

## Undergraduate Honors Projects – 2018-2019

### **Konrad Bailey**

Neural and Behavioral Assays for Studying Predictive Coding in the Mouse Brain

**Advisors:** Santiago Jaramillo, PhD and Nicole Dudukovic, PhD

‘Controlled hallucination’ is a term that has been used to describe the process of interpreting sensory information according to the theory of predictive coding. This theory posits that the brain’s mechanisms for interpreting sensory information function by generating predictions about the external world and comparing these predictions to sensory signals. To assist in identifying neuronal mechanisms for how the brain generates predictions about patterns of sounds we trained mice in a head-fixed, reward-driven, behavioral task that required the animals to make predictions about incoming sounds. We then recorded sound responses and assessed frequency tuning in auditory cortical neurons in awake, head-fixed, non-behaving mice in preparation for upcoming electrophysiological experiments that will be used to evaluate the neural basis for generating predictions about sounds. In these experiments, using the classical oddball sequence and the many-standards control sequence, we plan to isolate measures of deviance detection into repetition suppression and prediction error. After investigating neuronal mechanisms for generating predictions about sounds in non-behaving mice we plan to refine our experimental paradigm and conduct recordings in behaving mice.

### **Morgan Bunch**

How the Use of Simulations Effects the Understandability and Memory for Expert Testimony

**Advisor:** Robert Mauro, PhD

Experts are relying increasingly on the use of computer-generated simulations, or recreations of an incident that are constructed by entering data into a computer program, to effectively communicate complex information. However, the validity of a simulation is often based on key assumptions that are obscure and hidden while the imagery is vivid and compelling. This raises the question of whether simulations can be effective ways to enhance the ability of the courts to deal with arcane information, explain complex issues in ways that judges and jurors can understand, or allow judges and jurors to be swayed by presentations that are only loosely grounded in the facts and science. In the effort to enhance the clarity and persuasiveness of expert testimony, we seek to investigate the effect of simulations on individuals’ perceptions of the validity of expert testimony. The questions guiding our inquiry are as follows: How effective are simulations relative to traditional visualizations in persuading individuals? How can simulations be effectively cross-examined? In what ways are simulations persuasive and/or being potentially mistaken for fact? To answer these questions, participants will be recruited through the University of Oregon Psychology Department human subjects pool and randomly assigned to one of three conditions based on the use of a simulation and the use of cross-examination (1. No simulation, no cross, 2. With simulation, with cross, 3. With simulation, no cross), used to measure the extent of the simulation’s persuasiveness and its effect on juror decision making.

### **Aastha Dhingra**

Examining Parental Reflective Functioning and Breastfeeding Patterns

**Advisor:** Dare Baldwin, PhD

Motherhood is an inimitable experience in one’s life. It is viewed as a significant moment and is often considered to be the entry into adulthood. But, many women across the globe don’t feel prepared. They often experience fatigue, tiredness, depression, loneliness, powerlessness, anger and a sense of uncertainty. For many, incorporating breastfeeding as well as a myriad of other life changes (e.g., sleep patterns, work schedule, relationship changes, etc.) present serious challenges to coping and adjustment. Parental reflective functioning denotes one’s ability to

perceive self and child in terms of mental states, such as feelings, desires and goals. It helps with the successful navigation of parent-child interaction. In this research, we investigate the extent to which parental reflective functioning is related to mothers' adjustment to their breastfeeding experiences and success, in conjunction with other factors, such as depression/stress/anxiety and level of social support. Our findings will offer altogether new insight into the struggles and achievements of motherhood.

### **Andrew Dizon**

Juror Perceptions of Asian American Attorneys

**Advisor:** Robert Mauro, PhD

In the American judicial system, jurors are tasked with determining outcome of trials based on information presented as admissible evidence. One way in which attorneys sway jurors to decide in favor of their clients is through the telling stories that explain the facts in evidence (Findley & Sales, 2012). However, jurors may interpret these stories differently depending on the preexisting biases that they hold. The present study investigates the way in which jurors' biases about gender and race interact with attorneys' speech style to affect trial outcomes. We asked 119 participants (to act as mock jurors while reading a report of a hypothetical criminal trial. The participants were randomly assigned to one of eight conditions created by varying the race (Caucasian/Asian) and gender (Male/Female) of the defense attorney and the way that the defense attorneys presented their closing argument (story/legal issues). Dependent measures include verdict, culpability ratings, and attorney trait assessment. Data analyses will test for the main effects and interactions between the independent variables on the dependent measures. Implications, limitations, and future directions will be discussed.

