

UNDERGRADUATE RESEARCH Highlights

Boucher HC, Kofos M. The idea of money counteracts ego depletion effects. *Journal of Experimental Social Psychology*. 2012; 48:4:804-810. (Bates College)

Two experiments showed that activating the concept of money counteracts the ego depletion effect (whereby one act of self-control, by drawing on a limited resource, makes further self-control more difficult). Experiment 2 showed that this effect is due to the idea of money reducing both the subjective difficulty and effort required on subsequent self-control. Helen Boucher is an associate professor of psychology. Experiment 1 was conducted as Monthe Kofos' senior thesis, completed in 2010. He is a counselor in the inpatient unit of Marlborough UMASS Memorial Hospital.

Ide J, Jones L. Enumerating invariant subspace of R^n . *Linear Algebra and its Applications*. 2012; 437:7:1845-1853. (Shippensburg University)

We develop an algorithm to calculate the set of all integers m for which there exists a linear operator T on R^n such that R^n has exactly m T -invariant subspaces. Moreover, the algorithm gives a method for the explicit construction of such a linear operator T . Lenny Jones is a professor of mathematics. This research resulted from an independent study in advanced linear algebra that Joshua Ide took with Dr. Jones. Joshua Ide is entering a graduate program in mathematics at SUNY-Binghamton in the fall of 2013. The research was funded in part by the Shippensburg University Foundation.

Chapman MA, Tang S, Draeger D, Nambeesan S, Shaffer H, Barb JG, Knapp SJ, Burke JM. Genetic analysis of floral symmetry in Van Gogh's "Sunflowers" reveals independent recruitment of CYCLOIDEA genes in the asteraceae. *PLoS Genetics*. 2012; 8:3:1-10. (University of Georgia, Athens, GA)

Species in the flowering plant family Asteraceae exhibit flower heads that can contain both bilaterally and radially symmetric flowers. In this study, we identify a CYCLOIDEA-like gene that is responsible for determining flower symmetry in the sunflower. Mis-expression of this gene causes a double-

flowered phenotype, similar to those captured in Vincent van Gogh's famous nineteenth century paintings, whereas loss of gene function causes radialization of the normally bilaterally symmetric ray florets. Interestingly, this gene is not orthologous to the CYCLOIDEA-like gene responsible for floral symmetry in other members of the Asteraceae, providing evidence of the parallel recruitment of different members of the same gene family for the same function. John M. Burke is professor of plant biology at the University of Georgia. Hunter Shaffer was employed in Dr. Burke's lab during his sophomore and junior years. During his senior year he participated in the research as part of a biochemistry independent research project. He graduated in May 2012 with a major in biochemistry and molecular biology and is currently employed full-time in Dr. Burke's lab. Hunter plans on working as an EMT before starting medical school in 2013. This work was funded by grants from the National Science Foundation and the Gloeckner Foundation.

Schlewitz AJ, Fegel HL. Una nueva oportunidad en la investigación del Ejército guatemalteco en el Archivo General de Centro América. *Mesoamérica*. 2012; 54:126-136. (Archivo General de Centro América)

This essay describes military documents that the Archivo General de Centro América made accessible to the public in 2009, which are largely administrative. The essay also discusses the challenges of working with this collection, as well as its promise for researchers interested in reconstructing an institutional history of the Guatemalan military. Andrew J. Schlewitz is assistant professor of Latin American Studies. Heidi L. Fegel is a senior majoring in Spanish and minoring in Latin American Studies. She worked with Dr. Schlewitz in the Archivo General de Centro América as a student summer scholar in 2011. She is currently finishing an honor's thesis based on this archival research. After graduating, she plans to earn an MA in Latin American Studies. Grand Valley State University's Student Summer Scholarship program and its Center for Scholarly and Creative Excellence funded Schlewitz and Fegel's two months of research in Guatemala.

