

Thomas C. Sprague

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Education & Professional Appointments

Assistant Professor

- University of California, Santa Barbara, Dept of Psychological and Brain Sciences (July 2018-present)
- <https://spraguelab.psych.ucsb.edu/>

Postdoctoral Associate

- New York University, New York, NY (March 2016-December 2018)
- Advisers: [Clayton Curtis](#), Wei Ji Ma, and Jonathan Winawer

PhD in Neurosciences, with a specialization in Computational Neurosciences

- University of California, San Diego, La Jolla, CA (September 2010 – February 2016)
- PhD adviser: John Serences
- Degree conferred: February 8, 2016

B.A. in Cognitive Science and Neuroscience with Honors

- Rice University, Houston, TX (August 2006-May 2010)

Publications (1410 total citations; h-index: 15)

<https://scholar.google.com/citations?user=9eERyVwAAAAJ&hl=en>

Yoo, A.H., Bolaños, A., Hallenbeck, G.E., Rahmati, M., **Sprague, T.C.**, and Curtis, C.E. (2022). Behavioral prioritization enhances working memory precision and neural population gain. *Journal of Cognitive Neuroscience*.

Vo, V.A., Sutterer, D.W., Foster, J.J., **Sprague, T.C.**, Awh, E., and Serences, J.T. (2022). Shared long-term and short-term memory representational formats in occipital and parietal cortex. *Cerebral Cortex*. (Data & code available at: <https://osf.io/fcp5y/>)

*Li, H.-H., ***Sprague, T.C.**, Yoo, A.H., Ma, W.J., and Curtis, C.E. (2021). Joint representation of working memory and uncertainty in human cortex. (*equal contribution). *Neuron*. (Data & code available at: <https://osf.io/WDJRV/>)

*Hallenbeck, G.E., ***Sprague, T.C.**, Rahmati, M., Sreenivasan, K.K., and Curtis, C.E. (2021). Working Memory Representations in Visual Cortex Mediate the Effects of Distraction. (*equal contribution). *Nature Communications*. (Data available at: <https://osf.io/c9fst/>; code available at: https://github.com/clayspacelab/spDist_mFiles/tree/1.0.0)

Ester, E.F., **Sprague, T.C.**, and Serences, J.T. (2020). Categorical biases in human occipitoparietal cortex. *The Journal of Neuroscience*. (Data & code available at: <https://osf.io/xzay8/>)

Sprague, T.C., Boynton, G.M., and Serences, J.T. (2019). The importance of considering model choices when interpreting results in computational neuroimaging. Peer-reviewed commentary on “Inverted encoding models reconstruct an arbitrary model response; not the stimulus” by Gardner and Liu, 2019. *eNeuro*.

*Itthipuripat, S., ***Sprague, T.C.**, and Serences, J.T. (2019). Functional MRI and EEG index complementary attentional modulations. (*equal contribution). *The Journal of Neuroscience*. (Data & code available at: <https://osf.io/savfp/>)

*Itthipuripat, S., *Vo, V.A., **Sprague, T.C.**, and Serences, J.T. (2019). Value-driven attentional capture enhances distractor representations in early visual cortex. (*equal contribution). *PLoS Biology*. (Data & code available at: <https://osf.io/ky4jh/>)

*Henderson, M., *Vo, V.A., Chunharas, C., **Sprague, T.C.**, and Serences, J.T. (2019). Multivariate analysis of BOLD activation patterns recovers graded depth representations in human visual and parietal cortex. *eNeuro*. (Data &

code available at: <https://osf.io/j7tpf/>)

- Chunharas, C., Rademaker, R.L., **Sprague, T.C.**, Brady, T.F., and Serences, J.T. (2019). Separating memoranda in depth increases visual working memory performance. *Journal of Vision*. (Data & code available at: <https://osf.io/rhf7n/>)
- Sprague, T.C.**, *Adam, K.C.S., *Foster, J.J., *Rahmati, M., *Sutterer, D.W., and *Vo, V.A. (2018). Inverted encoding models assay population-level stimulus representations, not single-unit neural tuning. Peer-reviewed commentary on “Inverted encoding models of human population response conflate noise and neural tuning width” by Liu, Cable & Gardner, 2018 (*equal contribution, listed alphabetically). *eNeuro*.
- Sprague, T.C.**, Itthipuripat, S., Vo, V.A., and Serences, J.T. (2018). Dissociable signatures of visual salience and behavioral relevance across attentional priority maps in human cortex. *Journal of Neurophysiology*. (Data & code available at: <https://osf.io/svuzt/>)
- Vo, VA., **Sprague, T.C.**, and Serences, J.T. (2017). Spatial tuning shifts increase the discriminability and fidelity of population codes in visual cortex. *Journal of Neuroscience*. (Data & code available at: <https://osf.io/s9vqv/>)
- Sprague, T.C.**, Ester, E.F., and Serences, J.T. (2016). Restoring latent visual working memory representations in human cortex. *Neuron*. (Data & code available at: <https://osf.io/s5r6g/>)
- *Ester, E.F., *Rademaker, R.L. and ***Sprague, T.C.** (2016). How do visual and parietal cortex contribute to visual short-term memory? Peer-reviewed commentary on “Decoding the content of visual short-term memory under distraction in occipital and parietal areas” by Bettencourt & Xu, 2016 (*equal contribution, listed alphabetically). *eNeuro*.
- Samaha, J., **Sprague, T.C.**, and Postle, B.R. (2016). Decoding and reconstructing the focus of spatial attention from the topography of alpha-band oscillations. *Journal of Cognitive Neuroscience*.
- Ester, E.F., **Sprague, T.C.**, and Serences, J.T. (2015). Parietal and frontal cortex encode stimulus-specific mnemonic representations during visual working memory. *Neuron*.
- Sprague, T.C.**, Ester, E.F. and Serences, J.T. (2014). Reconstructions of information in visual spatial working memory degrade with memory load. *Current Biology*.
- Itthipuripat S., Garcia, J.O., Rungratsameetaweemana, N. **Sprague, T.C.**, Serences, J.T. (2014). Changing the spatial scope of attention alters the pattern of neural gain in human cortex. *Journal of Neuroscience*.
- Sprague, T.C.** and Serences, J.T. (2013). Attention modulates spatial priority maps in human occipital, parietal and frontal cortices. *Nature Neuroscience*.

