

March 2018

## Employment

2015 - Present	<b>Assistant Professor</b> , Department of Psychological and Brain Sciences, Dartmouth College
2012-2015	<b>Postdoctoral Fellow</b> , University of Colorado Boulder (with Tor Wager, PhD)
2011 – 2012	<b>Predoctoral Clinical Psychology Intern</b> , University of California Los Angeles Semel Institute for Neuroscience (Health Behavior Track)

## Education & Training

2006 – 2012	<b>Ph.D.</b> , Clinical Psychology, University of Arizona (with Alan Sanfey, PhD & John Allen, PhD)
2004 – 2006	<b>M.A.</b> , Psychology, New School for Social Research (with David Silbersweig, MD, Marcel Kinsbourne, DM)
1998 – 2002	<b>B.A.</b> , Psychology, Reed College (thesis with Jennifer Henderlong-Corpus, PhD)

## Funding

Pending	<b>PI</b> , National Institute of Health Director's Innovator Award. <i>Endogenous variation of ventromedial prefrontal cortex state dynamics</i>
Pending	<b>PI</b> , National Science Foundation CAREER. <i>Neural and computational basis of guilt in decision-making</i>
2018-Present	<b>PI</b> , R01MH116026-01 National Institute of Mental Health. <i>Dynamic brain representations underlying emotional experience</i>
2018-Present	<b>PI</b> , R56 MH080716 National Institute of Mental Health. <i>Prefrontal-Amygdala interaction in social-learning</i>
2017 – Present	<b>Co-PI</b> , Chiang Ching-kuo Foundation for International Scholarly Exchange. <i>Towards a computational understanding of social status and mianzi in Chinese and American Cultures</i>
2017 – Present	<b>PI</b> , The Nelson A. Rockefeller Center at Dartmouth College, Faculty Research Grant. <i>Improving healthcare decisions: Managing emotions in social decision-making with exogenous constraints</i>
2016 – Present	<b>PI</b> , Neukom Institute for Computational Science, CompX Grant Crowd sourced development and validation of Neuro-computational models of affect
2014 – 2016	<b>Co-I</b> , National Institute of Health, Big Data to Knowledge (PI: Tor Wager) <i>fMRI-based Biomarkers for Multiple Components of Pain</i>

2012 – 2015	<b>Co-I</b> , National Institute of Health (PI: Tal Yarkoni). <i>Large-scale automated synthesis of functional neuroimaging data</i>
2009 – 2012	<b>PI</b> , National Institute of Mental Health, National Research and Service Award. <i>Mechanisms Underlying Social Cooperative Behavior</i>

