

# Choong-Wan Woo

Department of Psychology and Neuroscience  
University of Colorado at Boulder  
Muenzinger D244, 345 UCB  
Boulder, CO 80309, USA

Phone: (720) 443-3640  
Email: Choongwan.Woo@Colorado.Edu  
Web: <http://wanirepo.github.io>  
(Last updated: May 2015)

## MAJOR RESEARCH GOALS

- Developing fMRI-based biomarkers for pain, emotion, and psychopathology. E.g., **Woo**, Koban, Kross, Lindquist, Banich, Ruzic, Andrews-Hanna, & Wager, 2014, *Nature Communications*; Wager, Atlas, Lindquist, Roy, **Woo**, & Kross, 2013, *The New England Journal of Medicine*
- Understanding the neural mechanisms of pain and emotion regulation using the fMRI-based biomarkers. E.g., **Woo**, Roy, Buhle, & Wager, 2015, *PLoS Biology*
- Translating the basic scientific findings into the development of prevention and treatment of depression, anxiety, and chronic pain. E.g., Wager & **Woo**, 2015, *Science Translational Medicine*

## CURRENT ACADEMIC POSITION

**PhD Student** Cognitive Neuroscience/Cognitive Science Fall 2011 ~ present  
Department of Psychology and Neuroscience,  
Institute of Cognitive Sciences,  
University of Colorado at Boulder, USA  
Advisor: Tor D. Wager, Ph.D.  
MA thesis at CU Boulder (submitted at Nov 2013)  
*Deconstructing pain: Sensory and cognitive manipulations of pain are mediated by distinct systems* (committee: Tor D. Wager, Matt Jones, Randall C. O'Reilly)

## EDUCATION and TRAINING

**Clinical Residency Training** Feb 2010.  
Full time 3-year Residency Training (Clinical Psychology)  
Department of Psychiatry, Seoul National University Hospital  
Advisor: Min-Sup Shin, Ph.D.

**M.A.** Clinical Psychology, GPA: 4.25/4.30 Feb 2007.  
Department of Psychology, Seoul National University, South Korea  
Advisor: Seok-Man Kwon, Ph.D.  
MA Thesis at Seoul National University (Feb 2007)  
*The Relationship between Excessive Doubts due to Error Processing Dysfunction and Obsessive Compulsive Symptoms*

**B.S. (cum laude)** Biological Sciences, GPA: 3.62/4.30 Feb 2005.  
Major GPA: 3.75/4.30, Last 2 years' GPA: 3.96/4.30  
Seoul National University, South Korea  
Advisor: Eun-Ju Lee, Ph.D.

**High School** Seoul Science High School Feb 1998.

**HONORS and AWARDS****Heyer Award,**

Dept. of Psychology and Neuroscience, University of Colorado at Boulder (May 2015)

**Carol B. Lynch Graduate Fellowship,**

University of Colorado at Boulder (May 2015)

**Institute of Cognitive Science (ICS) Travel Award,**

University of Colorado at Boulder (July 2014; Feb 2015)

**Invited scholar,**

European Pain School, Siena, Italy (June 2013)

**American Psychosomatic Society (APS) Travel Award for MacLean Scholars,**

American Psychosomatic Society (Jan 2013)

**United Government of Graduate Students Travel Award,**

University of Colorado at Boulder (Oct 2012)

**Fulbright Graduate Study Award,**

Bureau of Educational and Cultural Affairs,  
United States Department of State, (2011 ~ 2013)

**High Academic Achievement Award,**

College of Natural Sciences, Seoul National University (2005)

**Undergraduate Student Research Award,**

Title: "*The Role of Contrast and Exposure Duration in Pattern Motion Perception*"  
Institute of Psychological Science, Seoul National University (2004)

**Scholarship for the Research Participating Program for Undergraduate Students,**

Title: "*Brain Imaging Method: Focusing on Functional Magnetic Resonance Imaging*"  
Center for Teaching and Learning, Seoul National University (2004)

**PROFESSIONAL AFFILIATIONS**

2015 ~ Present	Society for Affective Sciences
2013 ~ Present	Social and Affective Neuroscience Society
2012 ~ Present	American Psychosomatic Society
2012 ~ Present	Society for Neuroscience
2011 ~ Present	Cognitive Neuroscience Society
2005 ~ Present	Korean Clinical Psychological Association
2005 ~ Present	Korean Psychological Association

