Abstracts by McNair Scholars at the University of Oregon

The Effect of De-noising fMRI Data: Using Independent Component Analysis

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Functional magnetic resonance imaging (fMRI) data is an important technique for non-invasive study of human brain activity, but its signal to noise ratio is quite low. Researchers have applied different statistical methods to de-noise fMRI data, identify the signal, and correlate that signal with the stimuli and responses from behavioral experiments. We used Independent Component Analysis (ICA) to decompose the fMRI time series from a behavioral experiment into independent components. We then manually inspected each component and rated it on the likelihood that it was an actual signal or a physiological, signal-related, or scanner-related noise. We then showed how the statistical maps of brain activation under several different stimuli changed as we dropped different proportions of the noise component from the data.

Allocation of Attentional Resources When Presented with a Dual-Task

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This study looks at two different types of action, featural and configural. To test how participants allocate attention, we used a dual-task design. This made it possible to investigate whether the detection of featural changes requires more attentional resources than the detection of configural changes. Participants watched two videos, the first of which depicted an actor doing an everyday action. The second video depicted the same basic action but with a change in the featural information of the action or a change in the configural information of the action. Half of the participants completed a subsequent task for which they paid attention to four rectangles changing around the video on the computer screen. We found that when presented with a dual-task, participants' detection of featural changes did not decrease more significantly than configural changes, $F(1,24) = .335$, $p = .568$. These results suggest that there are attentional components in processing both featural and configural information.

The Prison Within the Prison: An Inside Look at Oregon State Penitentiary's Intensive Management Unit

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Since the creation of the first "super-maximum" security prison in the U.S. in 1983, the number of Americans living in long-term solitary confinement has grown rapidly. Today, more than 30,000 inmates in over 40 states are living under these extreme conditions. What prompted the creation of these "super-max" facilities? What is their effect on inmates and on the larger prison culture? What are conditions like inside? Can negative effects be mitigated and positive ones be fostered through education? I explored these questions through my volunteer work at the Oregon State Penitentiary's Intensive Management Unit, a super-max facility. I taught a course on mindfulness, meditation, and creative writing, created information packets and essay prompts on a number of self-improvement topics, and responded individually to written work completed by inmates. I have approached this work through the ethical framework of philosopher Emmanuel Levinas.

Ring-Opening Polymerization of a Cyclopentadienyl-bridged Dimeric Molybdenum Complex

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Ring-opening polymerization (ROP) was investigated as a method for the preparation of organometallic polymers containing metal-metal bonds in the main chain. Early steps involved synthesizing the $(CH_3)_2Si(CpMo(CO)_3)_2$ ring complex as a substrate for this polymerization technique and verifying the structure of this complex through X-ray crystallography. Later steps used anionic ring-opening polymerization and thermal ring-opening polymerization techniques. Both *n*-butyl lithium and platinum(II) chloride failed to initiate the polymerization of the dimeric molybdenum complex. Tests of thermal ring-opening polymerization used differential scanning calorimetry (DSC) and a 150°C oil bath. This resulted in the formation of an oligomer (M_n = 1252, M_n/M_w = 1.03) with metal-metal bonds in the oligomer chain.

Encoding Schemes in Rat Primary Auditory Cortex

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The use of information theory in neuroscience opened the door to new models of brain activity but has remained theoretical with few experimental tests of predictions. Our test focuses on the B-G shift, which depends on the existence of an alternate encoding scheme to that traditionally predicted for neurons. This alternate scheme places the most informative neural responses on the flanks of the tuning curve rather than the peak. Therefore, neurons have at least two possible encoding schemes and choose which to use based on neuronal variability. By varying the intensity of sound stimuli we should be able to observe the B-G shift in neurons of the rat auditory cortex. This research may provide a new tool for analyzing cortical properties and a deeper understanding of the underlying functions of the auditory cortex.

Sexual Dimorphism in Manual Digit Proportions Growth Patterns and the Digit Ratio

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Manual digit sexual dimorphism, specifically the ratio of the second digit to the fourth digit (2D:4D), is linked to health, attractiveness, and reproductive factors. The 2D:4D ratio, if shaped by exposure to sex hormones in-utero as believed, should be observable early. Alternatively, sexual dimorphism in 2D:4D may be a consequence of normal patterns of hand growth that differ between the sexes. Radiographs from Oregon Health and Science University were used to measure the lengths of metacarpals and phalanges for fifteen males and fifteen females, first when the subjects were aged 2-3 and again when they were aged 17-18. Hand bone radiographs, traced onto acetate paper, were measured with digital calipers. The 2D:4D ratio was calculated by summing phalangeal lengths for the second digit and dividing the result by the comparable sum for the fourth digit. Despite overlap, males and females differed in 2D:4D ratio, females having higher values in both age classes. The difference was stronger in the adult age class. Results support that 2D:4D dimorphism is established by age 2-3 and that age is a factor in hand shape variation.