## Publications

- 1) FeldmanHall, O. & **Chang, L.J.** (In Press). *Social Learning: Emotions aid in optimizing goal-directed social behavior*. In *Understanding Goal-Directed Decision-Making: Computations and Circuits*, Bornstein, A & Shenhav, A (Eds). Elsevier.
- 2) **Chang, L.J.** & Jolly, E. (In Press). Emotions as computational signals of goal error. In *Nature of Emotion*, Fox, D., Lapate, R., Shackman, A., & Davidson, R.J (Eds). Oxford Press.
- 3) Cheong, J.H., Jolly, E., Sul, S., & **Chang, L.J.** (2017). Computational models in social neuroscience. In *Computational Models of Brain and Behavior*, Moustafa, A (Ed), Wiley-Blackwell.
- 4) Sul, S., Guroglu, B., Crone, E.A., & **Chang, L.J.** (2017). Medial prefrontal cortical thinning mediates shifts in other-regarding preferences during adolescence. *Scientific Reports*, 7(8510), 1-10.
- 5) Shermohammed, M., Mehta, P.H., Zhang, J., Brandes, C., **Chang, L.J.**, & Somerville, L.H. (2017). Does psychosocial stress impact cognitive reappraisal? Behavioral and neural evidence. *Journal of Cognitive Neuroscience*.
- 6) Taylor, V., **Chang, L.J.**, Rainville, P., & Roy, M. (2017). Learned Expectations and Uncertainty Facilitate Pain during Classical Conditioning. *Pain*, 158(8), 1528-1537.
- 7) Ashar, J.Y., **Chang, L.J.**, & Wager, T.D. (2017). Brain mechanisms of the placebo effect: An affective appraisal account. *Annual Reviews of Clinical Psychology*.
- 8) Woo, C.W., **Chang, L.J.**, Lindquist, M., & Wager, T.D. (2017). Brain signatures and models in translational imaging. *Nature Neuroscience*, 20 (3), 365-377.
- 9) Eisenbarth, H., **Chang, L.J.**, & Wager, T.D. (2016). Multivariate brain prediction of heart rate and skin conductance responses to social threat. *Journal of Neuroscience*, 36(47):11987-11998.
- 10) De La Vega, A., **Chang, L.J.**, Banich, M.T., Wager, T.D., & Yarkoni, T. (2016). Meta-analytic functional analysis of human medial frontal cortex reveals tripartite organization. *Journal of Neuroscience*.
- 11) Krishan, A., Woo, C.W.\*, **Chang, L.J.\***, Ruzic, L., Jackson, P., Wager, T.D. (2016). Somatic and vicarious pain are represented by dissociable multivariate brain patterns. *eLife*. \*denotes equal contributions.
- 12) Wager, T.D., Atlas, L.Y., Botvinick, M., **Chang, L.J.**, Coghill, R.C., Davis, K.D., Iannetti, G.D., Poldrack, R.A., Shackman, A.J., & Yarkoni, T. Pain in the ACC? Commentary on Lieberman and Eisenberger. (2016). *Proceedings of the National Academy of Science*.
- 13) Lindquist, M.A., Krishnan, A., Lopez-Sola, M., Jepma, M., Woo, C.W., Roy, M., Atlas, L.Y., **Chang, L.J.**, Losin, L., Eisenbarth, H., Ashar, Y.K., Koban, L., Delk, Z., & Wager, T.D. (2015). Group-regularized individual prediction: Theory and application to pain. *Neuroimage*.

- 14) **Chang, L.J.** & Smith, A. (2015). Social emotions and psychological games. *Current Opinions in Behavioral Sciences*, 5:133-140.
- 15) Yu, H., Shen, B., Yin, Y., Blue, P., & **Chang, L.J.** (2015). Dissociating guilt- and inequity-aversion in cooperation and norm compliance. *Journal of Neuroscience*, 35(24), 8973-8975.
- 16) Fareri, D.S.\*, **Chang, L.J.\***, Delgado, M.R. (2015). Neural and computational mechanisms underlying interpersonal collaboration. *Journal of Neuroscience*, 35(21), 8170-8180. \*denotes equal contributions.
- 17) **Chang, L.J.**, Gianaros, P., Manuck, S., Krishnan, K., & Wager, T.D. (2015). A sensitive and specific neural signature for picture induced affect. *PLoS Biology*, 13(6), 1-28.
- 18) **Chang, L.J.**, Reddan, M., Ashar, Y.K., Eisenbarth, H., & Wager, T.D. (2015). The challenges of forecasting resilience. *Behavioral Brain Sciences Commentary*, 38, 26-27.
- 19) Sanfey, A.G., Stallen, M., & **Chang, L.J.** (2014). Norms and expectations in social decision-making. *Trends In Cognitive Science*, 18(4), 172-174.
- 20) **Chang, L.J.** & Koban, L. (2013). Modeling emotion and learning of norms in social interactions. *Journal of Neuroscience*, 33(18), 7615-7617.
- 21) **Chang, L.J.**, Yarkoni, T., Khaw, M.W., & Sanfey, A.G. (2013). Decoding the role of the human insula in human cognition: Functional parcellation and large-scale reverse inference. *Cerebral Cortex*, 23(3), 739-749.
- 22) **Chang, L.J.**, & Sanfey, A.G. (2013). Great expectations: Neural computations underlying the use of social norms in decision-making. *Social Cognitive Affective Neuroscience*, 8(3), 277-284.
- 23) Brown, A.D., Root, J.C., Romano, T., **Chang, L.J.**, & Hirst, W. (2013). The limits of memory and imagination: Overgeneralized autobiographical Memory and future thinking in combat veterans with posttraumatic stress disorder. *Behavior Therapy and Experimental Psychiatry*, 44(1), 129-134.
- 24) Fareri, D.S., **Chang, L.J.**, Delgado, M.R. (2012). Effects of experienced social information on trust decisions and neural reward circuitry. *Frontiers in Decision Neuroscience*, 6, 1- 17.
- 25) Kahnt, T., **Chang, L.J.**, Park, S.Q., Heinzle, J., Haynes, J.D. (2012). Connectivity based parcellation of the human orbitofrontal cortex. *Journal of Neuroscience*, 32(8), 6240-6250.
- 26) Harle, K.M., **Chang, L.J.**, van't Wout, M., & Sanfey, A.G. (2012). The neural underpinnings of mood-driven biases in social economic decision-making. *Neuroimage*, 61(1), 32-40.
- 27) **Chang, L.J.**, Smith, A., Dufwenberg, M., & Sanfey, A.G. (2011). Triangulating the neural, psychological, and economic bases of guilt aversion. *Neuron*, 70, 560-572.
- 28) Van't Wout, M, **Chang, L.J.**, & Sanfey, AG. (2010). Emotion regulation and social interactive decision-making. *Emotion*, 10(6), 815-821.
- 29) **Chang, L. J.**, Doll, B., Van't Wout, M., Frank, M., Sanfey, A.G. (2010). Seeing is believing: Trustworthiness as a dynamic belief. *Cognitive Psychology*, 61(2), 87-105.
- 30) **Chang, L.J.**, & Sanfey, A.G. (2009). Unforgettable Ultimatums? Expectation violations promote enhanced social memory following economic exchange. *Frontiers in Behavioral Neuroscience*, 3, 1-12.