Ruble JF, Lefurgy ST, Cornish VW, Powers, RA. Structural analysis of the Asn152Gly mutant of P99 cephalosporinase. *Acta Crystallographica Section D*. 2012; 68:1189-1193. (Grand Valley State University)

We determined the X-ray crystal structure of a point mutant of the antibiotic resistance enzyme, P99 beta-lactamase in an effort to elucidate the structural reasons for its extended-spectrum activity. Unexpectedly, we discovered the engineered histidine tag bound in the active site. From a drug design perspective, this structure may suggest potential binding sites that could be exploited to discover novel inhibitors for this enzyme. Rachel Powers is an associate professor of chemistry. Jim Ruble worked on this project during his last two years as an undergraduate student at Grand Valley. He was instrumental in advancing this project, which was conducted in collaboration with Virginia Cornish's group at Columbia University. He is currently a graduate student in pharmacology at the University of Washington. This research project was funded by a Cottrell College Science Award from Research Corporation and an NSF-Advance professional development grant, which were awarded to Rachel Powers.

Moore J, Demchak TJ. Treatment of fibromyalgia syndrome with low-level laser therapy: a case report. *International Journal of Athletic Therapy & Training*. 2012; 17:4:28-31. (Indiana State University)

Fibromyalgia syndrome is typically treated pharmacologically. Low-level laser could serve as a non-pharmacological treatment for fibromyalgia syndrome. The low-level laser therapy treatments decreased pain and increased function in our patient. Timothy Demchak is an associate professor in the Department of Applied Medicine and Rehabilitation at Indiana State University. He was affiliated with the athletic training program at the time the study was conducted. Currently, he is considered a faculty member in the Physician Assistant program. Jesse Moore completed an internship during the summer of 2011 with Dr. Demchak at the St. Ann Medical Center. The case study was from a patient that he evaluated and helped treat throughout the summer. Jesse is

currently a senior athletic training major and is assigned to ISU football for his clinical work. The internship was funded with an Indiana State University Community Engagement Grant.

Barrett BS, Carrasco JF, Testino AP. Madden-Julian Oscillation (MJO) modulation of atmospheric circulation and Chilean winter precipitation. *Journal of Climate*. 2012; 25:5:1678-1688. (U.S. Naval Academy)

The smaller cousin of El Niño, the Madden-Julian Oscillation, also affects weather around the world by modulating atmospheric circulation on intra-seasonal (30-day) time scales. Medium-range forecasts of rainfall in semi-arid regions, including Chile, benefit from knowledge of the ways in which different phases of the oscillation modify weather systems, and in turn, rainfall. This study found that two of the eight phases of the oscillation were associated with significantly above-normal rainfall in central Chile, and two were associated with significantly below-normal rainfall in central Chile. This finding is a promising first step toward improving medium-range (30-day) forecasts in those semi-arid regions. Bradford S. Barrett is an assistant professor in the Oceanography Department at USNA. Jorge F. Carrasco is a senior meteorologist with the Chilean National Weather Service in Santiago, Chile. Anthony Testino, an honors oceanography major at USNA, graduated in May 2012. He was named the American Meteorological Society Macelwane Award winner for the top undergraduate research paper in 2012. He oversaw data gathering from online data bases and wrote several hundred lines of MATLAB code to statistically compare rainfall to the Madden-Julian Oscillation. He is currently stationed at the Naval Nuclear Power Training Command in South Carolina. This work was supported by an internal grant from the U.S. Naval Academy Research Council and the Office of Naval Research.

Martínez AK, Shirole NH, Murakami S, Benedik MJ, Sachs MS, Cruz-Vera LR. Crucial elements that maintain the interactions between the regulatory TnaC peptide and the ribosome exit tunnel responsible for Trp inhibition of ribosome function. *Nucleic Acids Research*. 2012; 40:5:2247-2257. (University of Alabama in Huntsville)

This study examined the molecular factors involved in the recognition of newly synthesized proteins by the cellular protein-making machinery, the ribosome. Genetic and biochemical experiments were performed to reveal ribosomal molecules that affect the production of proteins and expression of genes. These results open future experiments involving the generation of antibiotics inhibitors of the protein synthesis and bacterial growth. Luis R. Cruz Vera is an assistant professor of biological sciences. Shino Murakami was an undergraduate student at the biological sciences at UAH where she performed part of the work published in this article. Shino is currently a doctoral candidate in the program of Genes and Development at the UT-Southwestern Medical Center. Shino's work was supported by the Research Experiences for Undergraduates program sponsored by University of Alabama in Huntsville and Alabama Space Grant Consortium.