Reviews/Book chapters

- Curtis, C.E. and **Sprague, T.C.** (2021). Persistent activity during working memory from front to back. *Frontiers in Neural Circuits*.
- Sprague, T.C.**, Saproo, S. and Serences, J.T. (2015). Attention mitigates information loss in small- and large-scale neural codes. *Trends in Cognitive Sciences*. (Tutorials & sample data available at: http://bit.ly/IEM_tutorial)
- Sprague, T.C.** and Serences, J.T. (2015). Using human neuroimaging to examine top-down modulations of visual perception. *An Introduction to Model-based Cognitive Neuroscience*, eds. Birte Forstmann & E-J Wagenmakers.

Preprints and manuscripts in preparation

- Vu-Cheung, K., Ester, E.F., and **Sprague, T.C.** (In revision; preprint on *bioRxiv*). Spatial working memory representations in human cortex are robust to a task-irrelevant interrupting stimulus. (Preprint: <https://www.biorxiv.org/content/10.1101/2021.09.16.460692v1>).
- Sprague, T.C.** and Curtis, C.E. (In preparation). Temporal dynamics of visual working memory representations across human cortex.
- Thayer, D.J. and **Sprague, T.C.** (In preparation). Neural Dimension Maps Index Feature-Defined Saliency in Visual Cortex.

Thayer, D.J, Miller, M., Giesbrecht, B., and **Sprague, T.C.** (In preparation). Learned color regularities reduce distractor priority to guide attention.

Li, Y. and **Sprague, T.C.** (In preparation). Awareness of the Relative Quality of Spatial Working Memory Representations.

Foster, J.J. and **Sprague, T.C.** (In preparation). How to train your inverted encoding model: measuring changes in population responses across conditions requires training on a common training set.

Phangwiwat, T., Punchongharn, P., Chunharas, C., **Sprague, T.C.**, Wang, S., Woodman, G., Itthipuripat, S. (In revision). Sustained attention operates via dissociable neural mechanisms across different eccentric locations.

Funding – current external support

Sloan Research Fellowship from the Alfred P. Sloan Foundation Sprague (PI) 09/21/2019-09/20/2022

Title: Model-based assessment and prediction of neural representation of visual stimuli across task manipulations

Major goals: Test models for how visual spatial cognition impacts neural representations across task demands

Role: PI/Fellow

Total/direct costs: \$70,000

Institute for Collaborative Biotechnologies Project Grant

Sprague (PI)

12/01/2021-11/30/2023

Title: Modeling visual representations during manipulations of covert and overt attention

Major goals: Extend voxel receptive field model-estimation methods to scenarios in which covert attention may extend across the spatial extent of an object and in which overt attention requires spatial 'remapping'

Role: PI

Direct costs: \$210,112 (\$300,000 total)

Task 14 - Contract (Adv. Sci. Res.)

Grafton, Miller, Giesbrecht, Sprague (Co-I)

12/01/2019-11/30/2022

Title: Improved Synchronous Physiologic Monitoring to Enhance Human-Autonomy Teaming for Situational Awareness, Maneuverability and Decision Making (W911NF-19-D-0001-0014)

Major goals: Understand how human/AI interactions impact neural processing of sensory information and develop strategies to monitor and improve this process in real-time

Role: Co-I

Direct costs: \$665,181 (\$900,000 total)

Funding – current internal support

UCSB Academic Senate Research Grant

Sprague (PI)

07/01/2019-ongoing

Title: Uncovering the strategic recoding of visual information during working memory

Major goals: Test predictive models of strategic spatial recoding during non-spatial working memory tasks

Role: PI

Total/direct costs: \$18,597

UCSB Academic Senate Research Grant

Sprague (PI)

