

# Trafton Drew

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**Assistant Professor ° University of Utah**  
**Psychology Department ° Salt Lake City, UT**  
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## Primary Professional Appointments

Associate Professor	University of Utah, Department of Psychology Salt Lake City, UT	2020-present
Assistant Professor	University of Utah, Department of Psychology Salt Lake City, UT	2014-2020
Principal Investigator	Natick Soldier Research, Development, and Engineering Center Natick, MA	2014

## Education and Training

Post-doc	Brigham & Women's Hospital / Harvard Medical School Mentor: Jeremy M. Wolfe	2010-2013
Ph.D., M.S.	University of Oregon (Cognitive Psychology) Mentor: Edward K. Vogel	2009
B.A.	University of North Carolina-Chapel Hill (Psychology) <i>Magna cum laude</i>	2002

## External Funding

2021	<b>NSF Standard Grant: Conference Organization</b> Neural underpinnings of attention in the real world: Insights from co-registration of eye movements and EEG: #2032183 Role: Co-PI with Liz Schotter (UCF, PI) & Brennan Payne (Utah, Co-PI). Total funding: \$25,000
2020-present	<b>Cooperative Agreement: Army Research Office</b> Evaluating the efficacy of simulated augmented reality cueing in virtual reality 77210-LS

2/4/21

Role: PI with Sarah Creem-Regehr & Jeanine Stefanucci (University of Utah)  
Total funding: \$653,650

2020-present

**Cooperative Agreement: Army Research Labs**

Augmented target recognition: Quantifying the costs and benefits of implementation  
W911NF2020093

Role: PI with Sarah Creem-Regehr & Jeanine Stefanucci (University of Utah)  
Total funding: \$275,000

2020-present

**R21 National Institute for Biomedical Imaging and Bioengineering**

A scalable non-intrusive image annotation method using eye tracking for training deep learning models in radiology

1R21EB028367-01A1

Role: Co-PI with Tolga Tasdizen (University of Utah)  
Total funding: \$243,000

2019-present

**Binational Science Foundation Early Investigator Start-up Grant**

Interactions Between Visual Working Memory and Long Term Memory  
Grant #2018106

Role: Co-PI with Roy Luria (Tel Aviv University)  
Total funding: \$450,000

2018-present

**R01 National Cancer Institute /NIH**

Reader Accuracy in Pathology Interpretation and Diagnosis: Perception and Cognition (RAPID-PC)

1R01CA225585-01

Role: Co-Investigator with Joann Elmore (UCLA) and Donald L. Weaver (UVT)  
Total funding: \$3,888,327

2018-2020

**Radiological Society of North America: Radiology Education Research Development Grant**

Eye of the Beholder: Quantitative and Qualitative Measures of Radiology Residents' Perceptual Skills.

Role: Co-I with Megan Mills (University of Utah)  
Total funding: \$10,000

2016-2019

**Binational Science Foundation Early Investigator Start-up Grant**

Resetting Working Memory

Grant #2015301

Role: Co-PI with Roy Luria (Tel Aviv University)  
Total funding: \$150,00

2015-2019

**U.S. Army Research Office and Army Research Laboratory Cooperative agreement**

Attentional support for visual search and surveillance

Grant #W911NF-07-2-0055

Role: Co-PI with Jeremy Wolfe (Harvard Medical School)  
Total funding: \$898,310

2/4/21

- 2015-2016      **Army Research Office: Defense University Research Instrumentation Program**  
Augmenting Threat Detection Through Online Eye-Tracking Feedback  
Role: PI  
Total funding: \$81,524
- 2013            **Brazilian Science Foundation: National Counsel of Technological and Scientific Development**  
Symposium Optimizing Excellence in Athletes Performance  
The Cognitive Psychology of Kinship and Descent Tracking  
Role: Co-Organizer with Martina Navarro (University of Sao Paolo)
- 2011-2013      **NIBIB: NRSA Postdoctoral Fellowship**  
Searching 3D medical images: Using online feedback to increase accuracy and efficiency  
Grant #F32EB011959  
Role: PI  
Total funding: \$94,512