Demir M, Davidson I. Toward a better understanding of the relationship between friendship and happiness: perceived responses to capitalization attempts, feelings of mattering, and satisfaction of basic psychological needs in same-sex best friendships. *Journal of Happiness Studies*. 2012; 13. DOI 10.1007/s10902-012-9341-7. (Northern Arizona University)

In this study the roles of perceived responses to capitalization attempts, perceived mattering to, and satisfaction of basic psychological needs in same-sex best friendships in happiness among men and women were investigated (n = 4,382). Findings showed that although all of the friendship variables were positively associated with happiness to varying degrees, basic needs satisfaction emerged as the strongest predictor of happiness. Additional analyses revealed that competence-need satisfaction was the most important need predicting happiness. Importantly, these findings were

gender invariant. Meliksah Demir is an assistant professor of psychology. Ingrid Davidson completed this study in 2012. She is attending Colorado State University, pursuing a M.Ed. in counseling and career development, with school and college counseling emphases. Ingrid received a grant from the NAU Hooper Undergraduate Research Award program to conduct this research.

Shepherd TD, Koc MA, Molinero V. The quasi-liquid layer of ice under conditions of methane clathrate formation. *Journal of Physical Chemistry*. 2012; 116:12172-12180. (University of Utah and Westminster College)

Experiments suggest that the quasi-liquid layer (QLL) at the surface of ice may play an important role in the nucleation of clathrate hydrates from ice. Molecular dynamics simulations were run to determine the structure of the QLL under conditions amenable to clathrate formation at various temperatures. These results are relevant for the understanding the mechanism of formation of hydrate clathrates from ice. Tricia D. Shepherd is an associate professor of chemistry at Westminster College. Valeria Molinero is a associate professor of chemistry at the University of Utah. Matthew A. Koc is currently a senior at Westminster College expecting to graduate with a B.S. in chemistry and physics. He participated in this research through the 2010 Gore Undergraduate Summer Research Experience. This research was supported by the National Science Foundation through the award CHE-1012651 (to V.M.) and the Westminster College Gore Math & Science Endowment (to T.D.S. and M.A.K.).

Thomson AS, Summers PM. The effect of monetary policy on real commodity prices: a re-examination. *The Journal of Economics (MVEA)*. 2012; 38:1:1-21. (Texas Tech University)

The paper re-evaluated a recent claim that expansionary monetary policy results in higher inflation-adjusted commodity prices. After addressing several econometric problems in the original study, we found very little evidence of such an effect. Peter M. Summers was an assistant professor in economics, and

is now at High Point University. Amanda Thomson was an honors student in economics and graduated in 2010. She is now a law student at the University of Texas at Austin. The research was supported by an undergraduate research fellowship from the Texas Tech University Honors College, awarded to Amanda.

Kolawole AO, Sharma P, Yan R, Lewis KJ, Hostetler HA, Ashbourne Excoffon KJ. The PDZ1 and PDZ3 domains of MAGI-1 regulate the eight exon isoform of the coxsackievirus and adenovirus receptor. *Journal of Virology*. 2012; 86:17:9244-54. (Wright State University)

This manuscript demonstrates that the eight exon isoform of CAR (CAR^{Ex8}) and susceptibility to apical adenovirus (AdV) infection is differentially regulated by two different PDZ domains of the cellular scaffolding protein MAGI-1. Whereas PDZ3 sequesters CAR^{Ex8} within the cell and reduces AdV infection, PDZ1 protects CAR^{Ex8} from MAGI-1-mediated loss and rescues AdV infection. Katherine Excoffon is an assistant professor in the Department of Biological Sciences. Kyle Lewis was an undergraduate research assistant (2010-2011) and is currently a Ph.D. student at Baylor College of Medicine. This work was funded by National Institute of Allergy and Infectious Disease (NIH) 1R15AI090625-01 and a Wright State University Undergraduate Research Grant.