07/01/2020-ongoing

Title: Extending spatial encoding models to include feature information: a novel analysis framework to probe priority map theory

Major goals: Develop and test encoding models that combine spatial and feature channels

Role: PI

Total/direct costs: \$11,124

Funding – completed (last 5 years)

Institute for Collaborative Biotechnologies Seed Grant

Sprague (PI)

12/01/2019-11/30/2021

Title: Testing models of attentional control of neural representations (W911NF-19-2-0026)

Major goals: Evaluate how changes in stimulus properties (stimulus size, location, contrast) and attentional goals (attend to fixation, attend to one of several stimuli, attend to multiple stimuli) interact in neural codes

Role: PI

Direct costs: \$131,236 (\$180,000 total)

NIH/NEI F32-EY028438

Sprague (PI/fellow)

09/12/2017-1/11/2019

Title: Effects of behavioral priority on working memory representations

Major goals: Relate judgments of 'uncertainty' about WM to fidelity of fMRI-based neural population codes, and determine how manipulations of behavioral priority act on these population codes and judgments of uncertainty

Role: PI/Fellow (Supervisors: Clayton Curtis and Wei Ji Ma)

Other funding

- NYU Visual Neuroscience NIH Training Grant (2017)
- UCSD Institute for Neural Computation NIH Training Grant (2014-2015).
- National Science Foundation Graduate Research Fellow (2011-2014)

Awards

- Sloan Research Fellowship (2019)
- Leon Thal Award for Outstanding Neurosciences Graduate Student (2015)
- Vision Sciences Society Student Travel Award (2015)
- Fine Science Tools Travel Award (2012)
- National Science Foundation Graduate Research Fellowship (2010)
- Outstanding Graduate in Cognitive Sciences at Rice University (2010)
- Voted Outstanding Oral Presentation, 2nd Annual Tohoku University Brain Sciences Retreat, Sendai, Japan (2009)
- National Merit Scholar (2006)

Invited Talks

University of Texas, Austin. *Cognitive Neuroscience Seminar*. February 2020.

Donders Institute for Brain, Cognition, and Behavior. *Cognitive Neuroscience Seminar*. September 2019.

University of California, Riverside. *Cognitive Brownbag Seminar Series*. April 2019.

University of California, Santa Barbara. *Kavli Brain Showcase*. January 2019.

New York University Langone School of Medicine. *Neuroscience Institute Invited Talk*. December 2018.

University of California, Irvine. *Dept Neurobiology and Behavior*. January 2018.

University of California, Santa Barbara. *Dept Psychological and Brain Sciences*. January 2018.

Rice University. *Department of Psychology*. December 2017.

Yale University. *Department of Psychology*. November 2017.

University of California, Irvine. *Department of Cognitive Science*. November 2017.

Western University. *Brain and Mind Institute*. January 2017.

University of Oregon. *Department of Psychology*. January 2017.

Princeton University. *Department of Psychology Guest Lab Meeting*. January 2016.

UC San Diego, *Cognitive Neural Systems Seminar Series*, November 2015.

UC San Diego, *Keck Center for Functional MRI Invited Seminar*, November 2015.

Princeton University, *Department of Psychology Guest Lab Meeting*. August 2014.

UC San Diego, *Dept Cognitive Science Wa! Seminar Series*. January 2014.

UC San Diego, *Neurosciences Graduate Program Annual Retreat, Student-invited speaker*. May 2014

UC San Diego, *Dept Radiology Brain Talks Seminar Series*. December 2013.

UC San Diego, *Cognitive Neural Systems Seminar Series*. January 2012.

RIKEN Brain Science Institute, *RIKEN BSI Summer Program*. July 2009.

Tohoku University, *2nd Annual Brain Science Retreat*. July 2009.

Invited Workshops

Using inverted encoding models in cognitive neuroscience: a tutorial. Invited workshop. *Summer Institute in Cognitive Neuroscience*. Santa Barbara, CA. July 2019.

How to use (and how not to use) inverted encoding models. Invited workshop with Justin Gardner. *Summer Institute in*

Cognitive Neuroscience. Santa Barbara, CA. July 2019.

Inverted Encoding Models. Invited workshop. *CuttingEEG*. Paris, France. July 2018.

Inverted Encoding Models. Invited workshop. *Bernstein Center for Computational Neuroscience*. Berlin, Germany. March 2015.

Selected Conference Presentations (full list available upon request)

Li, Y. & **Sprague, T.C.** (2022, May). Awareness of the Relative Quality of Spatial Working Memory Representations. Vision Sciences Society Annual Meeting.

Vu-Cheung, K. and **Sprague, T.C.** (2022, May). Identifying the format of neural codes for orientation WM by predictive modeling of fMRI activation patterns. Vision Sciences Society Annual Meeting.

Thayer, D.J, Miller, M., Giesbrecht, B., and **Sprague, T.C.** (2022, May). learned color regularities enable suppression of spatially-overlapping stimuli. Vision Sciences Society Annual Meeting.