### **Karlie Donaca**

Story Model of Juror Decision Making

**Advisor:** Robert Mauro, PhD

In the United States criminal justice system, juries are tasked with the most important, complex job in a criminal trial – determining the guilt or innocence of the accused. Previous research has indicated jurors' decisions are greatly influenced by composition of attorneys' closing statements, with preferences toward clear, understandable stories. Pennington and Hastie's (1981) Story Model of Juror Decision Making argues that jurors reorganize trial evidence into a narrative-based sequence of events, with verdicts favoring the most easily-organized evidence. The present study seeks to expand on Pennington and Hastie's Story Model (1981) by comparing the effectiveness of narrative-style defense closing statements and traditional, legal fact-based closing statements. In line with Pennington and Hastie's (1981) Story Model, we hypothesized that narrative-based defense closing statements would be more likely to produce a verdict of "not-guilty" than fact-based closing statements. Additionally, we hypothesized that attorneys, regardless of race and gender, who utilized a narrative-based closing statement would receive higher ratings on measures of personal traits such as likeability, intelligence, and aggression.

### **Emily Dunning**

Adverse Childhood Experiences and Self-Regulation in At-Risk Children: An Intergenerational

**Advisors:** Elizabeth Skowron, PhD; Nicole Dudukovic, PhD; and Emma Lyons, MA

Exposure to early adversity creates lasting negative effects in biological and behavioral functioning across the lifespan (Anda et al., 2006; Shonkoff & Garner, 2012; Felitti et al., 1998; Gunnar & Quevedo, 2007; Obradovic et al., 2010), such as deficits in self-regulatory abilities (Skowron, Cipriano-Essel, Gatzke-Kopp, Teti, & Ammerman, 2014). The parasympathetic nervous system (PNS), a branch of the autonomic nervous system, is key in physiological regulation and is often used to measure self-regulatory capacity. The current study examined the

intergenerational impact of early adversity on self-regulatory functioning by clarifying the relationship between parents' early adversity (ACES) and their child's self-regulation, as measured by respiratory sinus arrhythmia (RSA). Participants (N=203) were parent-child dyads in which children were 3 to 7-years-old; families were recruited from the Department of Human Services (DHS) and the Eugene, Oregon community. RSA was measured while children were at rest and the Adverse Childhood Experience Scale (ACES) scores were used to assess the extent of adversity that children and their parents had experienced. A simple correlation analysis was run to test the relationship between parent ACES and child ACES, finding a significant positive relationship, indicating that parents who experienced childhood adversity were more likely to have children who experienced childhood adversity. A regression analysis was run to compare child ACES with child RSA, controlling for child age and gender, and no significant relationship was found. A second regression analysis was conducted to compare parent ACES with child RSA, controlling for child age, child gender, and child ACES, and no significant relationship was found. Future research should recruit a sample with a more representative distribution of ACES and should control for other potentially important variables, such as race and socioeconomic status.

### **Madison Edgar**

Caregiver Singing and Infant Vocalizations in Everyday Life

#### **Advisor: Caitlin Fausey, PhD**

The auditory environments infants encounter impact their vocal development, especially during interactions between a caregiver and their infant (e.g., Franklin et al., 2014; Cartmill et al., 2013). We know that caregivers not only talk but also sing to their infants; however, we don't yet know how singing might matter for many infant behaviors in everyday life (Custodero, Britto, & Brooks-Gunn, 2003). In this study, I ask: Does singing impact infant vocalizations in everyday life? We audio recorded one full day at home from 35 infants (ages 6-12 months old). Trained coders identified moments of live vocal music by listening to these recordings. Speech modeling software automatically identified infant vocalizations (Ford et al., 2008). Overall, infants encountered 6.5 minutes of live vocal music each day and vocalized 1165 times over the course of each day. Interestingly, infants who encountered more live vocal music also vocalized more. These results raise the possibility that caregiver singing promotes vocalization practice for infants.

