

Curriculum Vitae

Kathleen Carrie Armel

Precourt Energy Efficiency Center
Stanford University

kcarmel@stanford.edu
(650) 380-1965

Research Positions

- 7/08-Current, Research Associate, Precourt Energy Efficiency Center, Stanford
- 1/07-6/08, Postdoctoral Fellow, School of Medicine, Stanford
- 2004-6, Postdoctoral Fellow, Economics Department, Stanford
- 1995-6 Research Assistant, Massachusetts Jamaica Plains VA & Beth Israel Hospital, Time Estimation in Amnesic and Frontal Patients
- 1994-5 Honors Thesis, NCSU, Mechanisms Underlying Visual Imagery
- 1994 Research Assistant, NCSU, Nutritional Support by Neuronal Glial Cells

Higher Education

- Ph.D., 10/03, University of California, San Diego
Joint degree in Psychology and Cognitive Science, Concentration in Neuroscience
- M.A., 1997, University of California, San Diego
- B.A., 1995, North Carolina State University, Raleigh
Magna Cum Laude; Psychology with minors in Pre-Medicine & Cognitive Science

Awards

- 2014-2016 ARPA-E Sensor & Behavior Initiative renewed, w/James Sweeney. (\$3.3M)
- 2012 Energy Whisperer Project. Funder: PEEC (\$120k)
- 2011 Energy Monitoring and Feedback. Funder: Google and Tides Foundation (\$10k)
- 2010-2013 ARPA-E Sensor & Behavior Initiative, w/Byron Reeves. Leverages wireless energy sensors with behavioral approaches to maximize energy savings. One of 37 awards granted out of 3,700 applications; ours was the only behavior-related award. The initiative oversees 20 research projects and 15 investigators across 10 academic departments at Stanford. Funders: Advanced Research Projects Agency for Energy (ARPA-E) (\$5.5M), California Energy Commission (\$500k)
- 2009 High School Climate Behavior Change Curriculum. Funder: PEEC (\$150k)
- 2009 Summer Energy Feedback Infrastructure Project. Funder: PEEC (\$100k)
- 2007 Behavior Website and Literature Database. Funder: PEEC (~\$65K)
- 2001-2 University of California President's Dissertation Fellowship

Professional Activities

Ad-Hoc Reviewer

- Climatic Change, Energy Efficiency, American Economic Review, Neurocase, Psychophysiology

Past or Current Member

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- Society for Neuroeconomics, Society for Neuroscience, Cognitive Neuroscience Society, Society for Psychophysiological Research, American Psychological Association, Association for Psychological Science

Press

- Wall Street Journal, Climate Confidential, NY Times, Greenwire, Science Magazine, Climate One, Nature Energy, Scientific American, etc. for behavior & energy work; NBC nightly news, Nova, BBC (with John Cleese), Science Magazine, and Scientific American for cognitive neuroscience work

Conferences and Workshops

- 2013 Organized & led Energy Data Jam where ~30 participants were guided through the brainstorming and development of energy data applications to change behavior. Materials useful for the development of any behavioral interventions http://peec.stanford.edu/energybehavior/events_datajam.php
- 2010-current Organized ARPA-E site visits and workshops
- 2008-10 Chair of multiple workshops on energy sensors and behavior, including one focused on disaggregation (Sept 2008, Feb 2009, Feb 2010) http://piee.stanford.edu/cgi-bin/htm/Behavior/2008_energy_and_feedback_workshop.php
- 2007-9 Co-chair for the 1st, 2nd, and 3rd national “Behavior, Energy, and Climate Change (BECC) Conference”. This conference draws ~800 professionals from government, industry, academia, etc. <http://beccconference.org/> <http://peec.stanford.edu/events.php>
- 1999 Organized the Brain, Conscious Experience, and Human Nature Conference in La Jolla which lasted two days and included 15 international speakers