Sprague, T.C., Thayer, D.J., and Vu-Cheung, K. (2022, May). Disentangling the impact of top-down spatial attention and bottom-up stimulus drive on voxel receptive fields in human cortex. Vision Sciences Society Annual Meeting.

Itthipuripat, S., Phangwiwat, T., Punchongharn, P., Chatnuntawech, I., Chunharas, C., **Sprague, T.C.**, Wang, S., & Woodman, G.F. (2021, November). Attention operates differently across eccentricities. Poster to be presented at the Society for Neurosciences Annual Meeting.

Thayer, D. & **Sprague, T.C.** (2021, January). Feature-selective modulations of neural priority maps in human cortex. Society for Neuroscience Global Connectome 2021.

Lam, K. & **Sprague, T.C.** (2020, June). Spatial working memory performance is similar for simple stimuli and real world objects. Poster presented at the Virtual Vision Sciences Society Annual Meeting

Thayer, D. & **Sprague, T.C.** (2020, June). Attentional modulation of feature-selective priority maps across human visual cortices. Poster presented at the Virtual Vision Sciences Society Annual Meeting

Li, H.-H., **Sprague, T.C.**, Yoo, A.H., Ma, W.J., and Curtis, C.E. (2020, June). Neural correlates of uncertainty of visual spatial working memory in human cortex. Talk presented at the Virtual Vision Sciences Society Annual Meeting

Lam, K. & **Sprague, T.C.** (2020, June) Spatial working memory performance is similar for simple stimuli and real world objects. Talk presented at the Virtual Working Memory Symposium

Sprague, T.C., Li, H.-H., Yoo, A.H., Rahmati, M., Hallenbeck, G.E., Ma, W.J., and Curtis, C.E. (2019, October). Prioritized visual spatial working memory representations are maintained more precisely and with lower uncertainty. Talk presented at the Society for Neuroscience Annual Meeting, Chicago, IL.

Hallenbeck, G.E., **Sprague, T.C.**, Rahmati, M., Sreenivasan, K.K., and Curtis, C.E. (2019, October). Tracking spatial working memory representations during distraction. Poster presented at the Society for Neuroscience Annual Meeting, Chicago, IL.

Sprague, T.C., Yoo, A.H., Rahmati, M., Hallenbeck, G.E., Ma, W.J., and Curtis, C.E. (2019, May). Prioritizing relevant information in visual working memory sculpts neural representations in retinotopic cortex to reduce their uncertainty. Poster to be presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.

Rahmati, M., **Sprague, T.C.**, Sreenivasan, K.K., and Curtis, C.E. (2019, May). The nature of top-down signals during non-spatial working memory. Poster to be presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.

Hallenbeck, G.E., **Sprague, T.C.**, Rahmati, M., Sreenivasan, K.K., and Curtis, C.E. (2019, May). Spatial working memory representations are resistant to an intervening stimulus and behavioral task. Poster to be presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.

Yoo, A.H., Bolaños, A., Hallenbeck, G.H., Rahmati, M., **Sprague, T.C.**, and Curtis, C.E. (2019, May). Prioritization affects working memory precision and neural population gain. Poster to be presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.