### **Kate Haynes**

Parsing Out Perspective Taking: Patterns in Narrative Strategies and their Impact on Social Relations

#### **Advisor: Sara Hodges, PhD**

Perspective taking is often regarded as a tool to improve social relations, but it can sometimes "backfire," leading to negative outcomes (e.g., increased stereotyping). Past research has examined the effect of instructing people to perspective take (or not) on various outcomes but has focused less on the strategies people employ when taking another person's perspective. To better understand what causes this "backfiring," we asked participants to write about the typical day of an out-group target (i.e., someone who supported the opposing candidate in the 2016 U.S. Presidential Election) and then answer questions about social outcomes in relation to the target (e.g., how much they liked the target, willingness to engage in conversation with the target, and validity of the target's position). Participants' narratives were coded for the point of view they were written in (i.e., first-person, embedded/marked, third-person, and no point of view), the concentration of stereotypes for each political group (i.e., liberal and conservative), and average valence (i.e., negative to positive) of content. Third-person point of view was hypothesized to be the most commonly chosen point of view, but first-person was hypothesized to have the most positivity and the least stereotyping. Separate multiple regressions conducted found that smaller concentrations of stereotypes and more positive valence generally predicted better social outcomes. Liberal participants generally exhibiting greater negative perceptions of out-group relations, which could be potentially explained by bitterness over their loss in the 2016 U.S. Presidential Election. Altogether, the findings show the need for deeper understanding of the natural strategies people employ when perspective taking before perspective taking can be used to foster a more consistently effective intergroup intervention.

## **Hannah Henderson**

Olfaction and Oxytocin: Understanding Attraction/Aversion Behaviors in Mice

**Advisors:** Matt Smear, PhD and Marike Reimer, MS

In humans as well as mice, oxytocin is a neurotransmitter that creates social connections and bonds between members. In mice, it is involved in enhancing social recognition by modulating olfactory neural functions, while in people it is theorized that dysfunction in the oxytocin system early on in development could lead to the development of autism. Because of its link to the social and emotional brain, oxytocin is a likely candidate to moderate social behaviors. In this study, we hypothesized that oxytocin is vital for social memory and connections in mice. Using machine vision techniques, we will determine memory preferences in female mice. We will then inject a dose of oxytocin receptor antagonist, allowing us to knock out the oxytocin receptors in the granule cells of adult female mice, revealing the role of attraction and social recognition. The potential findings between oxytocin signaling and social disorders in mice explain how studying these specific underlying behavioral mechanisms may lead to new information about the nature and biological basis of certain social disorders.

## **Takako Iwashita**

Effects of Acculturation on Normative Dissociative Experiences in an East Asian Sample

**Advisors:** Gordon Nagayama Hall, PhD and Jennifer Lewis, MS

It has been suggested that culture influences individual differences in dissociative experiences. Previous work has indicated that people with East Asian backgrounds tend to report higher tendencies of trait dissociation than their Caucasian peers. The present study investigated normative dissociative experiences in Asian cultures and explored the roles that language and acculturation might have on these experiences. Thirty-seven international and American students with Chinese or Japanese background were recruited to complete the Dissociation Experiences Scale, as well as two measure of acculturation. Mean dissociation values of our sample were tested against a sample of Caucasian students collected from a previous study. Results did not find a significant difference in mean dissociation scores between the Caucasian sample and our Asian sample. Furthermore, behavioral acculturation and English proficiency significantly predicted dissociative levels of our sample while value acculturation did not. The present study shed light on the possible relationship between inherent behaviors in a given culture and dissociative tendencies.

## **Jack Kapustka**

Negative Valence and Associative Memory

**Advisor:** Dasa Zeithamova-Demircan, PhD

Our ability to create and remember associations is an essential aspect to our day-to-day lives. Previous research suggests that the ability to remember associations is impaired by negative emotions, though these findings remain inconclusive. In this study, we examined whether this impairment from exposure to a negative stimulus could be transferred to subsequent associations. Sixty-five students were recruited from the University of Oregon Psychology Department through the Human Subjects Pool. Subjects completed a paired-associates paradigm, in which they learned to link neutral object pairs (AB & BC) that shared a common associate (B). Subjects were randomly assigned to a condition in which they were exposed to either negative or neutral distractor images prior to learning each AB pair association. After being tested on AB learning, subjects then learned BC pairs, as well as unrelated pairs (XY) that did not share any AB associations. Results showed that subjects had worse memory performance for BC compared to both AB and XY pairs. However, there were no differences in learning for any of the pairs as a

function of emotional distractor condition. Overall, our results suggest that irrespective of distracting emotional experiences, learning of overlapping associations is more difficult than learning of non-overlapping associations.