- 31) **Chang, L.J.** & Sanfey, A.G. (2008). Emotion, decision-making, and the brain. In D. Houser & K. McCabe (Eds.), *Neuroeconomics*. Elsevier, 31-53.
- 32) Sanfey, A.G. & **Chang, L.J.** Multiple systems in decision-making. (2008). In W.T. Tucker, S. Ferson, A. Finkel, T.F. Long, D. Slavin, P. Wright (Eds.), *Strategies for risk communication: Evolution, evidence, experience*. New York: Annals of the New York Academy of Science, 1128, 53-62.
- 33) Protopopescu, X., Pan, H., Tuescher, O., Root, J., **Chang, L.**, Altemus, M., Polanecsky, M., McEwen, B., Stern, E., & Silbersweig, D. (2008). Toward a Functional Neuroanatomy of Premenstrual Dysphoric Disorder: Differential Amygdalar, Orbitofrontal and Ventral Striatal Activity. *Journal of Affective Disorders*, 108, 87-94.
- 34) Butler, T., Pan, H., Tuescher, O., Engelien, A., Goldstein, M., Epstein, J., Weisholtz, D., Protopotesu, X., Root, J. C., Cunningham-Bussell, A.C., **Chang, L.**, Xie, X.H., Chen, Q., Phelps, E.A., Ledoux, J.E., Stern, E., Silbersweig, D.A. (2007). Human fear-related motor neurocircuitry. *Neuroscience*, 150 (1) 1-7.
- 35) Butler, T., Imperato-McGinley, J., Pan, H., Voyer, D., Cunningham-Bussell, A. C., **Chang, L.**, Zhu, Y. S., Cordero, J., Stern, E., Silbersweig, D. (2007). Sex specificity of ventral anterior cingulate cortex suppression during a cognitive task. *Human Brain Mapping*, 28 (11), 1206-12.
- 36) Root, J.C., Robbins, R., **Chang, L.**, & Van Gorp, W.G. (2006). Detection of suboptimal effort on the California Verbal Learning Test, Second Edition: analysis and normative data for forced choice recognition. *Journal of the International Neuropsychological Society*, 12 (5), 688-96.