Weidler BJ, Multhaup KS, Faust ME. Accountability reduces unconscious plagiarism. *Applied Cognitive Psychology*. 2012; 26:626-634. (Davidson College)

Participants completed a Boggle task with a computer partner. Accountable participants were told that they would review their puzzle solutions with the researcher at the end of the session. Accountable participants plagiarized less than control participants. [This study was picked up by a *Wall Street Journal* blog: <http://blogs.wsj.com/ideas-market/2012/06/06/reducing-i-mixed-up-my-notes-plagiarism/>]. Kristi Multhaup is a professor of psychology. Mark Faust is an associate professor of psychology. Blaire Weidler is currently in a doctoral program in cognitive psychology at Washington University in St. Louis. This research was supported by an Abernethy grant (Davidson College) awarded to Blaire and a Faculty Study & Research grant (Davidson College) to Multhaup.

Morrison-Smith S, Dighans S, Daniels T, Marmon C, Izurieta C. Technical Debt Reduction Using a Game Theoretic Competitive Source Control Approach Paper. 2012. (Montana State University)

The management of technical debt and the use of productivity games are important aspects of developing software projects. A productivity game was created in the form of a competitive source control plug-in that rewards technical debt-reducing actions. The plug-in has potential practical applications in the management of technical debt in workplace environments. The approach described in this paper is promising, and in future work we plan to test the plug-in with a wider variety of existing projects. Additional research is also planned to investigate the impact on workplace productivity. Clemente Izurieta is an assistant professor in the Department of Computer Science. All the authors with the exception of Clemente Izurieta were students in the senior software engineering class. This project/research was conducted over the course of the semester, and the students worked with Professor Izurieta during the summer to make the work publishable. No funding was provided for the research. However, professor Izurieta will use funds from his start-up package to send Sarah Morrison-Smith to present the paper at the 25th International Conference on Computer Applications in Industry and Engineering, in New Orleans, LA.

Hark RR, Remus JJ, East LJ, Harmon RS, Wise MA, Tansi BM, Shughrue KM. Geographical analysis of "conflict minerals" utilizing laser-induced breakdown spectroscopy. *Spectrochim Acta B*. 2012; 74:131-136. (Juniata College)

Laser-induced breakdown spectroscopy (LIBS) offers a means of rapidly distinguishing different geographic sources for a mineral on the basis of a geochemical fingerprint. An application of this approach with potentially significant commercial and political importance is the spectral fingerprinting of "conflict minerals" such as columbite-tantalite ("coltan"). A geographically diverse set of 57 samples from 37 locations around the world was analyzed using a commercially available LIBS system. Partial Least Squares Discriminant Analysis (PLSDA) resulted in a correct place-

level geographic classification at success rates above 90%. The possible role of rare-earth elements (REE's) as a factor contributing to the high levels of sample discrimination was explored. RR Hark is in the Department of Chemistry at Juniata College. JJ Remus is in the Department of Electrical and Computer Engineering at Clarkson University. RS Harmon is a geochemist with the Department of Marine, Earth & Atmospheric Sciences at North Carolina State University. MA Wise is a geologist with the Smithsonian Institution. Ben Tansi did this research during the summer of 2011 and was involved in the project throughout the 2011-2012 academic year. Last summer East did an internship at the University of Massachusetts-Amherst in the field of polymer chemistry. Katrina (Katie) Shughrue did this work during the 2010-2011 academic year as part of her senior thesis on LIBS analysis of conflict minerals. She graduated in May 2011 and is now employed by an environmental consulting firm in the Philadelphia area. The research was supported by funding from the II-VI Foundation.