Resources Developed

Many can be viewed here: <https://peec.stanford.edu/people/carrie-armel>

- Stanford ARPA-e Energy Behavior Website and Summary Report <https://peec.stanford.edu/research/behavior-initiative>
- PEEC's Behavior and Energy website and bibliographic database (~1000 citations). <https://peec.stanford.edu/resources/readings>
- Surveys: self-reported energy actions, and a supplement for sensor measures
- Disaggregation policy recommendations
- Reference Energy Disaggregation Dataset (REDD) Database, and Protocol for data collection (for others to replicate), to aid researchers in improving disaggregation algorithms
- 350 Residential Building Energy Actions Database & attributes ratings to aid program developers in selecting actions to target
- Programs/Interventions:
 - High School Curriculum <http://peec.stanford.edu/behavior/HighSchoolCurriculum.php>
 - Girl Scouts Learning Environment & Energy (GLEE) Program <https://glee.stanford.edu/>
 - Appliance Calculator Web App <https://peec.stanford.edu/research/appliance-calculator>
 - Energy Whisperer Web App <http://energywhisperer.org/>
 - HowPower Web App <http://appliancecalculator.stanford.edu/> <https://www.howpower.org>
 - PowerDown Feedback Interface
- Energy Services Platform, a computational platform, supported the development, implementation, and objective evaluation of web-based behavioral programs
- Ethogram for recording pygmy chimpanzee behavior

Advisory and Consulting Roles

- Briefings or participation in advisory meetings (Dept. of Energy, American Gas Association, Facebook)
- 2009-2012 Advisory board member of People Power Co.
- 2000-1 Consulting for Nuance Communications, a speech recognition company. This usability research involved interviewing and testing lay people, analyzing data, writing technical reports, and giving business presentations.

Public Service

- 2004 Union of Concerned Scientists, developed climate change educational talk for a speakers bureau
- 1998-9 Raleigh NC, elected to the environmental board that advises city council
- 1991 Easton MA, nominated to the town recycling committee

Peer-Reviewed Publications

Boudet, H., Ardoin, N.M., June Flora, J.A., Armel, K.C., Desai, M., & Robinson, T.N. (2016). Effects of a behaviour change intervention for Girl Scouts on child and parent energy-saving behaviours. *Nature Energy*, 1, 16091. Doi: 10.1038/nenergy.2016.91

Boudet, H., Flora, J.A., Armel, K.C. (2016). Clustering household energy-saving behaviours by behavioural attribute. *Energy Policy*, 92, 444-454.

Bailey, J., Bailenson, J.A., Flora, J.A., Armel, C., Voelker, D., & Reeves, B. (2015). The Impact of Vivid Messages on Energy Savings Behaviors, *Environment and Behavior*, 47(5), 570-592.

Boudet, H., Ardoin, N., Flora, J., Armel, K.C., Desai, M., Robinson, T.N. (2014). Energy behaviours of northern California Girl Scouts and their families. *Energy Policy*, 73, 439–449.

Cornelius, M., Armel, K. C., Hoffman, K., Allen, L., Bryson, S. W., Desai, M., & Robinson, T. N. (2014). Increasing energy- and greenhouse gas-saving behaviors among adolescents: a school-based cluster-randomized controlled trial. *Energy Efficiency*, 7(2), 217-242. [A high school behavior change curriculum]

Armel, K. C., Gupta, A., Shrimali, G., Albert, A. (2013). Is Disaggregation The Holy Grail of Energy Efficiency? The Case of Electricity. *Energy Policy*, 52, 213-234. [30,000+ hits]

Houde, S., Todd, A., Sudarshan, A., Flora, J. A., Armel, K. C. (2013). Real-time Feedback and Electricity Consumption: A Field Experiment Assessing the Potential for Savings and Persistence. *The Energy Journal*, 34(1). [A collaboration with Google]