### *Manuscripts Under Review*

- Cheong, J.H., Brooks, S., & **Chang, L.J.** *FaceSync: Open source framework for recording facial expressions*. Manuscript Under Review
- Jolly, E., & **Chang, L.J.** *The Flatland Fallacy: Moving beyond low dimensional thinking*. Manuscript Under Revision Topics in Cognitive Science.
- Van Baar, J., **Chang, L.J.**, & Sanfey, A.G. *Neural and computational substrates of moral phenotypes in social decision-making*. Manuscript Under Revision at Nature Neuroscience.
- Jolly, E. & **Chang, L.J.** *Gossip drives vicarious learning and facilitates robust social connections*. Manuscript Under Review.
- Gong, X, Brazil, I.A., **Chang, L.J.**, & Sanfey, A.G. *Psychopathic traits are related to diminished guilt aversion and reduced trustworthiness during social decision-making*. Manuscript Under Review
- Fox, A.S., **Chang, L.J.**, Gorgolewski, K., & Yarkoni, T. *Bridging genetics and psychology using large-scale spatial analysis of neuroimaging and neurogenetic data*. Manuscript Under Revision at Nature Neuroscience
- Shvil, E., Papini, S., Markowitz, J.C., Schafer, S., Sullivan, G.M., **Chang, L.J.**, Rusch, H.L., van der Hoorn, K.R., Milad, M.R., Wager, T.D., & Neria, Y. *Impaired hippocampal-dependent context modulation in posttraumatic stress disorder*. Manuscript Under Review.
- Vavra, P., & **Chang, L.J.**, & Sanfey, A.G. *Expectations in the Ultimatum Game*. Manuscript Under Review.

Taylor, V., Roy, M., **Chang, L.J.**, & Rainville, P. Reduced Fear-Conditioned Pain Modulation in Experienced Meditators. Manuscript Under Review

### *Manuscripts In Preparation*

**Chang, L.J.**, Eisenbarth, H., Reddan, M., Andrews, E., & Wager, T.D. *Recovering sparse emotional ratings with collaborative filtering*. Manuscript in Preparation.

**Chang, L.J.**, Burnashev, A., & Wager, T.D. Crowd sourced training and validation of multivariate models of psychological states with neuro-learn. Manuscript in Preparation.

**Chang, L.J.**, Gianaros, P.J., Gross, J., Manuck, S., & Wager, T.D. *Reappraisal alters the construction of negative affect*. Manuscript in Preparation.

**Chang, L.J.**, Robustelli, B., Whisman, M., & Wager, T.D. The analgesic effects of relationship. Manuscript in Preparation.

Chen, P.Y., Jolly, E., Elhence, H., Wager, T.D., & **Chang, L.J.** Socially transmitted placebo effects. Manuscript in Preparation.

Jolly, E., Smith, A., & **Chang, L.J.** Guilt-aversion motivates harm minimization in surrogate decision-making. Manuscript in Preparation.

Parkinson, C. & **Chang, L.J.** Social networks impact trust learning. Manuscript in Preparation.

Cheong, J.H., Jolly, E., & **Chang, L.J.** Endogenous variation in affective experiences. Manuscript in Preparation

**Chang, L.J.**, Cheong, J.H., & Jolly, E. Endogenous variation in ventromedial prefrontal state dynamics. Manuscript in Preparation

Yarkoni, T, De La Vega, A., & **Chang, L.J.** Fully automated meta-analytic clustering and decoding of human brain activity. Manuscript in Preparation.

**Chang, L.J.**, Smith, A., Dufwenberg, M., Wager, T.D., & Sanfey, A.G. *Computational substrates of guilt*. Manuscript in Preparation.

Rossi, F., Fasel, I., Bartlett, M., Sanfey, A.G & **Chang, L.J.** Affective mechanisms of reinforcement-learning in social and non-social decision-making.

### *White Papers*

Chang, L.J. (2017). *The science of trust*. Commission on Trust, Media, and American Democracy. The Aspen Institute.