### **Madison Kelm**

The Relationship between Child Baseline RSA and Critical Parenting Practices

**Advisors:** Elizabeth Skowron, PhD; Dare Baldwin, PhD; and Carrie Scholtes, MS

Parenting behavior has been shown to be a predictor of child self-regulation. Previous studies have demonstrated an association between supportive parenting behavior and positive child outcomes as well as an association between harsh parenting behavior and difficulties with child emotion regulation (Binion & Zalewski, 2017). Despite extensive research on emotional and behavioral self-regulation, less is known about physiological processes of self-regulation. It is important to examine self-regulation at a biological level because this measure is uninfluenced by the thoughts and emotions of the individual. The current study sought to examine pathways through which harsh and controlling parenting practices, assessed via the Conflict Tactic Scale-Parent Child (CTSPC) and three five-minute parent-child interaction tasks, impact children's ability to physiologically self-regulate. Child physiological self-regulation was assessed using baseline resting respiratory sinus arrhythmia (RSA). An analysis of the relevant literature revealed that children whose mothers utilized more negative control during dyadic interactions exhibited deficits in their ability to self-regulate physiologically (Calkins, Smith, Gill, & Johnson, 1998; Hastings et al., 2008). Thus, we hypothesized that parents who use critical parenting practices will have children who exhibit deficits in physiological self-regulation. Contrary to our predictions, a hierarchical linear regression revealed no significant relationship between either harsh or controlling parenting and child physiological self-regulation.

### **Ellyn Kennelly**

The Role of Infant Attachment and Self-Efficacy in Predicting Later Academic and Social Competence

**Advisors:** Jennifer Ablow, PhD and Jeff Measelle, PhD

Child self-efficacy has been shown to predict better social and academic problem solving skills, both of which are foundational to school success. Additionally, attachment security has been linked to school achievement via its effect on socioemotional adjustment. Presently, few studies have addressed the interaction of self-efficacy and attachment early in life to determine whether they have a joint role in shaping readiness for school. We hypothesize that self-efficacy during infancy will predict school readiness outcomes at age 5. However, we also anticipate that this association will be moderated by infant attachment security. In particular, we expect that infants with disorganized attachment histories will fail to develop the self-efficacy capacities needed to begin school on an adaptive trajectory. Our high-risk sample comprises 72 low SES mother-infant dyads who were followed longitudinally from pregnancy through 60 months postnatally. When infants were 17-months-old they completed the Strange Situation Procedure as well as a task designed to probe early self-efficacy, which together we used to predict mother's reports of their child's social and academic competence at age 5, before entry to kindergarten. Contrary to our predictions attachment style and self-efficacy did not predict later academic and social competence, and there was no interaction between self-efficacy and attachment style. These findings suggest that self-efficacy is still changing and has yet to consolidate at 17 months of age. Other factors of our high risk sample, such as poverty, could have made a larger impact than attachment style on academic and social competence at 5 years, thus overshadowing the affects attachment style may have had.

### **Jena Kunimune**

Is Inhibition Dependent on Working Memory Capacity?

**Advisors:** Ulrich Mayr, PhD and Melissa Moss, MS

The ability to stop initiated actions is a critical component of effective self-regulation, such as resisting the urge for ‘sex, drugs, and rock and roll.’ The current dominant theory in cognitive control assumes that maintaining task-relevant information in working memory is necessary for the effective implementation of inhibitory control. In this study, we addressed the interplay of inhibitory control and working memory maintenance processes using a dual-task paradigm in which both inhibitory control demands and working memory load were manipulated. Because the standard theory predicts mutual interference between the two processes, we hypothesized that if inhibition interferes with working memory maintenance, working memory performance will be lower when participants successfully employ inhibitory control in response to a stop signal, versus when they fail to inhibit their action. Further, this interference in performance should be greatest when working memory load is high. Participants completed a combined working memory and stopping task in which stopping behavior occurred during the working memory maintenance interval. Our results showed no evidence of mutual interference between working memory load and stopping behavior on working memory performance. This result is inconsistent with the dominant view of working memory capacity as the primary constraining factor in inhibitory control. Rather, distinct processing resources may underlie these two different aspects of self-regulation.