## **Internal Funding**

- 2018            **University of Utah Research Instrumentation Fund Program**  
Funding to support a high-density, high impedance EEG system  
Role: Co-PI with Matt Euler and Brennan Payne  
Total funding: \$110,532
- 2016-2017      **Neuroscience Initiative Pilot Funding**  
Identifying infant neurophysiological signatures linked with prenatal exposure to maternal anxiety  
Role: Co-PI with Elisabeth Conradt and Erin Clark (University of Utah)  
Total funding: \$50,000
- 2016-2017      **Kickstart Grant: UofU College of Humanities**  
Expertise, Perception and Attention  
Role: Co-PI with Jeanine Stefanucci & Dustin Stokes (University of Utah)  
Total funding: \$10,000
- 2015-2016      **CSBS Interdisciplinary Research Pilot Program at the University of Utah**  
The Cognitive Psychology of Kinship and Descent Tracking  
Role: Co-PI with Douglas Jones (University of Utah)  
Total funding: \$9,066

## **Peer Reviewed Publications**

(bold names = student collaborator)

50. **Lavelle, M., Alonso, D., Luria, R., and Drew, T.** (in press). Visual working memory load plays limited, to no role in encoding distractor objects during visual search. **Visual Cognition**. <https://doi.org/10.1080/13506285.2021.1914256>

49. **Ostlund**, B. D., Alperin, B. R., Drew, T., & Karalunas, S. L. (2021). Behavioral and cognitive correlates of the aperiodic (1/f-like) exponent of the EEG power spectrum in adolescents with and without ADHD. **Developmental Cognitive Neuroscience**, 100931.
48. **Ivy S., Rohovit T., Lavelle M., Padilla L., Stefanucci J., Stokes D., & Drew T.** (2021). Through the Eyes of the Expert: Evaluating Holistic Processing in Architects Through Gaze-Contingent Viewing. **Psychonomic Bulletin & Review**.
47. **Williams**, L.H., Carrigan, A., Auffermann, W.F., Mills, M., Rich, A.N., Elmore, J., Drew, T. (2020). The invisible breast cancer: Experience does not protect against inattentive blindness to clinically-relevant findings in radiology. **Psychonomic Bulletin & Review**.
46. Brunyé, T. T., Drew, T., Kerr, K. F., Shucard, H., Weaver, D. L., & Elmore, J. G. (2020). Eye tracking reveals expertise-related differences in the time-course of medical image inspection and diagnosis. **Journal of Medical Imaging**, 7(5), 051203.
45. **Williams**, L.H., & Drew, T. (2020). Maintaining rejected distractors in working memory during visual search depends on search stimuli: Evidence from Contralateral Delay Activity. **Attention, Perception, & Psychophysics**, 1-18.
44. Elmore, J., Shucard, H., Lee, A., Wang, P. C., Kerr, K., Carney, P., Drew, T., Brunyé, T., Weaver, D. (2020). Pathology trainee experience and attitude on use of digital whole slide images. **Academic Pathology**, 7, 2374289520951922.
43. Drew, T., **Guthrie**, J., **Reback**, I. (2020). Worse in real life: An eye-tracking examination of the cost of CAD at low prevalence. **Journal of Experimental Psychology: Applied**, 26(4), 659–670.
42. Fawver, B., Thomas, J. L., Drew, T., Mills, M. K., Aufferman, W. F., Lohse, K. R., Williams, A. M. (2020). Seeing isn't necessarily believing: Misleading contextual information influences perceptual-cognitive bias in radiologists. **Journal of Experimental Psychology: Applied**, 26(4), 579–592.
41. Banerjee, S., Drew, T., Mills, M. K., Aufferman, W. F. (2019). Perceptual training: learning versus attentional shift. **Journal of Medical Imaging**, 7(2), 022407.
40. Balaban, H., Drew, T., Luria, R. (2019). Neural evidence for an object-based pointer system underlying working memory. **Cortex**, 119, 362-372.
39. **Williams**, L.H., Drew, T. (2019). What do we know about volumetric medical image search?: A review of the basic science and medical image perception literatures. **Cognitive Research: Principles and Implications**, 4(1), 21.
38. Brunye, T. T., Drew, T., Weaver, D. L., & Elmore, J. G. (2019). A review of eye tracking for understanding and improving diagnostic interpretation. **Cognitive Research: Principles and Implications**, 4(1), 7.
37. Clement, A., Stothart, C., Drew, T., & Brockmole, J.R. (2019). Between-Category Semantic Associations Do Not Modulate the Visual Awareness of Objects. **Quarterly Journal of Experimental Psychology**, 72(5), 1224-1232.