### *Selected Open-Source Software Packages*

**Neuro-learn.** A suite of Python tools for conducting multivariate analysis of neuroimaging data (<http://neuro-learn.org>; <https://github.com/ljchang/nltools>; <https://github.com/neurolearn> )

**emotionCF.** A Python toolbox for performing collaborative filtering on emotion datasets (<https://github.com/ljchang/emotionCF> ).

**feat.** A Python toolbox for analyzing facial expression data (<https://github.com/cosanlab/feat> ).

### *Chaired Symposia, Workshops, & Summer Schools*

2017-Present	Co-Organizer of 8-day Methods in Neuroscience at Dartmouth Computational Summer School, Hanover, NH
2017	Co-Organizer of Dartmouth BrainHack (4-day department neuroscience hackathon), Hanover, NH
2016	Co-Organizer of Dartmouth Affective Neuroscience Symposium, Hanover, NH
2016	"Insights into human cognition and emotion using large-scale neuroinformatics" Nanosymposium, Society for Neuroscience Meeting, San Diego, CA
2016	Co-Chair for Dartmouth Affective Neuroscience Symposium, Hanover, NH
Apr 2014	Computational approaches to social affective neuroscience (co-chaired with Damian Stanley) The 7th Annual Social Affective Neuroscience Society Meeting, Denver, CO
2010	Co-Organizer of a 3-day introductory workshop on the R statistical language to the University of Arizona School of Arts and Sciences, Tucson, AZ.

### *Invited Talks*

May 2018	Association for Psychological Science, San Francisco, CA
Apr 2018	Society for Affective Science, Los Angeles, CA
Mar 2018	Computational Systems Neuroscience Meeting, Breckenridge, CO
Mar 2018	Society for Personality and Social Psychology, Atlanta, GA
Feb 2018	Templeton Roundtable, Hanover, NH
Jan 2018	Science Pub, Lebanon, NH
Oct 2017	Dartmouth Hitchcock Medical Center Department of Psychiatry, Lebanon, NH
Oct 2017	Princeton University, Princeton, NJ
Oct 2017	New York University, NY, NY
Sep 2017	Harvard University, Boston, MA
Aug 2017	Social Neuroeconomics Summer School, Duke University, Durham, NC
July 2017	Beyond the Lab Psychonomics Workshop, Madison, WI
May 2017	Dartmouth 21 <sup>st</sup> Annual Neuroscience Day, Hanover, NH
May 2017	Multimodal Neuroimaging Training Program, Pittsburgh, PA
May 2017	New England Research Decision-Making Group (Brown University)
May 2017	Boston Area Moral Cognition Group (MIT)
May 2017	Affectiva, Boston, MA
Apr 2017	Dartmouth Interdisciplinary Network Research Group, Hanover, NH
Apr 2017	Society for Affective Neuroscience, Boston, MA
Mar 2017	Society for Social and Affective Neuroscience, Los Angeles, CA
Jan 2017	Society for Social and Personality Psychology, San Antonio, TX
Nov 2016	Society for Neuroscience Nanosymposium, San Diego, CA
Jun 2016	Dartmouth Affective Neuroscience Symposium
May 2016	Hanover Rotary Club, Hanover, NH
Nov 2015	Yale University, New Haven, CT
Oct 2015	Harvard University, Cambridge, MA
Oct 2015	The 45 <sup>th</sup> Annual Society for Neuroscience Meeting, Chicago, IL