**PROFESSIONAL ACTIVITIES**

Ad-Hoc Reviewer	<i>Brain and Language</i>
	<i>Journal of American Neuroradiology</i>
	<i>Pain</i>
	<i>Cognitive, Affective, and Behavioral Neuroscience</i>

**LICENSURE**

- 2010 ~ Present      Professional Clinical Psychologist (Korean Psychological Association)
- 2010 ~ Present      Mental Health Clinical Psychologist (Ministry of Health and Welfare,  
Republic of Korea)

**RESEARCH EXPERIENCE****Publications (Journal Articles):***In press*

- Woo, C. -W.**, & Wager, T. D. (in press). Neuroimaging-based biomarker discovery and validation. *PAIN*.

*2015*

- Woo, C. -W.**, Roy, M., Buhle, J. T. & Wager, T. D. (2015). Distinct brain systems mediate the effects of nociceptive input and self-regulation on pain. *PLoS Biology*. 13(1): e1002036. doi:10.1371/journal.pbio.1002036

Commentary on this publication

Bray, N. (2015). Reappraising pain. *Nature Review Neuroscience*. 16, 124-125

Ploner, M., Bingel, U., & Wiech, K. (2015). Towards a taxonomy of pain modulations. *Trends in Cognitive Sciences*. 19, 180-182

Mano, H. & Seymour, B. (2015). Pain: A Distributed Brain Information Network? *PLoS Biology*. 13(1): e1002037

- Wager, T. D. & **Woo, C. -W.** (2015). fMRI in analgesic drug discovery. *Science Translational Medicine*. 7, 274fs6, doi:10.1126/scitranslmed.3010342

- Losin, E. A. R., **Woo, C. -W.**, Krishnan, A., Wager, T. D., Iacoboni, M. & Dapretto, M. (2015). Brain and psychological mediators of imitation: Sociocultural versus physical traits. *Culture and Brain*. doi:10.1007/s40167-015-0029-9

- Yamamoto, D. J., **Woo, C. -W.**, Wager T. D., Regner, M. & Tanabe, J. (2015) Influence of dorsolateral prefrontal cortex and ventral striatum on risk avoidance in addiction: a mediation analysis. *Drug and Alcohol Dependence*, 149, 10-17. doi: 10.1016/j.drugalcdep.2014.12.026

*2014*

- Woo, C. -W.**, Koban, L., Kross, E., Lindquist, M. A., Banich, M. T., Ruzic, L., Andrews-Hanna, J. R. & Wager, T. D. (2014). Separate neural representations for physical pain and social rejection. *Nature Communications*, 5, 5380. doi: 10.1038/ncomms6380

Commentary on this publication

Rogachov, A., Cheng, J. C., & DeSouza, D. D. (2015). Discriminating neural representations of physical and social pains: how multivariate statistics challenge the 'shared representation' theory

of pain. *Journal of Neurophysiology*

**Woo, C. -W.**, Krishnan, A., Wager, T. D. (2014) Cluster-extent based thresholding in fMRI analyses: Pitfalls and recommendations. *NeuroImage*, 91, 412-419

2013

Wager, T. D., Atlas, L. Y., Lindquist, M. A., Roy, M., **Woo, C. -W.** & Kross, E. (2013). An fMRI-based Neurologic Signature of Physical Pain. *New England Journal of Medicine*, 368 (15), 1388-1397.

2010-2012

**Woo, C. -W.**, Kwon, S. -M., Lim, Y. -J., & Shin, M. -S. (2010). The obsessive-compulsive inventory-revised (OCI-R): psychometric properties of the Korean version and the order, gender, and cultural effects. *Journal of Behavior Therapy and Experimental Psychiatry*, 41, 220-227.

**Woo, C. -W.** & Shin, M. -S. (2010). Cognitive impairments in schizophrenia and psychotic bipolar disorder and their relation to psychotic symptoms. *Korean Journal of Clinical Psychology*, 29, 471-489.

**Woo, C. -W.**, Shin, M. -S, & Kwon, S. -M. (2010). Are obsessive beliefs specific to obsessive-compulsive symptoms? *Korean Journal of Clinical Psychology*, 29, 35-52.