36. Drew, T., **Williams, L., Jones, C.**, Luria, R (2018). Neural processing of repeated search targets depends upon the stimuli: Real world stimuli engage semantic processing and recognition memory. **Frontiers in Human Neuroscience**, 12, 480.
35. **Williams, L.H.**, Drew, T. (2018). Working memory capacity predicts search accuracy for novel as well as repeated targets. **Visual Cognition**, 26(6), 463-474.
34. Balaban, H., Drew, T., Luria, R. (2018). Delineating resetting and updating in visual working memory based on the object-to-representation correspondence. **Neuropsychologia**, 113, 85-94.
33. Balaban, H., Drew, T., Luria, R. (2018). Visual working memory can selectively reset a subset of its representations. **Psychonomic Bulletin & Review**, 25(5), 1877-1883.
32. Drew, T., **Williams, L.H.**, Aldred, B., Heilbrun, M. & Minoshima, S. (2018). Quantifying the costs of interruptions during diagnostic radiology using mobile eye tracking. **Journal of Medical Imaging**, 5(3), 031406.
31. Boettcher, S.E., Drew, T., Wolfe, J.M. (2018). Lost in the supermarket: partitioning memory in hybrid search. **Memory & Cognition**, 46(1), 43-57.
30. Drew, T. & **Williams, L.H.** (2017). Simple eye-movement feedback during visual search is not helpful. **Cognitive Research: Principles and Implications**, 2(14), 44.
29. Drew, T., Boettcher, S. E., Wolfe, J. M. (2017). One visual search, many memory searches: An eye-tracking investigation of hybrid search. **Journal of Vision**, 17(11), 4-4.
28. **Aizenman, A.**, Drew, T., Ehinger, K. A., Georgian-Smith, D., Wolfe, J. M. (2017) Comparing search patterns in digital breast tomosynthesis and full field digital mammography: An eye tracking study. **Journal of Medical Imaging**, 4(4), 045501.
27. **Williams, L.H.** & Drew, T. (2017). Distraction in diagnostic radiology: How is search through volumetric medical images affected by interruptions? **Cognitive Research: Principles and Implications**, 2(1), 39.
26. Cunningham, C., Drew, T., Wolfe, J.M. (2017). Analog computer aided detection (CAD) information can be more effective than binary marks. **Attention, Perception & Psychophysics**, 79(2), 679-690.
25. Drew, T. & Stothart, C. (2016). Clarifying the role of target similarity, task relevance, and feature-based suppression during sustained inattention blindness. **Journal of Vision**, 16(15):13, 1-9.
24. Wen, G., **Aizenman, A.**, Drew, T., Wolfe, J.M., Haygood T. M., Markey M.K. (2016). Computational Assessments of Visual Search Strategies in Volumetric Medical Images. **Journal of Medical Imaging**, 3(1), 015501-13.
23. Wolfe, J. M., Evans, K. K., Drew, T., **Aizenman, A., Josephs, E.** (2016). How do radiologists use the human search engine? **Radiation Protection Dosimetry**, 169(1-4), 24-31.

