Talk Session I Abstracts – 2:15 – 4:45**

**An information-space analysis of perception of object length by sound**

Drew H. Abney* and Jeffrey B. Wagman

*University of California, Merced*

Previous research provided evidence that auditory perception of object length is constrained by the object’s mechanical properties. Specifically, such research has shown that, like perception of length by dynamic touch, perception of length by audition is primarily constrained by the object’s major and minor principal moments of inertia. The current study provided a stronger test of this hypothesis by formalizing auditory perceptual learning of length using the theory of direct learning. The focal empirical question was whether an information space constructed for variables of relevance to dynamic touch is useful as an information space for audition. In two experiments, participants perceived the length of occluded rods that were dropped onto a hard surface. In Experiment 1, veridical feedback specifying the optimal locus was given during a practice session. After such feedback was provided, the participants’ loci in the information space moved toward the optimal locus. Experiment 2 consisted of two steps of feedback. In the first phase, participants were given feedback specifying the optimal locus. In the second phase, they were given feedback specifying a different locus in the space. For both steps, participants moved toward the locus specified by feedback. The results from these two
experiments suggest that the information space developed for perception by dynamic touch can be used for perception by audition. On a broader level, the results provide additional support for the theory of direct learning.

**Self-organization and semiosis in jazz improvisation**

Ashley Walton*, Michael J. Richardson, and Anthony Chemero

*University of Cincinnati*

Self-organization provides new ways to understand the dynamics behind the emergent, spontaneous exchanges of musical performance. In biological self-organization, energy is expended to maintain order in a system in the form of work that constrains the possible behaviors of the components of the system. When two self-organized systems become closely coupled they compose a teleodynamic system where each does work to maintain one another’s constraints. The semiotic exchange between two improvising jazz musicians forms a teleodynamic system where musicians expend energy that constrains each other’s sign behavior, and each allows their sign behavior to be constrained by the work of the other. This self-organization framework allows for new insight into developing theories of musical semiotics to address spontaneous, emergent musical performances, and non-linear time series analyses can provide the tools necessary for explicating the processes of these complex semiotic exchanges.

**Getting a grip on extended cognition**

Anastasia Jinks*, Luis Favela, and Anthony Chemero

*University of Cincinnati*

Extended cognition, unlike embodied cognition, is not a well-established part of current cognitive science. Some proponents and opponents of extended cognition believe the issue to be an empirical one. Not only do we agree that the issue is an empirical one, but we think there is already empirical evidence for extended cognition. In order to demonstrate this, we present evidence from within an empirically based theoretical and methodological framework for investigating extended cognition, which we call “radical embodied cognitive science.” This framework has ecological psychology as its theoretical basis and dynamical systems theory as its methodology. We present findings from two perception-action tasks, both of which utilized a sensory-substitution device called the Enactive Torch. These experiments demonstrated that sensory-substitution devices could become parts of interaction-dominant, extended cognitive systems. Participants used haptic tools to substitute for vision in two different tasks: Maze walking and making judgments about aperture passability. Following previous investigations of interaction-dominant cognitive systems (Dotov, Nie, & Chemero, 2010), we utilized detrended fluctuation analysis, a type of fractal analysis, to demonstrate 1/f scaling at participant-tool interfaces. Sometimes called “pink noise” or ‘1/f noise,’ 1/f scaling is associated with the behavior of complex systems that are interaction-dominant, due to the interaction of components at multiple time scales (Holden, 2005). Results from both experiments indicate that the Enactive
Torch was a component of interaction-dominant, extended systems, thereby bolstering our claim that there is already empirical evidence for extended cognition.

When one is rejected, others loom: Social rejection makes others appear closer

Kurt Hugenberg*, Shane Pitts, and John Paul Wilson

*Miami University

Social rejection causes a host of interpersonal consequences, including increases in reaffiliative behaviors. In two experiments, we show that reaffiliation motivation stemming from rejection biases perceptions of one’s distance from a social target, making others seem closer than they are. In Experiment 1, participants who had written about rejection under-threw a beanbag when the goal was to land it at the feet of a new interaction partner, relative to control participants. In Experiment 2, rejected participants provided written underestimates of the distance to a person relative to control participants, but only when the target was a real person, and not a life-sized cardboard simulation of a person. Thus, using multiple manipulations of social rejection, and multiple measures of distance perception, this research demonstrates that rejection can bias distance judgment, making actual sources of reaffiliation (actual people), but not mere images of people, loom toward the self.

Do geographical slants feel steeper than they look?