### Conference Presentations:

**Woo, C. -W.**, et al. (June, 2015). *Cerebral contributions to pain independent of nociceptive stimulus intensity*. Poster presentation at the annual meeting of the Organization for Human Brain Mapping, Honolulu, Hawaii

**Woo, C. -W.** (April, 2015). *Understanding pain and emotions using multivariate pattern analysis*. Oral presentation at a workshop sponsored by the Society for Affective Sciences, "Pattern Recognition in Affective Neurosciences", Oakland, CA.

**Woo, C. -W.**, Koban, L., Kross, E. Lindquist, M. A., Ruzic, L., & Wager, T. D. (June, 2014). *Separate neural representations for somatic pain and social rejection*. Poster presentation at Keystone Symposia on "The Brain: Adaptation and Maladaptation in Chronic Pain", Keystone, CO.

López-Solà, M., **Woo, C. -W.**, Pujol, J., Deus, J., Garcia-Fontanals, A, Contreras-Rodríguez, O., Blanco-Hinojo, L., Harrison, B. J., Wager, T. D. (May, 2014). *Aberrant fMRI Responses to multisensory events classify fibromyalgia patients: a machine learning approach*. Poster presentation at the 69<sup>th</sup> annual meeting of the Society of Biological Psychiatry, New York, NY.

Koban, L., Kross, E., **Woo, C. -W.**, Ruzic, L., & Wager, T. D. (April, 2014). *Placebo treatment*

*reduces social rejection-related pain via activation of the dorsolateral prefrontal cortex and the periaqueductal gray.* Poster presentation at 21<sup>st</sup> annual meeting of the Cognitive Neuroscience Society, Boston, MA

**Woo, C. -W.,** Roy, M., Buhle, J. T. & Wager, T. D. (November, 2013). *Deconstructing pain: Sensory and cognitive manipulations of pain are mediated by distinct systems.* Oral presentation at the 43<sup>rd</sup> annual meeting of the Society for Neuroscience, San Diego, CA.

Chang, L. J., **Woo, C. -W.** & Yarkoni, T. (November, 2013). *Automated Functional Parcellation and Meta-Analytic Decoding of fMRI Data With Neurosynth.* Poster presentation at the 43<sup>rd</sup> annual meeting of the Society for Neuroscience, San Diego, CA.

Krishnan, A., **Woo, C. -W.,** Ruzic, L., Fan, J., Gu, X., Chang, L. J., Wager, T. D. (June, 2013). *Physical and observed pain are represented by distinct neural patterns.* Poster presentation at the 19th annual meeting of the Organization for Human Brain Mapping, Seattle, WA.

**Woo, C. -W.,** Roy, M., Buhle, J. T. & Wager, T. D. (April, 2013). *Cognitive reappraisal influences pain valuation, not nociception.* Poster presentation at the 20<sup>th</sup> annual meeting of the Cognitive Neuroscience Society, San Francisco, CA.

López-Solà, M., **Woo, C. -W.,** Pujol, J., Deus, J., Garcia-Fontanals, A, Contreras-Rodríguez, O., Giménez-Navarro, M., Blanco-Hinojo, L., Soriano-Mas, C., Harrison, B. J., Ortiz, H., Chang, L. J., Wager, T. D. (April, 2013). *Neural responses to pressure pain classify fibromyalgia patients.* Poster presentation at the 20<sup>th</sup> annual meeting of the Cognitive Neuroscience Society, San Francisco, CA.

**Woo, C. -W.,** Roy, M., Buhle, J. T. & Wager, T. D. (March, 2013). *Cognitive reappraisal influences pain valuation, not nociception.* Poster presentation at the 71<sup>st</sup> annual meeting of the American Psychosomatic Society, Miami, FL.

\* selected to receive the APS Travel Award for MacLean Scholars

**Woo, C. -W.,** Roy, M., & Wager, T. D. (October, 2012). *Deconstructing pain: Separate contributions of noxious input and top-down bias.* Oral presentation at the 42<sup>nd</sup> annual meeting of the Society for Neuroscience, New Orleans, LA.

\* selected to receive the UGGS Travel Award

Pauli. W. M., Yarkoni, T., **Woo, C. -W.,** Wager, T. D., & O'Reilly, R. C. (October, 2012). *Orchestrating prefrontal cortical areas: meta-analytic insights into the division of labor among striatal subregions.* Poster presented at the 42<sup>nd</sup> annual meeting of the Society for Neuroscience, New Orleans, LA.