- Ester, E., Camp, J., Latortue, T., **Sprague, T.C.**, and Serences, J.T. (2019, May). Rapid onset of category-selective biases in human cortex. Talk to be presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Sprague, T.C.**, Yoo, A., Rahmati, M., Ma, W.J., and Curtis, C.E. (2018, November). Tracking the dynamics and uncertainty of visual spatial WM representations across human cortex. Talk presented at the Society for Neuroscience Annual Meeting, San Diego, CA.
- Rahmati, M., Payton, M.J., **Sprague, T.C.**, Sreenivasan, K.K., and Curtis, C.E. (2018, November). Spatial priority in the service of non-spatial working memory. Talk presented at the Society for Neuroscience Annual Meeting, San Diego, CA.
- Sprague, T.C.**, Ma, W.J., and Curtis, C.E. (2018, May). Temporal dynamics of visual working memory representations across human cortex. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Hallenbeck, G.E., Bolaños, A., **Sprague, T.C.**, and Curtis, C.E. (2018, May). Frontal and parietal cortex make distinct contributions to the storage and allocation of resources that support WM. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Rahmati, M., **Sprague, T.C.**, Curtis, C.E., and Sreenivasan, K.K. (2018, May). The role of task-irrelevant space in non-spatial working memory. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Sprague, T.C.**, Rahmati, M., Yoo, A., Ma, W.J., and Curtis, C.E. (2017, November). Decoding uncertainty in visual spatial short term memory from retinotopic cortex. Poster presented at the Society for Neuroscience Annual Meeting, Washington, DC.
- Itthipuripat, S., Vo, V.A., **Sprague, T.C.**, and Serences, J.T. (2017, November). Reward and selection history shape neural representations of attentional priority in human visual and parietal cortex. Poster presented at the Society for Neuroscience Annual Meeting, Washington, DC.
- Ester, E.F., **Sprague, T.C.**, and Serences, J.T. (2017, August). Categorical representations in human visual cortex. Poster presented at the International Conference for Cognitive Neuroscience, Amsterdam, NL.
- Sprague, T.C.**, Rahmati, M., Yoo, A., Ma, W.J., and Curtis, C.E. (2017, May). Decoding visual spatial working memory uncertainty from human cortex. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Vo, V.A., Sutterer, D., Foster, J., **Sprague, T.C.**, Awh, E., and Serences, J.T. (2017, May). Neural representations of spatial position recalled from long-term and short-term memory diverge across the cortical hierarchy. Talk presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Chunharas, C., Rademaker, R.L., **Sprague, T.C.**, Brady, T.F. and Serences, J.T. (2017, May). Remembering stimuli in different depth planes increases visual working memory precision and reduces swap errors. Poster to be presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Sprague, T.C.**, Itthipuripat, S., Vo, V.A., and Serences, J.T. (2016, November). Graded representations of stimulus salience and attentional priority across visually-responsive cortex. Talk presented at the Society for Neuroscience Annual Meeting as part of a nano-symposium on Spatial Attention and Working Memory (organizer: **TC Sprague**). San Diego, CA.
- Vo., V.A., **Sprague, T.C.**, and Serences, J.T. (2016, November). Spatial attention modulates voxel receptive fields to boost the fidelity of multi-voxel stimulus representations. Talk presented at the Society for Neuroscience Annual Meeting as part of a nano-symposium on Spatial Attention and Working Memory. San Diego, CA.
- Samaha, J., **Sprague, T.C.**, Voytek, B., Gazzaley, A., Postle, B.R. Preparatory encoding of the location and scope of human spatial attention. Talk presented at the Society for Neuroscience Annual Meeting as part of a nano-symposium on Spatial Attention and Working Memory. San Diego, CA.
- Sprague, T.C.**, Ester, E.F., and Serences, J.T. (2016, May). Visual and parietal spatial working memory representations are robust to brief irrelevant distracters. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.
- Chunharas, C., Itthipuripat S., **Sprague, T.C.**, Ester, E.F., Serences, J.T. (2016, May). Individual differences in depth

discrimination predicts differences in visual working memory for stimuli rendered in 3D. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.

Henderson, M.M., Chunharas, C., Vo, V.A., **Sprague, T.C.**, Serences, J.T. Reconstructing 3D stimuli using BOLD activation patterns recovers hierarchical depth processing in human visual and parietal cortex. Poster presented at the Vision Sciences Society Annual Meeting, St Petersburg, FL.

Sprague, T.C., Itthipuripat, S. and Serences, J.T. (2015, October). Different population-level measurements and analysis techniques enable complementary insights into attentional modulation of visual responses. Poster presented at the Society for Neuroscience Annual Meeting, Chicago, IL.

Vo, V.A., **Sprague, T.C.**, and Serences, J.T. (2015, October). Linking attentional modulations of single-voxel population receptive fields and region-level spatial reconstructions. Poster presented at the Society for Neuroscience Annual Meeting, Chicago, IL.

Ester, E.F., **Sprague, T.C.** and Serences, J.T. (2015, October). Category learning biases representations of orientation in early human visual cortex. Talk presented at the Society for Neuroscience Annual Meeting, Chicago, IL.

Sprague, T.C., Ester E.F., and Serences, J.T. (2015, May). Recovery of degraded information in visuospatial working memory representations in human occipital, parietal and frontal cortex. Talk presented at the Vision Sciences Society Annual Meeting, St. Petersburg, FL.

Ester, E.F., **Sprague, T.C.** and Serences, J.T. (2015, May). Visual working memory representations are distributed throughout human cortex. Talk presented at the Vision Sciences Society Annual Meeting, St. Petersburg, FL.

Smith, M.E., **Sprague, T.C.**, and Serences, J.T. (2015, May). Univariate frontoparietal BOLD does not track the magnitude of attentional modulations in visual cortex. Poster presented at the Vision Sciences Society Annual Meeting, St. Petersburg, FL.

Sprague, T.C., Ester, E.F., and Serences, J.T. (2015, March). Attention to items in working memory improves fidelity of population codes in human cortex. Poster presented at COSYNE 2015, Salt Lake City, UT

Sprague, T.C., Ester, E.F., and Serences, J.T. (2014, November). Mnemonic representations in human occipital, parietal and frontal cortex index visuospatial working memory acuity. Talk presented at the Society for Neuroscience Annual Meeting, Washington, DC.

Vo, V.A., **Sprague, T.C.**, and Serences, J.T. (2014, November). The effects of spatial attention on voxel-level population receptive fields and spatial information content. Poster presented at the Society for Neuroscience Annual Meeting, Washington, DC.

Sprague, T.C., Itthipuripat, S. and Serences, J.T. (2014, May). Within-participant differences in attention-related shifts in contrast response functions measured using EEG and fMRI. Poster presented at the Vision Sciences Society Annual Meeting, St. Petersburg, FL.