### **Aaron MacArthur**

Referential Communication Task in a Naturalistic Setting

**Advisors:** Dare Baldwin, PhD and Netanel Weinstein, MS

Reaching shared understanding in conversation is an important part of daily life. Various mechanisms facilitate this achievement including: the ability to engage in perspective taking, sensitivity to gaze, sharing attention, and making pragmatic inferences about an interlocutor’s intent. Prior research on this topic has prioritized experimental control over ecological validity by placing participants in highly constrained situations. We addressed these limitations in the present study by correlating performance in a modified referential communication task with participants’ performance on several standard personality and socio-cognitive measures. Specifically, pairs of participants were placed on either side of a shelf with a series of cells and prepared a cake from a given recipe card. Some of the cells on the shelf were visible to only one participant or the other, while some cells were visible to both. We measured participants use of various disambiguation strategies (e.g. gaze checking or making a clarification request) and examine whether performance on standard socio-cognitive measures predict these behaviors. This research helped shed light on the relationship between standard decontextualized socio-cognitive measures and real-life social interaction as well as the extent to which these measures predict individual differences in the way people achieve shared understanding in conversation.

### **Dillon Murphy**

The Effect of Memory Self-Efficacy on the Dynamics of Delayed Free Recall, Encoding Strategies, and Performance

**Advisors:** Nash Unsworth, PhD and Ashley L. Miller, MS

Memory self-efficacy (MSE), a self-assessment of one’s memory abilities, has been found to positively relate to memory performance, however, the reasons for this relationship remain unclear, particularly in the context of free recall. The current study (n = 169) examined the relationship between individual differences in MSE, the use of effective encoding strategies, and the dynamics of free recall (e.g., serial position curves, probability of first recall, conditional response probabilities, recall latencies, and inter-response times). While we found that MSE was related to encoding strategy use and overall recall performance, converging evidence from the dynamics of delayed free recall did not reveal any MSE-related differences in how individuals retrieve items from long-term memory. The results suggest that variation in performance is partially due to differences in encoding strategies but differences in

MSE are also important in that they uniquely predicted recall even when taking effective encoding strategies into account.

### **Xinran Niu**

Repetitive Negative Thinking Changes the Effect of Sleep Extension on Stress Response

**Advisors:** Melynda Casement, PhD and Xi Yang, MS

Insufficient sleep duration can disrupt physiological stress response systems, but the relationship between sleep and stress may depend, in part, on how stressors are perceived or interpreted. The present study investigated whether repetitive negative thinking (RNT) affects the strength of the relationship between sleep duration and parasympathetic nervous system response during rest and stress. Young adult women with symptoms of depression and insufficient sleep (n=18) were assigned to a week of extended sleep opportunity or typical sleep opportunity. Following sleep manipulation, parasympathetic activity was evaluated using high-frequency heart rate variability (HRV) during rest and exposure to a social stressor. Extended sleep opportunity increased resting HRV, but only in participants with low RNT. However, neither sleep extension nor its interaction with RNT affected reactivity to the social stressor. Future research should examine this sleep by RNT interaction with larger sample size and more statistical power.

### **Camy Sibley**

Can Parent Harshness Predict Child Inhibitory When Familial Economic & Subjective Standing are Controlled For?

**Advisors:** Elizabeth Skowron, PhD; Phil Fisher, PhD; and Akhila Nekkanti, MS

Inhibitory control is a rapidly developing skill during early childhood, which predicts school readiness and social competence (Ponitz et al. 2009). Familial socioeconomic status, social standing, and parenting behaviors have all been shown to influence children's development of this skill (Dilworth-Bart 2012; Ursache, Noble, & Blair 2015; Blair & Raver 2012). The current study examined whether harsh parenting was still a significant predictor when socioeconomic status and social standing were controlled for. Interestingly, within our high-risk welfare involved sample, none of these were significant predictors of child inhibitory control performance on a child version of a Go-No Go task.