Alen Hajnal*, Wagman, J. B., Bunch, D. A., and Doyon, J. K.

*University of Southern Mississippi

Kinsella-Shaw, Shaw, and Turvey (1992) have shown that nonvisible surface slant perceived haptically by foot is matched with visually perceived slant by a factor of 0.81. Hajnal, Abdul-Malak, and Durgin (2011) have demonstrated that the same slope perceived visually without standing on it appears shallower than when stood on without looking. We asked participants to judge whether they would be able to stand on a ramp. In the first experiment, visual inspection was compared with trials in which participants took half a step with one foot onto an occluded ramp. Visual perception closely matched the actual maximal slope angle that one could stand on. However, the maximum slope angle based on perception by foot was significantly lower. We suspected that the additional balance task of standing on one foot might cause distortion in haptic perception. In the second experiment we repeated the same except that participants sat in a chair. This manipulation resulted in no differences between modalities, and a perfect match between perception and action capabilities. In the third experiment we offered a direct test of whether balance may cause a split between vision and haptics, by having participants hold onto a sturdy tripod while standing on one foot in the haptic condition. We obtained the same modality differences as in the first experiment. This led us to conclude that differences in the range of motion at the ankle and knee joints may play a role in pedal perception. The range of motion is larger while sitting down compared to when standing, thus potentially causing distortion of haptic perception. Implications for ecological theory (Gibson, 1979) will be offered by discussing the need for multisensory integration, instead of nonrepresentative comparisons of modalities tested in isolation.
People perceiving fractals

Henry Cook IV*, J. A. Hassebrock, & L. James Smart

Miami University

Though our research we have noticed that there are qualitative behavioral differences in postural sway patterns between individuals who report being sick versus those who remain well. In essence changes in postural stability precede the occurrence of motion sickness. At a very coarse level people seem to have the ability to determine and differentiate postural motion plots of sick and well individuals. Today we discuss whether more fine detailed changes are detectable by people and if so is this detectable information structured in a usable manner. Is it possible that we can use other people or systems to detect these changes as they are occurring real time? The first study I will discuss examines people’s ability to detect structures and patterns from postural motion phase plots (AP-Velocity). The second study presented participants with other people’s motion (optic flow) to see if there are recognizable qualitative differences in flow patterns and to determine whether the structure of the motion (should) influence(s) their own behavioral strategies. What we find is that the changes that are perceived and exploited are very similar to that of the fractal measures that we employed to derive behavioral patterns of sick and well. This also suggests that people were able to recognize whether posturally-produced optic flow could be used to facilitate their own action; potentially suggesting our perceptual systems are sensitive to the same structure as fractal analyses. This is promising for training and programming.

Morning Symposium II – 9:15am – 11:45am

Exploring the Complexities of Len Marks’s Affordances: Evolution of the Concept

1. Dr. Jeff Wagman
   Len Mark’s Research on Affordances: A Personal History

2. Dr. Thomas Stoffregen
   Exploring Len Mark’s Affordances

3. Dr. Claire Michaels
   TBA

4. Dr. Marvin Dainoff
   Marks’s Mark: Contributions of Ecological Psychology to Safety
5. Dr. Len Mark  

*Exploring what the world affords: Observations from a new grandfather*

**Poster Abstracts – Session II (in alphabetical order) – 12:00pm – 2:00pm**

**Trash talk: The effect of tone and target framing on recycling behavior and attitude**

Rachel Aron* and Christopher Wolfe  
*Miami University*

Recycling is an individual effort to solve the group problem of landfill usage. While recycling can become an unconscious habit, it must first be motivated by outside pressure. Because attitude towards recycling predicts recycling behavior, it is important to frame messages about recycling to effectively increase recycling behavior. This experiment will determine the most effective way of framing the message, using messages in a 2 (individual/group) x 2 (praise/blame) design. Participants will answer a pre- and post-test survey on recycling attitudes, and will be shown a poster with a framed message from one of these conditions. A second dependent variable will be a recyclable piece of trash at the participant’s computer station: recycling the trash is a sign of recycling behavior. My hypothesis is that positive recycling attitude predicts recycling behavior, and attitude is affected by tone and target. Attitude is improved more with a positive tone than negative, and targeting the individual has a more significant effect on attitude than targeting the group. However, a negative tone might increase recycling behavior even as it worsens attitude towards recycling. This research has the potential to guide and drive recycling campaigns, and lead to a more sustainable world.