Kaye, K.E., **Sprague, T.C.**, Itthipuripat, S. Prado, E. and Serences, J.T. (2014, May). Steady-state sensory-evoked responses are enhanced prior to oculomotor execution. Poster presented at the Vision Sciences Society Annual Meeting, St. Petersburg, FL.

Garcia, J.O., Kaye, K.E., Williams, D., **Sprague, T.C.**, and Serences, J.T. (2014, May). The phase of intrinsic oscillations modulates feature and space-based visual attention. Talk presented at the Vision Sciences Society Annual Meeting, St. Petersburg, FL.

Sprague, T.C., Ester, E.F, and Serences, J.T. (2013, November). Delay period spatial representations of remembered visual stimuli in human occipital, parietal and frontal cortex depend on memory load. Poster presented at the Society for Neuroscience Annual Meeting, San Diego, CA.

Itthipuripat S., Garcia, J.O., Rungratsameetaweemana, N. **Sprague, T.C.**, Serences, J.T. (2013, November). Manipulating attention strategy alters patterns of neural gain in human cortex. Poster presented at the Society for Neuroscience Annual Meeting, San Diego, CA.

Garcia, J.O., Kaye, K.E., **Sprague, T.C.**, and Serences, J.T. (2013, November). Near real-time spatial reconstructions of visual stimuli with EEG: Exploring the dynamics of spatial attention. Poster presented at the Society for

Neuroscience Annual Meeting, San Diego, CA.

Sprague, T.C., Ester E.F. and Serences, J.T. (2013, May). Reconstructing delay-period representations of remembered visual stimuli in visual, parietal and frontal cortex. Poster presented at the Vision Sciences Society Annual Meeting, Naples, FL.

Sprague, T.C. and Serences, J.T. (2012, October). Using a forward encoding model for spatial visual information reveal effects of attention across different cortical regions. Poster presented at the Society for Neuroscience Annual Meeting, New Orleans, LA.

Sprague, T.C. and Serences, J.T. (2012, May). Reconstructing spatial maps in occipital, parietal and frontal cortex using an encoding model of spatial receptive fields. Poster presented at the Vision Sciences Society Annual Meeting, Naples, FL.

Sprague, T.C. and Serences, J.T. (2011, November). Estimating motion and saccade direction-selective responses in human visual, parietal and frontal cortex. Poster presented at the Society for Neuroscience Annual Meeting, Washington, D.C.

Sprague, T.C. and Eagleman, D.M. (2009, May). The perceived duration of a stimulus depends on temporal context. Poster presented at the Vision Sciences Society Annual Meeting, Naples, FL.

Sprague, T.C. and Eagleman, D.M. (2009, February). Neural latencies are not equivalent to perceptual latencies. Poster presented at the Baylor College of Medicine Department of Neuroscience Annual Form, The Woodlands, TX.

Sprague, T.C. and Eagleman, D.M. (2008, November). Perceptual asynchrony depends on stimulus predictability. Poster presented at the Society for Neuroscience Annual Meeting, Washington, D.C.

Research mentorship

- Amelia Harrison (UC Santa Barbara, Junior Specialist, fall 2021-2022; PhD student, fall 2022-)
- Alison Li (UC Santa Barbara, PhD student, fall 2021-present)
- Daniel Thayer (UC Santa Barbara, PhD student, fall 2019-present)
- Kelvin Vu-Cheung (UC Santa Barbara, MA student, fall 2019-summer 2022)
- Toni Schindler-Ruberg (UC Santa Barbara, undergraduate volunteer, 2021-present)
- Caden Coronado (UC Santa Barbara, undergraduate volunteer, 2021-present)
- Amel Alrifai (UC Santa Barbara, undergraduate volunteer, 2021-present)
- Maggie Miller (UC Santa Barbara, undergraduate volunteer, 2020-present)
- Ivan Trigueros (UC Santa Barbara, undergraduate volunteer, 2020-present)
- Jeremy Marquez (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Luke Hamilton (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Precious Ruvalcaba (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Jonathan Jolly (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Rijul Singhal (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Ivan Trigueros (UC Santa Barbara, undergraduate volunteer, 2020-present)
- Maggie Miller (UC Santa Barbara, undergraduate volunteer, 2020-present)
- Klaire Hua (UC Santa Barbara, undergraduate volunteer, 2019-present)
- Lindsey Gollom (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Emma Wiedeling (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Melody Pezeshkian (UC Santa Barbara, undergraduate volunteer, 2019-2020)
- Rafael Cruz (New York University, Psychology masters student, 2017-2018)
- Connor Williams (New York University, undergraduate volunteer, 2017)
- Gaoyang Gui (New York University, Psychology masters student, 2017-2018)
- Alfredo Bolaños (New York University, PhD student; 2016-2018)
- Helena Palmieri (New York University, masters student, 2016-2018)
- Grace Hallenbeck (New York University, PhD student; 2016-present)
- Haider Al-Hakeem (UC San Diego; undergraduate research assistant; 2014- 2015)

- Jon MacLeod (William & Mary University; undergraduate summer volunteer; summer 2013)
- Zoe Kohl (Rice University; undergraduate summer volunteer; 2012)

Teaching Experience

Instructor – “PSY 108: Cognitive Psychology” - (UC Santa Barbara; Spring 2019: 290 students; Spring 2020: 582 students; Spring 2022: 354 students).