**Woo, C. -W.,** Roy, M., & Wager, T. D. (April, 2012) *Deconstructing pain: separate contributions of noxious input and top-down bias.* Presented at the 31<sup>st</sup> annual Ekstrand Memorial Mini-convention at the University of Colorado Boulder.

- Woo, C. -W.** & Kwon, S. -M. (October, 2010) *Feelings that something is wrong and error-related neural hyperactivity*. Poster presented at the 50<sup>th</sup> annual meeting of the Society for Psychophysiological Research.
- Woo, C. -W.** & Shin, M. -S. (August, 2010) *Measuring insight in obsessive-compulsive disorder: psychometric properties of the Korean version of the overvalued idea scale and the overvalued idea self-report questionnaire*. Poster presented at the annual meeting of the Korean Psychological Association.
- Woo, C. -W.** & Shin, M. -S. (October, 2009). *Thought disorder and neuropsychological deficits in patients with obsessive-compulsive disorder: relation to overvalued ideas*. Poster presented at the semiannual symposium of the Korean Clinical Psychological Association.
- Shin, M. -S. & **Woo, C. -W.** (May, 2009). *The relationships between symptoms of schizophrenia and the cognitive domains of MATRICS cognitive battery*. Poster presented at the annual meeting of the American Psychiatry Association.
- Woo, C. -W.**, Shin, M. -S., & Kwon, S. -M. (October, 2007). *The Relationship between Error-related Doubt and Obsessive Compulsive Symptoms*. Poster presented at the semiannual symposium of the Korean Clinical Psychological Association.

### **Research Method Program Participation:**

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|-------------|---|
| Spring 2014 | fMRI Image Acquisition and Analyses Course with SPM8 and ICA, Mind Research Network (MRN) (3 days) *attended as a helper                            |
| Fall 2012   | fMRI analysis: Part 2 (one semester course) – teacher: Tor D. Wager<br>Machine learning techniques as applied to fMRI data analysis                 |
| March 2012  | fMRI Image Acquisition and Analyses Course with SPM8 and ICA, Mind Research Network (MRN) (3 days)  |
| Fall 2011   | fMRI analysis: Part I (one semester course) – teacher: Tor D. Wager<br>Fundamentals of fMRI (fMRI physics, experimental design, GLM-based analyses) |

### **TEACHING EXPERIENCE**

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|-------------|--|
| Spring 2006 | Teaching assistant, Abnormal Psychology (undergraduate course)<br>Seoul National University                            |
| Spring 2008 | Teaching assistant, Clinical Psychology (undergraduate course)<br>School of Dentist, Seoul National University         |
| Spring 2010 | Teaching assistant, Counseling Psychology (undergraduate course)<br>Seoul Digital University                           |
| Fall 2010   | Teaching assistant, Counseling Psychology (undergraduate course)<br>Seoul Digital University                           |
| Spring 2011 | Lecturer, Cognitive Behavioral Therapy (undergraduate course)<br>Seoul Digital University                              |
| Spring 2011 | Guest lecture (Title: Neuropsychological Assessment),<br>Learning and Memory (graduate course), Ewha Womans University |

Spring 2011     Guest lecture (Title: Psychopathology and psychophysiology),  
                     Seoul National University  
Fall 2014        Teaching assistant, Cognitive Psychology (undergraduate course)  
                     University of Colorado at Boulder

## **SKILLS**

Computer        Matlab (proficient), Python, Bash  
Neuroimaging   SPM, AFNI  
Statistics        R, SPSS, AMOS, CEFA (Comprehensive Exploratory Factor Analysis),  
                     Mplus (multivariate statistics including Structural Equation Modeling)

## **PROFESSIONAL REFERENCES**

Tor D. Wager, Ph.D. (PhD research advisor)  
Professor  
Department of Psychology and Neuroscience  
University of Colorado at Boulder  
Tel) 303-492-7487  
Email) [Tor.Wager@Colorado.Edu](mailto:Tor.Wager@Colorado.Edu)

Martin A. Lindquist, Ph.D.  
Professor  
Department of Biostatistics  
Johns Hopkins University  
Tel) 410-614-5107  
Email) [mlindqui@jhspk.edu](mailto:mlindqui@jhspk.edu)