Sullivan, D., Armel, K. C., Todd, A. (2012) When "Not Losing" is Better Than "Winning:" Using Behavioral Science to Drive Customer Investment in Energy Efficiency. ACEEE Summer Study on Energy Efficiency in Buildings. Washington, D.C.: American Council for an Energy Efficient Economy. [Derived from the longer, in preparation, paper, and presentation: Armel, K. C., Behavior and Energy: A Solutions-Oriented Approach on Addressing Climate Change and Energy Security. <http://www.stanford.edu/group/peec/cgi-bin/docs/behavior/research/Behavior%20Energy%20and%20Climate%20Change%20-%20A%20Solutions-Oriented%20Approach.pdf>]

Armel, K. C., Yan, K., Todd, A., & Robinson, T. N. (2011). Validation of the Stanford Climate Change Behavior (SCCB) Survey: Assessing greenhouse gas emissions-related behaviors in individuals and populations. *Climatic Change*, 109(3), 671-694.

Krajbich, I., Armel, C., & Rangel, A. (2010). Visual fixations and the computation and comparison of value in simple choice. *Nature Neuroscience*, 13, 1292-1298.

Armel, K. C., Pulido, C., Wixted, J., Chiba, A. (2009). Forming preferences: Behavioral, facial electromyography, and preferential looking findings. *Learning and Motivation*, 40(1), 74-93.

Armel, K. C. & Robinson, T. R. (2008). Estimating greenhouse gas emissions for individual behaviors. Symposium Issue: Climate Change and Consumption. *Environmental Law Reporter*, 38, 10825-10888.

Armel, K. C., Beaumel, A., & Rangel, A. (2008). Biasing simple choices by manipulating relative visual attention. *Judgment and Decision Making*, 3, 396–403.

Armel, K. C. & Rangel, A. (2008). The impact of computation time and experience on decision values. *American Economic Review*, 98, 163-68.

Armel, K. C. & Ramachandran, V. S. (2003). Projecting sensations to external objects: Evidence from skin conductance response. *Proceedings of the Royal Society of London: Biological*, 270, 1499-1506.

Armel, K. C. & Ramachandran, V. S. (1999). Acquired synesthesia in retinitis pigmentosa. *Neurocase: Case Studies in Neuropsychology, Neuropsychiatry, & Behavioural Neurology*, 5 (4), 293-296.

Ramachandran, V. S., Armel, C., Foster, C., Stoddard, R. (1998). Object recognition can drive motion perception. *Nature*, 395 (6705), 852-853.

Manuscripts Under Review or In Preparation

Armel, K. C., Reeves, B., Sweeney, J., Flora, J.A., et al. (in preparation). An overview of the Stanford ARPA-e Energy Behavior Initiative: 20 Projects on leveraging the smart grid with behavioral approaches to save energy.

Armel, K. C., Cornelius, M., Bridgeland, B., Morton, L., Ardoin, N. (in preparation). Identifying Innovative Options for Deep Residential Energy Savings.

Kolter, J.Z., Chadwick, S.J., Plano, L., Armel, C., Flora, J. (in preparation) "REDD 2.0: The Expanded Reference Energy Disaggregation Data Set"

Armel, K. C., Reeves, B., Bartels, J., Davidson, A. (waiting resubmission). An Energy Services Platform (ESP) for Sensor and Behavior Program Development, Implementation, and Evaluation.

Todd, A., Armel, K. C., & Robinson, T. N. (working paper) The Effect of Competition on Dormitory Electricity Use.

Armel, K. C. & Chiba, A. A. (working paper). Neural underpinnings of the mere exposure effect.

Armel, K. C. (working paper). Characteristics and neural underpinnings of stimulus-specific predispositions (a review). (Regarding 'hard-wired' responses to affective cues.)

Balogh, J., Armel, C., and Cohen M. H. (2000). Preference for rapid re-prompt as an error recovery strategy. *Internal Nuance Company publication*.

Invited Talks and Conference Presentations

+Numerous presentations for PEEC Advisory Board, ARPA-E Site Visits, ARPA-E Annual Summit, utilities, potential industry partners, as a guest speaker in classes, etc.

June 2016. Bits and Watts Seminar. Stanford, CA.

June 2015. Stanford at SLAC (Stanford Linear Accelerator) Master Class. Stanford, CA.