22. Drew, T., **Aizenman, A.M.**, Thompson, M., Kovacs, M. D., Trambert, M., Reicher, Wolfe, J. M. (2016). Image toggling saves time in mammography. **Journal of Medical Imaging**, 3(1), 0110031-0110037.
21. Drew, T., **Boettcher**, S. Wolfe, J.M. (2016). Searching while loaded: Visual working memory does not interfere with hybrid search efficiency but hybrid search uses working memory capacity. **Psychonomic Bulletin & Review**, 23(1), 201-212.
20. **Josephs**, E., Drew, T., Wolfe, J.M. (2016). Shuffling your way out of change blindness. **Psychonomic Bulletin & Review**, 23(1), 193-200.
19. Wolfe, J.M., **Boettcher**, S.E.P., **Josephs**, E.L., **Cunningham**, C. A., Drew, T. (2015) You look familiar, but I don't care: Target detection in hybrid visual and memory search is not based on familiarity. **Journal of Experimental Psychology: Human Perception and Performance**, 41(6), 1576-1587.
18. Drew, T., **Boettcher**, S.E.P., **Sherman**, A. Wolfe, J.M. (2014). Memory search for the first target modulates the magnitude of the attentional blink. **Memory & Cognition**, 42, 1333-1344.
17. Drew, T., Mance, I., Horowitz, T. S., Wolfe, J.M., Vogel, E.K. (2014). A soft handoff of attention. **Current Biology**, 24(10), 1133-1137.
16. Drew, T., Wolfe, J.M. (2014). Hybrid search in the temporal domain: Evidence for rapid, serial logarithmic search through memory. **Attention, Perception & Psychophysics**, 76, 296-303.
15. Drew, T., Võ, M.L.H., Wolfe, J.M. (2013). The invisible gorilla strikes again: Sustained inattentive blindness in expert observers. **Psychological Science**, 24(9), 1848-1853.
14. Drew, T., Võ, M.L.H., Olwal, A., Jacobson, F., Seltzer, S.E., Wolfe, J.M. (2013). Scanner and Drillers: Characterizing expert visual search through volumetric images. **Journal of Vision**, 13(10), article 3.
13. Drew, T., Horowitz, T. S., Vogel, E.K. (2013). Swapping or Dropping? Electrophysiological measures of difficulty during multiple object tracking. **Cognition**, 126, 213-223.
12. Drew, T., Evans K.E., Vo, M.L.H., Jacobson, F. L., Wolfe, J. M. (2013). What can you see in a single glance and how might this guide visual search in medical images? **Radiographics**, 33(1), 263-274.
11. Drew, T., **Cunningham**, C., Wolfe, J.M. (2012). When and why might a Computer Aided Detection (CAD) system interfere with visual search? An eye-tracking study. **Academic Radiology**, 19, 1260-1267.
10. Ester, E., Drew, T., Klee, D., Vogel, E.K., Awh, E. (2012). Neural measures reveal a fixed item limit in subitizing. **Journal of Neuroscience**, 32(21), 7169-7177.
9. Drew, T., Horowitz, T.S., Wolfe, J.M., Vogel, E.K. (2012). Neural measures of dynamic changes in attentive tracking load. **Journal of Cognitive Neuroscience**, 24(2), 440-450.