**Sample Entropy and Shannon Entropy from Recurrence Quantification Analysis: A Comparison of Concepts and Calculations**

Scott Bonnette*, Michael T. Tolston, and Michael A. Riley  
*University of Cincinnati*

The use of entropy measures—which quantify the predictability of a time series—to analyze human behavioral data has increased over the past two decades. The measure sample entropy (SampEn) and the measure of entropy provided through recurrence quantification analysis (i.e., the Shannon information entropy of the distribution of line lengths; EnRQA) are examples of analyses that have differentiated past experimental manipulations (e.g., vision’s influence on postural sway) and physiological states (e.g., heartbeat dynamics). The two measures at first glance may seem distinct and unrelated. Whereas SampEn quantifies the probability that given a sequence of matching data points the next data point will match as well, EnRQA returns the summed probability values of all defined sequence lengths of data. However, the measures are conceptually (and computationally) connected. In the current work, the differences in calculations between SampEn and EnRQA are discussed, and a method for determining SampEn through recurrence quantification analysis is presented.
Following the beat: How 1/f scaling transfers across systems

Samuel M. Breheim*, Charles A. Coey, and Michael J. Richardson

University of Cincinnati

Several studies have shown the dynamics of many different behavioral and biological systems tend to contain 1/f scaling relationships. In such ‘fractal’ dynamics, behaviors are not truly random (‘white’ noise), but instead show a complex, scale-invariant pattern of variation over time (‘pink’ noise). More recent research also suggests that two interacting systems tend to adopt the same fractal structure. It is yet unclear how this ‘complexity matching’ happens, and the current study was designed to further investigate this phenomenon. Participants tapped their fingers on a keyboard in time with a metronome. The inter-onset intervals of the metronomes were not perfect, but contained some type of noise pattern. Specifically, metronomes either shifted from white noise to pink noise and back to white (WPW) or from pink to white to pink (PWP). Preliminary results suggest that the inter-tap intervals of the participants’ behavior indeed followed the same noise patterns as embedded in the metronomes. Furthermore, we also investigated whether this ‘global’ pattern of coordination was driven by ‘local’ coordination between the participant and metronome at the immediate timescale, or instead reflected some other process. These results provide valuable insight as to the significance of 1/f scaling in human behavior as well as the dynamics of coordination between natural (i.e., imperfect) systems.

Perception of maximum stepping and leaping distances

Brian Day* and Jeffrey Wagman

Illinois State University

To successfully perform everyday behaviors, people must be able to perceive affordances. Two general categories of affordances have been investigated: body-scaled affordances depend on geometric properties (e.g., arm length) and action-scaled affordances depend on dynamic properties (e.g., maximum running speed, body compressibility, etc.). The fact that these affordances depend on different kinds of relationships between animal and environment, suggests that body scaled affordances and action scaled affordances may be qualitatively different. We investigated this hypothesis by using a transfer of calibration paradigm. In particular, we investigated whether improvements in perception of maximum stepping distance (a body scaled affordance) transferred to perception of maximum leaping distance (an action scaled affordance), and vice versa. Participants reported maximum stepping and leaping distances in three different phases: a pre-test, practice session, and a post-test. In the practice session, half of the participants practiced performing a maximum distance step or leap, and half did not practice performing either behavior. The results showed that practice performing a maximum distance leap improved perception of maximum leaping distance and maximum stepping distance. Practice performing a maximum distance step brought about no changes in perception of maximum leaping or stepping distance. Such results suggest that body-scaled affordances and action-scaled affordances may be related hierarchically. In other words, it is likely that all body scaled affordances are action scaled affordances, but not vice versa.
Coordinative dynamics: Joint action synergies during a cooperative puzzle task

J. A. Hassebrock*, Jayne Nagey, Jason Stone, Boyce Tolson, Henry Cook IV, and L. James Smart

Miami University

Humans are creatures of habit and typically repeat many different types of behaviors over time. These behaviors are not always repeated identically and tend to vary depending on the action and the context (this can been seen as a strength). Previous research has indicated that a multitude of human behaviors demonstrate fractal characteristics, including postural sway. Postural sway is influenced by environmental constraints and can be affected visually and haptically. Though it is not clear how postural sway may affect the postural sway of another individual during cooperative coordination tasks (i.e. moving a table). We examined the postural sway of two individuals coordinating to solve a labyrinth puzzle (move a ball from one end of a maze to the other) a number of times. It was found that performance improved when postural sway was more similar across the participants. Also, there were performance decrements when there were asynchronies across the participant’s postural sway. During more complex tasks postural sway was more strongly coupled between the participants and long range dependencies increased.