March 2015. Recycled Water & the "Yuck" Factor Forum Workshop. Stanford, CA.

January 2015. Innovation in Relation to Building Energy Demand in IAMs. Utrecht, Netherlands.

January 2015. Smart Grid and Transit Seminar. Stanford, CA.

January 2015. The Global Sustainability Challenge Course. Stanford, CA.

January 2015. Watersmart Monthly Seminar. San Francisco, CA.

April 2014. Climate Confidential Panel. San Francisco, CA.

March 2014. Synapse private school. Menlo Park, CA.

March 2014. Electric Power Research Institute. Knoxville, TN.

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February 2014. Public Policy Department, University Texas. Austin, TX.

February 2014. ARPA-E Transportation Workshop. San Francisco, CA.

November 2013. National Renewable Energy Laboratory. Golden, CO.

June 2013. Behavior Workshop hosted by California Public Utilities Commission and California's investor-owned utilities. San Francisco, CA.

May 2013. Joint Institute for Strategic Energy Analysis. Webinar.

May 2013. Conference of the Stanford Energy and Environment Affiliates Program on Energy Efficiency and Smart Energy. Stanford, CA.

March 2013. *Vail Global Energy Forum*. Vail, CO.

September 2012. Energy at SLAC. Stanford, CA.

July 2012. California's Energy Future - Policy Committee. Berkeley, CA.

June 2012. *Pecan Street Project Consortium Technical Workshop*, San Diego, CA.

June 2012. Southern California Edison, Rosemead, CA.

June 2012. Connectivity Week, Santa Clara, CA. (plenary panel & break-out session)

April 2012. Woods Institute for the Environment retreat, Monterey, CA.

March 2012. Natural Resource Defense Council (NRDC), San Francisco, CA.

Feb 2012. California's Energy Future. Sacramento, CA.

Feb 2012. Energy Modeling Forum (EMF), hosted in Stanford, CA.

Jan 2012. G'Day USA Conference. Jointly hosted by Australian Gov't and Stanford, Stanford, CA.

Dec 2011. *Stanford Energy Forum*, Stanford, CA.

Nov 2011. *Behavior, Energy, and Climate Change (BECC) Conference*. Washington, DC.

Nov 2011. *Always On - Going Green*, San Francisco, CA.

Aug 2011. Chevron, hosted in Stanford, CA.

Aug 2011. Tokyo Gas Delegation, hosted in Stanford, CA.

Aug 2011. California Municipal Utilities Association Conference, Santa Clara, CA.

July 2011. *Achieving Energy Savings in California Buildings Workshop*. IEPR/ERED, CEC, Sacramento, CA.

July 2011. Energy Upgrade California, Assn of Bay Area Governments (ABAG), Oakland, CA.

June 2011. *Silicon Valley Summit*. Hosted by PEEC and SVLG. Stanford, CA.

May 2011. *Stanford Energy Forum*, Stanford, CA.

April 2011. *E-Source Annual Conference*, San Francisco, CA.

March 2011. *Garrison Institute Climate, Mind, and Behavior Initiative Workshop*, Garrison, NY.

Dec 2010. French Delegation, hosted in Stanford, CA.

Nov 2010. *BECC Conference, 2010*, Sacramento, CA.

Nov 2010. *SEE Action Government Working Group meeting*, Washington, DC.

June 2010. *The Roots of Energy Efficiency*, hosted by UC Davis, Mountain View, CA.

June 2010. Sacramento Municipal Utilities District. Sacramento, CA.

May 2010. Bonneville Power Administration. Portland, OR.

Dec 2009. European Delegation, hosted at Stanford University.

Jan 2009. *Annual Consortium for Energy Efficiency (CEE) Conference*, San Fran., CA. (plenary)

Nov 2009. *BECC Conference*. Washington, DC.

Summer 2009. California Public Utilities Commission, San Francisco, CA.