8. Drew, T., Horowitz, T.S., Wolfe, J.M., Vogel, E.K. (2011). Delineating the neural signatures of tracking spatial position and working memory during attentive tracking. **Journal of Neuroscience**, 31(2), 658-668.
7. Howe, P.D.W., Drew, T., Pinto, Y., Horowitz, T.S. (2011). Remapping attention in multiple object tracking. **Vision Research**, 51(5), 489-495.
6. Umemoto, A., Drew, T., Ester, E.F., Awh, E (2010). A bilateral advantage for storage in visual working memory. **Cognition**, (117), 69-79.
5. Drew\*, T., McCollough\*, A. W., Horowitz, T.S., Vogel, E.K. (2009). Attentional enhancement during multiple object tracking. **Psychonomic Bulletin & Review**, 16(2), 411-417.
4. Drew, T. & Vogel, E.K. (2008). Neural measures of individual differences in selecting and tracking multiple moving objects. **Journal of Neuroscience**, 28(16), 4183-4191.
3. Drew, T. & Vogel, E.K. (2008). Recently Attended Masks are Less Effective. **Perception & Psychophysics**, 70(1), 96-103.
2. Drew, T, McCollough, A., Vogel, E.K. (2006). Event-related potential measures of working-memory. **Clinical EEG and Neuroscience**. 37(4), 286-291.
1. Drew, T. & Shapiro, K. (2006). Representational masking in the attentional blink. **Visual Cognition**, 13, 513-528.

## **Chapters and Commentary**

Aufferman, W. F., Drew T., Krupinski, E. (2020). Special section guest editorial: Medical image perception and observer performance. **Journal of Medical Imaging**. 7(2), 022401, doi: 10.1117/1.JMI.7.2.022401.

Wolfe, J. M., Drew, T., Evans K. (2018). The role of sub-second and peripheral perception. In Samei, E., & Krupinski, E. A. (Eds.), **The Handbook of Medical Image Perception and Techniques** (Chapter 12), Cambridge University Press.

Rubin, G., Williams, L. Drew, T. (2018). Perception of volumetric data. In Samei, E., & Krupinski, E. A. (Eds.), **The Handbook of Medical Image Perception and Techniques** (Chapter 21), Cambridge University Press.

Wolfe, J. M., Drew, T., & Boettcher, S. E. (2015). Hybrid search: Picking up a thread from Schneider and Shiffrin (1977). In Raaijmakers, J. G. W., Criss, A. H., Goldstone, R. L., Nosofsky, R. M., Steyvers, M. **Cognitive Modeling in Perception and Memory: Festschrift for Richard M. Shiffrin** (63-81). New York: Psychology Press.

Drew, T. & Vogel, E. K. (2009). The capacity of working memory. In **New Encyclopedia of Neuroscience**, L Squire, T Albright, F Bloom, F Gage & N Spitzer (Eds.)

Aminoff, E., Baslev, D., Borroni, P., Bryan, R., Chua, E., Cloutier, J., Cross, E. S., Drew, T., Funk, C. M., Gil-da-Costa, R., Guerin, S. A., Hall, J. L., Jordan, K. E., Landau, A. N., Molnar-Szakacs, I., Montaser-

Kouhsari, L., Olofsson, J. K., Quadflieg, S., Somerville, L. H., Sy, J. L., Uddin, L. Q., Yamada, Y.\* (2009). The landscape of cognitive neuroscience: Challenges, rewards, and new perspectives. In M. Gazzaniga (Ed.), **The Cognitive Neurosciences** (4th Edition), MIT Press, 1255-1292. \*all authors contributed equally

Drew, T. & Vogel, E. K. (2008). The fuzziness of memory. **Scientific American: Mind Matters Online Commentary**, November.

## Teaching/ Advising Experience

Creator & Instructor: Advanced Cognitive Electrophysiology; University of Utah	2019
Instructor: Graduate Neuropsychology; University of Utah	2015, 2016, 2018
Instructor: Brain & Behavior; University of Utah <i>In person and online classes</i>	2015, 2018
Summer Student Advisor: High School Student Projects <i>Project Success, Research Science Institute and CELEST Programs</i>	Summer 2010-2013
Instructor: Sensation and Perception; Simmons College	Spring 2011
Co-instructor: Biological Psychology; University of Oregon	Summer 2006
Teaching assistant: Cognition; University of Oregon	Fall 2008
Lab instructor: Introduction to Psychology; University of Oregon	2004-2005