- Large lecture-style course offered in-person in 2019, 2022, online (asynchronous) 2020

Instructor – “PSY 163TS/PSY594TS: Models of Working Memory” – (UC Santa Barbara; Fall 2019: 95 undergraduate, 2 graduate students; Spring 2021: 17 undergraduate, 4 graduate students)

- Seminar-style special-topics course for upper-year undergraduates and graduate students
- Graduate version includes proposal-writing and presenting (e.g., mock study section)

Instructor – “PSY 221B: Design and Measurement” – (UC Santa Barbara; Winter 2022: 12 graduate students)

- Graduate-level statistics class, focusing on

Guest lecturer – “Attention” - Cognitive Neuroscience (NYU; Spring 2018).

- Present lectures to undergraduate course

Lecturer – Invited Workshop on Inverted Encoding Models (March 2015), single-topic workshop at Bernstein Center for Computational Neuroscience in Berlin, attended by graduate students, post-doctoral researchers and faculty

- Develop course materials, including datasets and analysis code (available at bit.ly/IEM_tutorial)
- Lead participants through interactive analysis exercises

Course organizer – UCSD Vision Journal Club (Winter 2015), seminar course attended by faculty, post-doctoral researchers and graduate students from multiple departments, faculty oversight by Karen Dobkins

- Organized thematic content (“visual population codes”)
- Led discussion: “mixed vs. fixed selectivity in population codes during decision-making”
- Assisted with planning weekly discussion topics and readings

Co-Lead Computational Neuroscience Teaching Assistant, Project Leader – UCSD Neurosciences Graduate Program “Boot Camp” (2011-2014), intensive 2-week introduction to electrophysiology, imaging, and computational methods, organized by Bill and Kathy Kristan (2011-2013), Stefan Leutgeb and Jing Wang (2014)

- Assist students with data analysis using MATLAB and Python
- Design and lead computational data analysis student projects (2012: multivariate analyses of fMRI data, reconstructing images based on brain activation patterns; 2014: 2-photon calcium imaging of sensory systems)
- Design and assist with computational modeling student projects (2011: synaptic model of working memory; 2013: conductance-based model of attention)

Lecturer - Analytical Methods in Computational Neuroscience (UCSD; Spring 2014), student team-taught course, faculty oversight by Tatyana Sharpee

- Taught lecture and developed/graded problem set: “Methods in functional magnetic resonance imaging”

Course Organizer; Lecturer – Analytical Methods in Computational Neuroscience (UCSD; Spring 2013), student team-taught course, faculty oversight by EJ Chichilnisky and Tatyana Sharpee

- Graduate-level computational neuroscience course
- Upper-year computational neuroscience students give lectures highlighting a data-driven analysis technique
- Taught lecture and developed/graded problem set: “Encoding and Decoding in Systems Neuroscience”
- Organized thematic content of course and recruited lecturers from UCSD Computational Neuroscience student community

Guest lecturer – Neurodynamics, taught by Gert Cauwenbergh (Fall 2011, 2012)

- Graduate-level engineering course for computational neurosciences students
- Developed and taught tutorial on using BRIAN network simulation package for Python

Teaching Assistant – Introduction to Computational Neuroscience, taught by Pamela Reinagel (UCSD; Fall 2011)

- Graduate-level course for students interested in understanding methods in computational neuroscience, but little or no mathematical background
 - Topics: Poisson processes, information theory, Fourier analysis, cross- and autocorrelations, clustering analyses, Markov processes, Bayesian inference, random walks & diffusion processes, dimensionality reduction (PCA & ICA)
 - Guest lectures by EJ Chichilnisky & Terrance Sejnowski (Salk Institute)
- Taught weekly review section
- Planned course readings & lecture topics

Software Contributions

Inverted Encoding Model (IEM) tutorials: <https://github.com/tommysprague/IEM-tutorial>

- Publicly-available tutorials and workshop lecture materials for linear inverted encoding model (IEM) analysis
- Recipe for implementation of novel multivariate analyses enabling reconstruction of feature representations from brain activity patterns (fMRI, EEG).
- MATLAB implementation

gridfitgpu - GPU-optimized grid search to seed nonlinear optimization problems (e.g., voxel receptive field modeling):

<https://github.com/tommysprague/gridfitgpu>

- In progress: integrating functionality into widely-used visual neuroimaging analysis packages (vistasoft)
- MATLAB implementation

vRFtools – common functions used for fitting voxel receptive field models efficiently to data extracted from individual