Feb 2009. Workshop organized jointly by the Stanford Program on Regions of Innovation and Entrepreneurship, the Shorenstein Asia-Pacific Research Center at Stanford, the Industrial Technology Research Institute (ITRI) in Taiwan, and the Low Carbon Institute of Tsinghua University in Beijing. Stanford, CA.

Nov 2008. *BECC Conference*, Sacramento, CA. (opening plenary)

Sept 2008. *Electricity Measurement and Feedback Workshop*, Stanford, CA.

Aug 2008. *Wallenberg Hall Summer Institute*, Media X, Stanford, CA.

May 2008. *Stanford Prevention Research Center Research Conference*, Stanford, CA.

April 2008. *Climate Change and Consumption Conference*, Vanderbilt University, Nashville, TN.

March 2008. *Lighting and Health Symposium*, San Francisco, CA. (panel)

March 2008. Stanford's *Young Environmental Scholars Workshop*. (panel)

Feb 2008. Stanford's *Energy Seminar Colloquium*, Stanford, CA.

Feb 2008. Acterra's (SF Bay environmental group) *Be The Change* course for helping professionals to develop environmental programs.

Nov 2007. Lecture in *Reducing Stanford's Carbon Footprint Course*, Stanford, CA. (Instructor: Sarah Rizk)

Nov 2007. *BECC Conference*, Sacramento, CA.

Aug 2007. *National Research Program and Network on Human Behavior and Climate Change*, Vanderbilt University, Nashville, TN.

July 2007. *Workshop on Energy Efficiency*. Sponsored by Stanford's Precourt Institute and organized jointly with the Climate Change Impacts and Integrated Assessment workshop, Snowmass, CO.

March 2007. Lecture in *Climate Change Seminar*, Stanford, CA. (Professor: Steve Schneider)

Feb 2007. Lecture in *Controlling Climate Change in the 21st Century Course*, Stanford, CA. (Professor: Steve Schneider)

Nov 2004. *Stanford's SPANLAB Lab Meeting*, Stanford, CA. (Professor: Brian Knutson)

Conference Posters

Chadwick, S.J., Plano, L., Flora, J., Armel, C. (November, 2012). The energy reduction motivational interview: Pilot research. *Behavior, Energy, and Climate Change Conference*, Sacramento, CA. [Chadwick talk]

Cornelius, M., Armel, C., Ardoin, N. (November, 2012). Identifying Innovative Options for Deep Residential Energy Savings. *Behavior, Energy, and Climate Change Conference*, Sacramento, CA. [Cornelius talk]

Reeves, B., Armel, C., & Flora, J. (February, 2012). Stanford ARPA-E Sensor and Behavior Initiative. *Arpa-e National Summit*, Washington, DC.

Reeves, B., Armel, C., & Flora, J. (February, 2011). Stanford ARPA-E Sensor and Behavior Initiative. *Arpa-e National Summit*, Washington, DC.

Reeves, B. & Armel, C. (November, 2010). Stanford ARPA-E Sensor and Behavior Initiative. *Arpa-e Advisory Board Member Meeting*, Stanford University, Stanford, CA.

Todd, A. & Armel, C. (November, 2009). Energy and behavioral economics. *Behavior, Energy, and Climate Change Conference*, Washington, DC.

Cornelius, M., Armel, C., Robinson, T.R. (November, 2008). A high school intervention to reduce energy use. *Behavior, Energy, and Climate Change Conference*, Sacramento, CA. [Cornelius talk]

Rangel, A., Krajbich, I., & Armel, C. (2008). Visual attention drives the construction and comparison of values in simple economic choice. *Society for Neuroscience*, Washington DC.

Karjbich, I., Armel, C., & Rangel, A. (2008). Visual attention drives the construction and comparison of values in simple economic choice. *Cognitive Neuroscience Society*, San Francisco, CA.

Armel, C., Dudek, B., Bad Wound, A.C. Behavior and Energy Website and Database. *Behavior, Energy, and Climate Change Conference*, Sacramento, CA, November 8, 2007. *Stanford University School of Engineering Reunion Homecoming Poster Session*, Stanford, CA, October 12, 2007. *Stanford's Precourt Institute for Energy Efficiency Advisory Board Meeting* Stanford, CA, April 10, 2007.