## Honors & Outreach

Guest Editor: Cognitive Research: Principles and Implications Special Section	2020
Humboldt Research Fellowship for Experienced Researchers	2020-2021
Irv Altman Award for the University of Utah Psychology Department	2020
Bergmann Memorial Research Award (BSF Young investigator)	2019
Invited NCI 'Think Tank' Speaker and Discussant	2019
Co-Organizer: Medical Image Perception Society Bi-Annual meeting	2019
Chair and Organizer: Psychonomics Symposium <a href="https://www.psychonomic.org/page/2018symposia">https://www.psychonomic.org/page/2018symposia</a>	2018
University of Utah Faculty Fellow	2017
Poster Judge, SACNAS Conference	2017
Fellow of the Psychonomics Society	2016
Invited Panelist: 'Decoding the Mind' @Leonardo Museum	2016
Invited Panelist: 'SciFi Friday', sponsored by Utah Education Network	2015
Invited Panelist: 'The Brain' screening, sponsored by KUED	2015
Brigham and Women's Healthcare 'Hackathon' participant	2013
Best Poster: NIBIB 'Unconference' Meeting	2012
Cognitive area search committee member, University of Oregon	2008
Summer Institute of Cognitive Neuroscience, invited fellow	2008



Summer Institute of Cognitive Neuroscience, fellow	2007
Graduate Admissions Committee	2005-2007
Graduate School Research Award	2005,2007
Phi Beta Kappa	2002

## **Reviewing**

*Consulting Editor:* Cognitive Research: Principles and Implications 2017-present

*Grants:* British Academy-Leverhulme, Department of Defense: Army Research Office, National Science Foundation, Israel Science Foundation, National Institute of Health (Cognition & Perception Panel), Netherlands Organisation for Scientific Research.

*Journals:* Attention, Perception & Psychophysics, Cognition, BMJ: Quality & Safety, British Journal of Radiology, Cognition and Emotion, Cognitive Brain Research, Cognitive Neuroscience, Cognitive Research: Principles and Implications, Current Opinion in Psychology, Human Factors, Journal of Behavioral Decision Making, Journal of Digital Imaging, JEP: Human Perception and Performance, JEP: General, JEP: LMC, Journal of Neuroscience, Journal of Neurophysiology, Journal of Vision, Neuropsychologia, Neuroimage, Quarterly Journal of Experimental Psychology, PLOS One, Psychological Bulletin, Psychological Research, Psychological Science, Psychonomic Bulletin and Review, Psychophysiology, Visual Cognition.

## **Representative Presentations (bold=student)**

**Murdock**, R. J., **Lavelle**, M., Luria, R., & Drew, T. (May 2021). Increasing target template precision decreases distractor recognition in hybrid search. Poster presented at the Vision Sciences Society virtual meeting.

**Lavelle**, M., Brunyé, T. T., Kerr, K. F., Shucard, H., Weaver, D. L., Elmore, J. G. & Drew, T. (2021). Pathologist pupil dilation reflects difficulty in diagnosing digital breast tissue biopsies. Poster presented at the Vision Sciences Society virtual meeting.

**Ostlund**, B. D., Raby, K. L., **Williams**, L., Crowell, S. E., Conradt, E., & Drew, T. (2021, April 7-9). Linking prenatal maternal distress and infant neural noise to problem behavior in toddlerhood. In M. Camerota (Chair), *Prenatal distress and neurobehavior in infancy and early childhood: Testing putative biological mechanisms* [Symposium]. Society for Research in Child Development (SRCD) Biennial Meeting, Minneapolis, MN, United States.

**Lavelle**, M., Kerr, K. F., Shucard, H., Brunyé, T. T., Weaver, D. L., Elmore, J. G. & Drew, T. (July 2020). Scanning rate, but not drilling (magnification), is significantly associated with accuracy in pathologists' evaluation of whole slide images of breast biopsies. Talk submitted for presentation at the Object Perception, Attention, and Memory virtual meeting.