Stepping affordance across modalities

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The relationship between affordances of the environment and effectivities of the organism may be described as a dimensionless ratio. These ratios, π-ratios, show a critical-boundary value where actors transition from one stable mode of behavior to another. Recent investigations show that order of presentation, or hysteresis, influences systematic changes in the π-ratio and behavioral modes (Frank, Richardson, & Lopresti-Goodman, 2009; Lopresti-Goodman, Turvey, & Frank, 2013). To date, most of these investigations have focused on the perception of affordances through vision and few have explored how these effects might change with perceptual learning. These two issues motivated the present investigation, where we asked (1) whether similar effects would be found in both the visual perception and haptic perception of the same affordance, and (2) how repeated experience might modulate the strength of any observed hysteresis effects. Participants were asked to perceive the “step-on-ability” (Mark, 1987; Warren, 1984) of a platform while sighted, or with eyes closed and using a cane for exploration. Reports were taken over several blocks of sequentially increasing or sequentially decreasing the height of a platform. Results revealed hysteresis effects on the perception of step-on-ability for both modalities, however the strength of the effect differed. Additionally, repeated experience resulted in increased hysteresis effect in the vision conditions, but decreased in the haptic conditions.
A comparison of detrended fluctuation and adaptive fractal analyses of postural sway variability in adolescents with athletically induced mild traumatic brain injuries.

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The decision to permit an adolescent athlete’s return to sports after a mild traumatic brain injury (mTBI), or concussion, can be daunting. Allowing an injured athlete to participate too soon increases the chance of additional injuries and may lead to secondary health complications, including chronic traumatic encephalopathy, persistent cognitive and motor control deficits, and even death. Often, the choice to clear an athlete for participation in sports is made based on observer-rated assessments or self-reports of concussion-related symptoms. Recently, efforts to identify more objective return-to-sport criteria have taken advantage of the fact that mTBIs alter the normal functioning of sensorimotor processes responsible for postural control. Recent studies that applied nonlinear analysis methods to time series of postural center-of-pressure (COP) trajectories from concussion patients have yielded promising results in discriminating concussed from healthy individuals. In the present study, a relatively new type of analysis, adaptive fractal analysis (AFA), was applied to the COP time series of forty age and gender matched adolescent athletes (20 injured, 20 healthy). Detrended fluctuation analysis (DFA) was also applied. A force platform was used to acquire participants’ COP data at a sampling rate of 50 Hz. Participants were instructed to stand naturally on the platform for two 120 sec trials (one eyes-open and one eyes-closed trial). Differences between fractal scaling exponents (H) and scaling regions (i.e., time span of fractal scaling) provided by AFA and DFA for injured and healthy participants are discussed.

The effect of discontinuous transitions in story structure on postural sway dynamics

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Prior studies have shown that many cognitive processes are embodied by perceiving-acting systems. In particular, previous work has demonstrated that reorganizations of cognitive systems are observable in behavioral time series, namely, that sudden insights in problem solving are related to spontaneous re-organization of gaze and hand movement patterns. We extended this work by asking whether conceptual perturbations affect movement dynamics, specifically, whether listening to short narratives with topical transitions involving varying degrees of discontinuity affects the deterministic structure of postural sway. We evaluated the effects of story transition (high confusion, low confusion, and unaltered) and epoch (first, second, and third sections of the story) on postural sway dynamics of individuals quietly standing while listening to pre-recorded narratives. We found that postural sway dynamics measured at the head were overall more similar in the second and third epochs relative to the first while listening to unaltered stories compared to those with transitions that were independently rated as being comparatively higher or lower in confusion. We also found that the deterministic structure of postural sway measured at the head increased from the first to the second third of the story while listening to unaltered narratives, but not while listening to those rated as being high or low in
confusion. We interpret our findings as showing that inserting an artificial transition in a story disrupts postural sway dynamics: Whereas the overall similarity and deterministic structure of postural sway increased while listening to normal stories, this pattern was not observed when participants listened to those with alterations. We take these findings as evidence that cognitive processes related to story comprehension are revealed in postural sway dynamics.