Armel, C., Rangel, A. (2005). Attention Duration and the Computation of Decision Values in Simple Choice. *Society for Neuroeconomics*, Kiawah Island, SC.

Armel, C., Pulido, C., Wixted, J., Chiba, A. (2004). Forming preferences: Behavioral, facial electromyography, and preferential looking findings. *Society for Psychophysiological Research*, Santa Fe, NM.

Armel, C., Knutson, B.K., Rangel, A. (2004). Simple Choice: Psychophysiological and Neural Correlates. *Society for Neuroeconomics*, Kiawah Island, SC.

Armel, C. (2003). A review and prospectus of the neural bases of stimulus-specific predispositions. *Society for Neuroscience*, New Orleans, LA.

Armel, C., Ramachandran V.S., Armstrong, S., & Weiss, S. (2000). Projecting sensations to external objects: Skin conductance response evidence. *Cognitive Neuroscience Society*, San Francisco, CA.

Ramachandran, V.S., Foster, C., Armel, C., Stoddard, R. (1998). Object recognition can drive motion perception. *Society for Neuroscience*, Los Angeles, CA.

Armel, C. & Ramachandran V.S. Acquired Synesthesia in Retinitis Pigmentosa. (1998). *Cognitive Neuroscience Society*, San Francisco, CA.

Ramachandran, V.S., Hirstein, W., & Armel, K.C. (1997). Heightened Religiosity in Temporal Lobe Epilepsy. *Society for Neuroscience*, New Orleans, LO.

Grossfeld, R., Armel, K. C., and others. (1994). Nutritional Support by Glial Cells. *North Carolina State University Poster Session*, Raleigh, NC.

Teaching Experience

- 2007 & 2008 Designed and taught "Promoting Behavior Change" with Thomas N. Robinson at Stanford. The course focuses on behaviors relevant to climate change. It provides an

overview of effective behavior change techniques from various behavioral science disciplines, and the students translate theory into practice by working with local organization to develop interventions aimed at promoting carbon-neutral behaviors.

- 2002 Taught the upper-division undergrad. course “Brain Disorders & Cognition” at UCSD.
- 2001 Led a cognitive science graduate seminar and colloquium series on decision-making at UCSD.
- 1999-2000 Designed and taught the course “Understanding Human Nature Through The Behavioral Sciences” to minority high school students. Students were encouraged to think “outside the box” about the roots of societal problems, and how these might be alleviated. The course covered findings from cross-cultural anthropology, social psychology, behavioral neuroscience, and non-human primate behavior. Students also learned about methods in these fields; e.g., through a neuroscience laboratory visit and a primate ethology activity at the San Diego Zoo.
- 1996-2001 Teaching Assistant for numerous courses. Gave multiple guest lectures.

Advisees

Supervised the research of 30+ undergraduate and graduate students at UCSD and Stanford. The following students worked with me for at least one year and typically participated in honors or other special research programs: Carmen Pulido, Han Nguyen, Tim Nguyen, Aurelie Beaumel, Chris Candelaria, James Kung, Lara Rangel, Ben Dudek, Lindsay Allen, and Kat Hoffman (home departments spanned Psychology, Economics, Human Biology, Neuroscience, Symbolic Systems). Marilyn Cornelius was my PhD student (PhD 2013, Emmett Interdisciplinary Program in Environment and Resources (E-IPER)), and I currently serve on Jennifer Wang’s PhD committee (E-IPER). The following post-doctoral scientist and graduate students worked with me for extended periods on projects: Annika Todd (PhD in Economics), Sebastian Houde, Anant Sudarshan, Anshuman Sahoo, Juan Carlos Lopez (Management Sciences and Engineering Department). I also advise/have advised other post-doctoral, graduate, and undergraduate students, and project managers associated with ARPA-E research projects, spanning the School of Medicine, Psychology, Education, Electrical Engineering, and other fields.

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