Drew, T., **Williams**, L.H., **Vazquez**, S., Castro, S., **Alonso**, D. (May, 2020) What was I looking for? Modulating the role of working memory in response to telephone interruptions. Poster virtually presented at the Vision Sciences Society meeting, St. Pete Beach, FL.

**Alonso, D., Tasevac, A., Williams, L., & Drew, T.** (May 2020). Investigating the costs of interruptions on visual search performance. Poster virtually presented at the Vision Sciences Society meeting, St. Pete Beach, FL.

**Rohovit, T., Ivy, S., Lavelle, M., Stefanucci, J., Stokes, D. & Drew, T.** (May 2020) Through the eyes of an expert: Evaluating holistic processing in architects using gaze-contingent viewing. Poster virtually presented at the Vision Sciences Society meeting, St. Pete Beach, FL.

**Lavelle, M. E., Cornelison, K., Williams, L. H. & Drew, T.** (May, 2020) Similar EEG dynamics underlie repetition-related learning and subsequent memory of realistic images in visual search. Talk virtually presented at the Vision Sciences Society meeting, St. Pete Beach, FL.

**Williams, L.H., Wiegand, I., Lavelle, M., Wolfe, J.M., Fukuda, K., Drew, T.** (May, 2020). What is the role of working memory in hybrid search?: Evidence from the Contralateral Delay Activity. Talk virtually presented at the Vision Sciences Society meeting, St. Pete Beach, FL.

**Williams, L.H., Carrigan, A., Auffermann, W.F., Mills, M., Rich, A.N., Drew, T.** (2019, November). What are the characteristics of expert search behavior in volumetric medical images? Talk presented at the Object, Perception, Attention, and Memory meeting, Montreal, Que.

**Lavelle, M., Alonso, D., & Drew, T.** (2019, November). Do you remember these distractors? Exploring the factors that influence the relationship between incidental fixations and memory. Poster presented at the Object, Perception, Attention, and Memory meeting, Montreal, Que.

**Williams, L.H., Wilson, V., Alonso, D., Luria, R., Drew, T.** (November, 2019). Neural evidence of reactivating memory for recent search targets. Poster presented at the annual meeting for the Psychonomics Society, Montreal, Que.

**Nicora, G., Alonso, D., Orrego, J., Tasvec, A., Drew, T.** (November, 2019). Evaluating the target template theory in a real-world search design: a mobile eye-tracking study. Poster presented at the annual meeting for the Psychonomics Society, Montreal, Que.

**Alonso, D., Williams, L.H., Vazquez, S., Tasvec, A., Drew, T.** (November, 2019). Telephone interruptions lead to uniquely prolonged subsequent cognitive impairment. Poster presented at the annual meeting for the Psychonomics Society, Montreal, Que.

**Williams, L.H., Carrigan, A., Auffermann, W.F., Mills, M., Rich, A.N., Drew T.** (2019). Inattention blindness in response to medically-relevant stimuli in radiologists. Talk presented at the annual meeting for the Experimental Psychology Conference, Wellington, New Zealand.

**Williams, L.H., Carrigan, A., Auffermann, W., Mills, M., Rich, A.N., Drew, T.** (2019). The invisible breast cancer: Inattention blindness in response to medically-relevant stimuli in radiologists. Talk presented at the Medical Image Perception Society meeting, Salt Lake City, UT.

**Vazquez, S., Alonso, D., Drew, T.** (2019). Residual Costs of Interruption in Diagnostic Radiology. Talk presented at the Medical Image Perception Society meeting, Salt Lake City, UT.

**Drew, T. & Reback, I.** (2019). Worse in Real Life: An Eye-Tracking Examination of the Costs of CAD at Low Prevalence. Talk presented at the Medical Image Perception Society meeting, Salt Lake City, UT.

Banerjee, S., Drew, T., Aufferman, W. (2019). RadSimP - A Custom Software Solution for Perceptual Training Compared with Current Perceptual Software. Talk presented at the Medical Image Perception Society meeting, Salt Lake City, UT.