ROIs: <https://github.com/SpragueLab/vRFtools>

- Uses gridfitgpu functions to rapidly accelerate model fits during gridfit stage
- Flexible to allow for easy implementation of new modeling strategies
- Minimal overhead to maximize flexibility of input data types (e.g., timeseries can be fit directly)
- MATLAB implementation

iEye_ts – *in-progress* – package for automated eye movement scoring: https://github.com/tommysprague/iEye_ts

- Adapted from interactive eye movement scoring package *iEye* (Mackey & Curtis, in preparation)
- Optimized for scoring data from memory-guided saccade tasks
- MATLAB implementation, compatible with Eyelink data files

Academic Service

UC Santa Barbara Psychological and Brain Sciences Assessment Committee (2021-present)

- Develop and implement assessment strategy to evaluate efficacy of undergraduate and graduate training goals

UC Santa Barbara Dynamical Neurosciences Graduate Program Admissions Committee (2021-2022)

- Review applications and, in consultation with committee members, set admissions policies and procedures
- Organize recruitment events

UC Santa Barbara Psychological and Brain Sciences Graduate Admissions Committee (2019-2020)

- Review applications to identify promising internal university fellowship candidates

- Organize recruitment events and faculty interviews

UC Santa Barbara Psychological and Brain Sciences Shared Lab Policies Committee (2019-present)

- Establish policies supporting equitable access to shared departmental research resources

UC Santa Barbara Psychological and Brain Sciences Newsletter Committee (2019-present)

- Write news blurbs about significant events in the department (e.g., faculty and student grants and awards, new research contributions, departmental news coverage)

UC Santa Barbara Psychological and Brain Sciences Building/Reopening Committee (2021-present)

- Implement university policies concerning research reopening
- Review and applications for research reopening
- Keep track of application status for all submitted research reopening plans in the department
- Advise labs about best practices for safe resumption of research activities

SFN 2016 Nanosymposium organizer (Spatial Attention and Working Memory, chair: Clayton Curtis)

- Invited speakers from nonhuman primate and human labs studying different aspects of visual spatial cognition
- Developed nanosymposium application and coordinated talk order

UCSD Neurosciences Curriculum Committee (2010-2014)

- Identified course topics with student interest
- Recruited faculty to develop student-initiated courses
- Represent student body in discussions of curriculum efficacy

UCSD Neurosciences Computational Neuroscience Committee (2010-2015)

- Worked with faculty program directors to improve breadth and depth of computational neurosciences courses
- Leadership role in developing a seminar course taught by students

NSF Graduate Funding Panel

- Presented advice for optimizing NSF Graduate Research Fellowship applications
- Assisted students with edits to application documents

Neurosciences Graduate Program new student recruitment

- Organized or assisted with organizing non-academic activities for prospective students (2011-2013)
- Present posters during recruitment poster sessions (2012-2015)
- Led cognitive neuroscience lab tour (2013-2015)

Ad-hoc manuscript review

Cerebral Cortex; Cognitive, Affective and Behavioral Neuroscience; Current Biology; eLife; eNeuro; Frontiers in Human Neuroscience; Frontiers in Systems Neuroscience; Human Brain Mapping; Journal of Cognitive Neuroscience; Journal of Experimental Psychology: Human Perception and Performance; Journal of Neuroscience; Journal of Neurophysiology; Nature Communications; Nature Communications Biology; Nature Human Behavior; Nature Neuroscience; Neuroimage; PLoS Computational Biology; PLoS Biology; PNAS; Scientific Reports; Trends in Cognitive Sciences

Ad-hoc conference abstract review

- Cognitive Computational Neuroscience (2017; 2018; 2019)

Ad-hoc proposal/grant review

- National Science Foundation (2019; 2021)

- UCSB Errett Fisher Foundation Postdoctoral Fellowship (2021)

Academic Memberships

- Society for Neuroscience (2007-present)
- Vision Sciences Society (2008-present)

Academic Lecture Courses/Summer Schools

- Summer Institute for Cognitive Neuroscience, “Visual Attention and Emotional Cognition” (Santa Barbara, CA; Summer 2014)
- Cold Spring Harbor Laboratory Summer Course, “Computational Neuroscience: Vision” (Long Island, NY; Summer 2012)
- RIKEN Brain Science Institute Summer Lecture Course, “Interacting Brains” (Tokyo, Japan; Summer 2009)

Additional Activities

- UCSD Neuroscience Outreach Program volunteer (visit local middle and high schools to teach neuroscience, Fall 2010–Winter 2016)
- Writer, Catalyst: Rice Undergraduate Science and Engineering Review (Fall 2009-Spring 2010)
- Building Rice Academics in Neuroscience (BRAiN), a student/faculty initiative for implementing an undergraduate neuroscience program and increasing community neuroscience awareness, co-founder and co-president (Fall 2008-Spring 2010)
- Rice Undergraduate Scholars Program Research Fellow (Fall 2008–Spring 2009)
- Scientia, an institute for the history of science and culture; C.P. Snow Student Fellow (Fall 2008-Spring 2009)
- Gulf Coast Consortia for Theoretical and Computational Neuroscience NSF REU Research Fellow (summer 2008)