Sep 2015	University of New Hampshire, Durham, NH
May 2015	University of College London, London, UK
May 2014	The 26 <sup>th</sup> Annual American Psychological Science Meeting, SF, CA
Apr 2014	The 7th Annual Social Affective Neuroscience Society Meeting, Denver, CO
Jan 2014	University of California Santa Barbara, Santa Barbara, CA
Dec 2013	Princeton University, Princeton, NJ
Nov 2013	University of Colorado, Boulder, CO
Nov 2013	Dartmouth College, Hanover, NH
Oct 2013	Harvard University, Cambridge, MA
Sep 2013	University of Amsterdam, Amsterdam, The Netherlands
Sep 2013	Donders Institute for Brain, Cognition, and Behavior, Nijmegen, The Netherlands
Aug 2013	European Society for Cognitive Psychology, Budapest, Hungary
Apr 2013	University of Denver, Denver, CO
Jan 2013	University of Colorado, Boulder, CO
May 2012	UCLA, Department of Psychiatry, Los Angeles, CA
Apr 2012	Duke University, Durham, NC
Apr 2012	Virginia Tech Carilion Research Institute, Roanoke, VA
Mar 2012	University of Colorado, Boulder, CO
Feb 2012	Stanford University, Palo Alto, CA
Jun 2010	Leiden University, Leiden, Netherlands
Sep 2009	The 5 <sup>th</sup> Annual Society for Neuroeconomics Meeting, Evanston, IL.
Nov 2006	Clinical Psychology Datablitz, Tucson, AZ.

### *Teaching*

Social and Affective Motivations in Decision-Making, Dartmouth College  
 Experimental Study of Social Behavior, Dartmouth College  
 The Power of Beliefs, Dartmouth College  
 Research Methods in Psychology, University of Arizona  
 Graduate Statistics, University of Arizona

### *Awards & Fellowships*

Summer 2010	<b>Cognitive Science Center Neuroeconomics Summer School</b> , University of Amsterdam
2009	<b>Graduate and Professional Student Council Student Showcase - 1<sup>st</sup> place in Social Sciences &amp; Law</b> , University of Arizona
2009	<b>Technology Research Initiative Fund Graduate Student Imaging Fellowship</b> , University of Arizona
Summer 2008	<b>Neuroimaging Training Program</b> , University of California Los Angeles
Summer 2007	<b>Summer Institute in Cognitive Neuroscience Fellowship</b> , University of California Santa Barbara
2006 – 2007	<b>Graduate Minority Fellowship</b> , University of Arizona
2006 – 2007	<b>Deans Fellowship</b> , New School for Social Research (Declined)
2004 – 2006	<b>University Scholars Award</b> , New School for Social Research

### *Ad-hoc Reviewing (Papers, Grants, Proposals)*

Behavioral Sciences, Brain and Cognition, Brain Research, Cerebral Cortex, Cognitive Affective Behavioral Neuroscience, Cognitive Computation, DFG – German Research Federation, eLife, Emotion, Rotterdam School of Management, Erasmus University, Evolution and Human Behavior, Frontiers in

Neuroscience, Journal of Cognitive Neuroscience, Journal of Neuroscience, Journal of Economic Psychology, Human Brain Mapping, Nature Human Behavior, Nature Neuroscience, Neuroimage, Neuron, NSF – National Science Foundation, Perspectives in Psychological Science, PLoS One, PLoS Computational Biology, Proceedings for the National Academy of Science, Psychological Science, Psychological Review, Science, Scientific Reports, Social Cognitive Affective Neuroscience, Trends in Cognitive Science, University of Trento, Vermont Genetic Network

### *Professional Service*

2016	Reviewer Cosyne Meeting
2016 – Present	Review Editor for Emotion
2015- 2016	Organizing Committee Social Affective Neuroscience Meeting
2014 – Present	Review Editor Frontiers in Emotion Science
Summer 2013	Guest Lecturer in University of Colorado Science Discovery Program for adolescents
2008	Psychology Department Mini-Convention Organizer
2006 – 2008	Psychology Department Graduate Student Representative

### *Software/Programming Skills* (<http://github.com/ljchang>)

Scientific Computing (Python, Matlab, Bash), Statistics (R, Stan, SAS), Brain Imaging (Nipy, FSL, SPM), Web Development (Flask, Meteor)

### *Professional Memberships*

Society for Neuroscience, Society for Affective Neuroscience, Society for Social Neuroscience, Society for Social Affective Neuroscience, Association for the Advancement of Affective Computing, Society for Social and Personality Psychology, Society for Neuroeconomics, Organization for Human Brain Mapping, Cognitive Neuroscience Society, American Psychological Society