### **Josephine Swift**

The Relationship between Self-Reported Mindfulness and the P300

**Advisors:** Don Tucker, PhD and Jennifer Lewis, MS

Mindfulness is a state of awareness that allows an individual to more effectively monitor their cognition and emotions. The ways in which mindfulness impacts aspects of cognition, including attention and attentional control, are still being researched. The current study examines how dispositional mindfulness is related to individuals' attention and attentional control as measured through dense-array EEG (dEEG). We examined participant's (n=72) scores on the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) and their event-related potentials (ERPs) generated from completing the color-word Stroop task modified for dEEG recording. Response times were also recorded. ERP waveform amplitude differences for the P300, an ERP associated with attentional processes, did not significantly differ by category (i.e., Incongruent, Congruent). However, preliminary analyses showed a relationship between self-reported mindfulness and the amplitude of the P300 (across both categories), whereas higher scores on the FFMQ were associated with attenuated P300 amplitudes. Decreased P300 amplitudes may indicate the deployment of less attentional resources. It's possible that individuals who are more mindful, have naturally increased attention and therefore require less attentional resources in a cognitively demanding task. Mindfulness has been found to be an effective intervention for mood disorders,

particularly anxiety disorders (Blanck et al. 2018). Understanding the particular ways that mindfulness impacts cognition may lead to a further understanding of the mechanisms by which mindfulness improves anxiety symptoms and thus improve treatment.

## **Vy Tran**

Is Forgetting Good for Learning? Examining the Emergence of Abstract Rule Representations

**Advisors:** Ulrich Mayr, PhD and Atsushi Kikumoto, MS

Most actions are driven by abstract action rules that need to be applied to specific environmental conditions. The abstract goal to make coffee is implemented differently in your own than in your office kitchen. We examine here the degree to which improvements through practice result from (1) strengthened representations of abstract rules, from (2) better adaptation to specific environmental conditions, or from (3) representations that integrate abstract rules and specific conditions into conjunctive representations. We used a task that required the application of up to four different abstract spatial translation rules in order to respond to a given spatial stimulus. Subjects (N=46) performed an initial, 45-minute session applying two of the four rules to one of two possible stimulus configurations. During the second, 45-minute session, the two withheld abstract rules and the second stimulus configuration were introduced. To test the possibility that abstract, generalizable knowledge is fostered through consolidation or forgetting of specific conjunctive representations the second session occurred either right after the first session, or one week apart.

Results showed that it was harder to apply new rules to practice than to new stimulus configurations -- a clear indication conjunctive representations between abstract rules and stimulus settings. Importantly, this effect was substantially weakened when the new rules/stimulus settings were tested after one week. This suggests that during the 1-week delay, specific conjunctive representations were weakened (i.e., forgetting), thereby increasing the contributions of abstract rule representations. In other words, forgetting can benefit the emergence of generalizable skills.

## **Fan Yang**

Time Frequency Dynamics of Theta Rhythm During Self-Evaluation

**Advisor:** Don Tucker, PhD

In this study, we discussed some commonly used EEG preprocessing method with their pros and cons, and we used a fairly new method—joint time frequency analysis—to study the clinical significance of depression, particularly, self-evaluation. We created a subset from a larger EEG dataset including mildly depressed males and females, and more severely depressed males and females. All participants participated in a self-evaluation task where personality trait words were presented, and then behavioral responses were required based off whether the trait word is self-descriptive. Theta power was extracted for statistical analysis. From the statistical result, we found interesting electrode by task condition by sex by depression interactions from stimulus onset to 300 ms post-stimulus, and all main effects and interaction effects after 300 ms failed to exceed significance threshold.

## **Shijing Zhou**

The Effect of Absolute Value vs. Relative Value of Reward on Associative Memory

**Advisors:** Dasa Zeithamova-Demircan, PhD and Lea Frank, MS

People tend to remember information associated with high reward values better than low reward values. However, what is perceived as “high” reward may be relative to other potential rewards. Here, we hypothesized that the



memory advantage for a given reward value (e.g., penny over no reward) diminishes as higher possible rewards are offered. In the task, participants studied pairs of common objects, preceded by a cue indicating how much money they could earn (no reward, penny, dime, or dollar) for remembering the pair at a later test. Study block 1 included only no reward and penny cues, dime cues were added in block 2, and dollar cues were added in block 3. At test, participants saw one object from each pair and named the object that was paired with it at study. Contrary to our hypothesis, reward effects on memory were independent of other offered rewards. Together, these findings indicate that the absolute values of reward, rather than the relative values, dictate the effect of reward on memory performance.