**Task specific behavioral adaptation in a virtual environment**

Jason Stone*, Hannah Walter, Rick Payne, Boyce Tolson, David Gorley, Justin A. Hassebrock, and Henry Cook IV

*Miami University*

**The effectiveness of the Alexander technique in reducing static upper body muscle tension in collegiate violin and viola performers**

Harvey Thurmer*, Rachelle Wolf, William Berg, Henry Cook IV, and L. James Smart

*Miami University*

Upper string players are often faced with performance related injuries as a result of unnecessary muscle tension and narrowed focus. Musicians are trained to attend to certain senses to the detriment of others. Basic anatomical information concerning the musculoskeletal system or biomechanics, which would greatly enhance any musician’s understanding of performance, is considered outside the field. This has led to debilitating performance problems in collegiate instrumentalists seeking music degrees. The Alexander Technique (AT) is one method that addresses these concerns by approaching a given task from a process of whole-body consciousness. The author asserts that incorporation of AT concepts into performance practice will reduce static tension in playing as result in both prevention of injury and improved quality of performance. A pilot study that will test this hypothesis is currently in progress. Muscle tension and movement will be recorded using Electromyography (EMG) and a Flock of Birds, respectively as subjects play a scale and a musical excerpt. EMG data will be collected from the following muscles: upper trapezius (bilateral), sternocleidomastoid (bilateral), the lumbar area of the spinal erector muscles (bilateral), the anterior deltoid (left), and the biceps (left). The Six sensors from the Flock of Birds will be attached to each participant in the areas of the head (occipital lobe), the 6th cervical vertebra, upper left arm, left forearm, the left hand (right above wrist), and the shoulder (left scapula). Video will also be taken of these performances and will be evaluated for aspects of performance quality by an outside reviewer who is a qualified expert in violin or viola performance. Subjects will engage in ten weeks of group Alexander training before being tested again for muscle tension, movement, and performance quality. The anticipated result is an improved dynamic interplay of tension and release that results in a better technical and musical performance.
**Sin and Punishment: Behavioral Adaptation in a Virtual Environment**

Hannah Walter*, Rick Payne, Boyce Tolson, Lauren Fotta, Justin A. Hassebrock, and Henry Cook IV

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Human adaptation has been studied throughout the years as an “end” process, that is to say that the importance of the process is the end results. However, strides in technology have given researchers the ability to study the actual process of adaptation as it is occurs. It is proposed that the inability to adapt is usually related to an inability to detect and utilize information to support appropriate behavior, resulting in the implementation of inappropriate control strategies. These maladaptive behavioral control strategies negatively affect overall performance and the ability to transfer successful strategies from one interface to another. Research from Cook (2013) indicates that the properties of the interface, which in this instance is a game controller, has a significant effect on behavioral control, learning, and the development of behavioral strategies. Understanding how perceptual changes and interface constraints influence information processing and behavioral changes and how the two interact with each other is the goal of this research project.

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**The role of posture in facilitating auditory localization tasks**

Trenton Wirth*, Joubert Lucas, Butovens Médé, Scott Bonnette, and Michael A. Riley

*University of Cincinnati*

The performance and organization of upright stance is often carried out in service of other behavioral goals. These goals, such as reaching for a book on a high shelf, concurrently rely on the maintenance of posture and the execution of the movements required by a specific behavior. The current study investigated the role that upright posture has in facilitating an auditory localization task. Participants were asked to indicate the location of a sound’s source by looking towards (through the adjustment of their heads) where they judged the sound to come from. The speaker source, concealed from participants by a curtain, came from a possible eight speaker locations, all of which were equidistant from each other and the participant. Postural sway of participants was quantified as the center of pressure and was measured by a force platform. The indicative head movements were recorded with a Polhemus motion tracking system by placing a marker on the front and back of participants’ heads. Participants wore headphones for the duration of the experiment. Three different conditions were used to vary the difficulty throughout the experiment: (1) in the first condition, white noise was emitted from the headphones and the to-be-judged sound was played from the concealed speakers (2) during the second condition, white noise and the to-be-judged sound were both played from concealed speakers, and (3) only the to-be-judged sound was presented. The decibel level of white noise was controlled so that the loudness was equal when emitted from the headphones and speaker. Results examine the accuracy of location judgments and the function postural sway had in facilitating performance.
Ecological information in thermodynamic context: A robotic model

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In this talk, we attempt to set information as understood by ecological psychologists in the context of thermodynamics. In ecological psychology information is defined as structure in ambient energy arrays. That is, the fact that energy is different in different directions can be informative to a system capable of detecting such structure. As structure in an energy distribution, information stands juxtaposed with the notion of entropy (i.e., the homogeneity of an energy distribution). The ecological interpretation of information also includes another critical, thermodynamic term; work. The information necessary for the guidance of behavior of living systems is, in fact, exposed and sustained by virtue of interaction with the surrounds. We illustrate these relations with a robotic model. The robot does work, i.e., expends energy, in order to generate structure in its environment. This structure is a reduction of local entropy, and constitutes the information that the robot then uses to guide its behavior.