Characterization of a Gene Required for Specifying the Fate of *Drosophila* Photoreceptors

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During development, cells undergo differentiation in order to perform specialized tasks. To understand how cells differentiate as neurons, our research focuses on identifying genes required for the development of photoreceptor neurons in *Drosophila*. In this study, we used a technique known as Mosaic Analysis with a Repressible Cell Marker (MARCM) to create mosaic flies in which undifferentiated photoreceptor precursors were homozygous for a new mutation, z6. We then characterized the phenotype caused by the z6 mutation and observed that in mutant z6 adults, R1/R6s adopted an R8 fate but not an R7 fate. Through a series of complementation tests we were able to create a preliminary map of the location of the gene that z6 disrupts.

Reaching Ability in Infants: Contribution of Spinal Control

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The present study investigated the involvement of thoracic trunk control in infants' ability to reach. Nine typically developing infants (aged 4-6 months) sat on a bench supported by leg straps with external support at two different levels of the spine (mid-ribs and pelvis). Magnetic tracking of head, trunk and both arms, video documentation, and standardized tests of motor ability (AIMS) and trunk control (SATCo) were used to determine the influence of spinal motor control on reaching ability. All subjects reached less with pelvic support than with mid-ribs support. Our data also suggest that there is a positive correlation between the numbers of reaches and level of trunk control but not necessarily with mobility level. We conclude that the level of trunk control is a critical factor in successful reaching and that a test of trunk control such as the SATCo may be more useful than motor ability tests in prioritizing treatment goals for infants or children who have difficulty reaching.

Tim Burton's Grotesquerie

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The grotesque is a natural compulsion of human nature that finds itself manifested over and over in all forms of expression. It is subversive. It is errant. It is revolutionary. It is neo-culture no matter when or by whom it is used. The grotesque represents that part of human nature that questions and protests the accepted order of society. Among the many artists who wield the power of the grotesque, Tim Burton is the most well-known contemporary propagator and a highly skilled master of the grotesque. His work brings the viewer to a place of impossible possibility and fairytale wonder that, combined with simple, trivial contexts, serves as a guise for complex grotesquerie and social criticism. By systematically exploring the stock characteristics of the grotesque and then posing them against the vast body of Burton's known works, their deep connection easily emerges and the grotesque and Burton become inextricably bound. Contemporary grotesque art cannot be fully discussed without the inclusion of Burton's work, and Burton's art cannot be fully appreciated without an admiration for its arrangements of the grotesque.

Height Dependence of Like-Charge Attraction in Colloidal Systems

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For over a decade, the phenomenon of like-charge attraction between microscopic particles in water has puzzled scientists. Recent research has shown that, as expected, electrostatic interactions between colloidal particles are purely repulsive, but the presence of a nearby confining wall can induce inter-particle attractions. We investigate the dependence of the interactions on the distance from a confining wall, in this case, the height above an underlying substrate. The colloidal particles used in this study are silica microspheres 4.74 μm in diameter. Particle height can be controlled both by varying the ionic strength of the medium and by coating the particles in lipid membranes of differing charge densities. The height of the particles above the substrate is determined using the method of Reflection Interference Contrast Microscopy, from which we can extract information about the energy of inter-particle interactions.

Canoe Journey as a Model for Language Revitalization: Experiences with the Grande Ronde Canoe Family

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Canoe Journey is a yearly event that serves to preserve traditional Northwest Native life-ways and traditions, while also facilitating language and culture revitalization. The Journey is structured around Canoe Families comprising members of one or more tribes. The Families provide members a place to experience their culture and language. The Journey has been discussed in the literature as an important social, cultural, and political event for the tribes of the Pacific Northwest, but its potential use as a model for language revitalization has received little attention. This study seeks to describe the Canoe Journey as a unique cultural event that holds a variety of features that could foster an effective language learning environment. I will describe the Journey in general terms, as a member of the Grand Ronde Canoe Family, and as it relates to language revitalization. Given the rapid language loss experienced in the Pacific Northwest, use of the Canoe Journey as a model for language revitalization is ideal.

Emotion Regulation and Interpersonal Perception: How Emotion Regulation Affects How People Are Seen by Others

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Emotion regulation allows people to use strategies that alter emotional experiences and expressive behavior. Prior research has explored the effects of emotion regulation strategies on social relationships, showing that different strategies have different consequences for closeness and social support. The present study examined the role of interpersonal perception in explaining these effects. Specifically, it examined how emotion regulation strategies affect the way the regulator perceives the personalities of other people during a social interaction. Participants were put into small groups for a facilitated social interaction. After the interaction, we assessed the participants' perceptions of one another's personalities. Expressive suppression, an emotion regulation strategy in which people try not to show the emotions that they feel, predicted the perceptions others had of the suppressor. Specifically, we found that people who suppress their emotions are seen as less extraverted, less agreeable, and more neurotic. These perceptions may help explain why suppressors often receive less social support from others.

Selected Papers