Multiscale spatial distributions of eye fixations decouple over time

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Behavior is tightly coupled with the environment via perception-action loops comprised of simultaneous interactions between behavior and environment. Behavior can also be coupled less directly with the environment, for instance, when behavioral responses to environmental inputs are delayed. Recent work has shown that the multiscale spatial distributions of eye movements correspond with similar multiscale properties in environmental stimuli when drawing images of natural scenes from short-term memory. The present study analyzed multiscale spatial distributions of eye movements to test the decay of visuospatial memory and its effect on perceptual-motor task performance. Participants viewed images of natural scenes for 30 seconds each, and after each image was removed for either a 15 or 30 second delay, participants drew the image from memory. Results showed that eye movements during drawing became less like those during viewing after the longer delay compared with the shorter one. This apparent weakening in the coupling of eye movements was also reflected in performance, in that drawings were nominally less similar to their corresponding images after the longer delay period. The results suggest that multiscale properties of behavior and environment gradually decouple as a function of time.
Behavioral dynamics of joint-action and social movement coordination

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Performing everyday goal-directed tasks such as clearing a table or loading a dishwasher with a family member requires movement coordination that gives rise to and is affected by environmental constraints and designated action roles. Behavioral dynamics provides a way to understand how this coordinated activity between agents emerges and dissolves throughout joint-action tasks. To describe the self-organizing dynamics of physical interactions among socially coordinated human agents, a more experimentally controllable version of everyday tasks was created. In a multi-agent object-moving task two participants moved around a virtual environment depicted on a tabletop from one location to another using wireless motion tracking sensors attached to their fingers. Start, goal positions, and obstacle locations were chosen from a previous experiment to provide sufficient data for characterizing a dynamical model to capture the behavior. Sets were chosen so that conditions that either readily conform to the model or would be difficult to model based on previous research would be present for all participants. Results indicated that what, when, where and how to move or act during a social interaction can be implicit in the dynamics of the task, and that patterns of coordinated social movement can emerge spontaneously from these dynamics with little a priori planning.

Harmony from chaos: Examining aperiodic visual-motor and interpersonal coordination

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One only has to consider the performance of a group of improvisational jazz musicians to be reminded that people are capable of coordinating in an effortless manner, even when faced with highly variable, often unpredictable behavioral events. While a substantial amount of research on joint-action has focused on the coordination that occurs between simple stereotyped or periodic movements, a larger proportion of everyday social and interpersonal interaction requires that individuals coordinate complex, aperiodic actions. In fact, many of the actions performed by individuals in an interactive context likely exhibit characteristics synonymous with chaos (i.e., are unpredictable yet deterministic). Although counterintuitive, recent research in physics and human movement science indicates that small temporal feedback delays may actually enhance an individual's ability to synchronize with chaotic environmental events. Together, this research suggests that a similar process may be at work in the interpersonal coordination of aperiodic behaviors. Here we present data from a study that investigated this possibility. The results suggest that individuals are able to coordinate aperiodic (chaotic-type) movements in a bi-directional context, and that small information feedback delays may (in some instances) enhance such joint-action coordination and facilitate social anticipation.
Coordination in conversation: Investigating social interaction from the behavioral dynamics perspective

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Human behavior is deeply rooted in the interpersonal activity that permeates daily life. Successful navigation of this social environment requires interpersonal behavior that is contingent upon a mutual awareness of how actions are identified and understood. Recent research conducted from the dynamical systems perspective suggests that coordination with others directly influences feelings of social connection, and reliably reflects measurements of cooperative task performance. Many of these studies, however, have typically involved incidental, non-goal directed tasks (e.g., rhythmic limb movement), or limit subjects to virtual contact. As such, socially contextual interactions of real communicators are uncommon. Here, we present data from several structured conversation tasks that investigated meaningful changes in the coordinative movement of interacting individuals and their role in successful communication. Employing various linear and nonlinear measures, we examined the structure of the interpersonal movement dynamics and assessed the degree of interpersonal coordination between pairs. The results are discussed in terms of the low-level dynamical processes involved in social interaction that function to stabilize behavioral performance and shared understanding, with a particular emphasis on the differences in interpersonal movement coordination during collaborative action.

TBA (a few words regarding Drs. Mace and Mark)

Dr. Robert Shaw

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