Banerjee, S., Mills, M. Drew, T., Aufferman, W. (2019). Perceptual Training – Learning Versus Attentional Shift. Talk presented at the Medical Image Perception Society meeting, Salt Lake City, UT.

Thomas, J., Fawver, B. Mills, M. Auffermann, W., Drew, T., Williams, A. M. (2019). Visual Search Behavior Reveals Differences in Diagnostic Accuracy Based on Experience. Talk presented at the Medical Image Perception Society meeting, Salt Lake City, UT.

Balaban, H., Drew, T., Luria, R. (2019) Neural evidence for a dissociation between the pointer system and the representations of visual working memory. Poster presented at Vision Sciences Society, St. Petersburg FL.

Drew, T., **Williams** L. H., Wolfe, J. M. Wiegand, I. (2019). How do you know if you saw that? Electrophysiological correlates of searching through memory. Poster presented at Vision Sciences Society, St. Petersburg FL.

**Alonso**, D. F., **Falla** S. Y., Vaskevich, A., Luria, A., Drew, T. (2019). Does the relationship between incidental fixations and distractor recognition depend on target consistency across visual search trials? Poster presented at Vision Sciences Society, St. Petersburg FL.

**Nicora**, G. L., **Wilson**, V. Stokes, D. Stefanucci., J. Drew, T. (2019). The Sum or Parts: Exploring Radiologist Reliance on Peripheral Vision and Holistic Processing Through Gaze-Contingent Viewing. Talk accepted for presentation at the Medical Image Perception Society meeting, Salt Lake City, UT.

**Ostlund**, B.D., **Alonso**, D., **Williams**, L., Crowell, S., Conradt, E., and Drew, T. (2019). “Developmental Origins and Temperamental Correlates of Neural Reactivity to Novelty Among 7-Month-Olds: An ERP Study “. Poster to presented at the Biennial Society for Research in Child Development.

**Alonso**, D. F., **Wilson**, V., Williams, L., **Jones**, C., Luria, R., Drew, T. (2018). “Old or New? Electrophysiological measures of working-memory and long-term memory for previously encountered targets during visual search”. Poster presented at Utah Neuroscience Snowbird Symposium.

**Falla**, S. Y., Alonso, D. F., Drew, T. (2018). Neural Measures of Tracking Objects Through Occlusions. Poster presented at Utah Neuroscience Snowbird Symposium.

**Williams**, L.H., Wiegand, I., Wolfe, J., & Drew, T. (2018). Electrophysiological correlates of searching through memory during hybrid visual search. Posted accepted for presentation at the annual meeting of the Object, Perception, Attention, and Memory, New Orleans, LA.

**Nicora**, G.L., Drew, T., Stokes, D., & Stefanucci, J. (2018). Do you see what I see? Exploring holistic processing with gaze-contingent viewing. Poster to be presented at the 2018 Psychonomic Society Annual Meeting, New Orleans, LA.

**Williams**, L.H., Drew, T., Wolfe, J., and Wiegand, I. (2018, July). “How do you know if you saw that? Electrophysiological correlates of searching through memory.” Talk accepted for presentation at the annual meeting for the Cognitive Science Association for Interdisciplinary Learning, Hood River, OR.

**Alonso, D.F., Nicora, L. G., Rand, K., Creem-Regehr, S.H., Drew, T. (2018)** “Take A Walk: Using mobile eye tracking to investigate the effects of incidental fixations in real-world search.” Talk presented at Cognitive science meeting for interdisciplinary learning (CSAIL): Hood River, OR.

**Guthrie, J., Aufferman, W., Mills, M., & Drew, T. (2018, May)** The Effect of Interruption On Structures of Primary and Secondary Importance In Diagnostic Radiology. Poster session presented at the 27<sup>th</sup> Annual UCLA Psychology Undergraduate Research Conference, Los Angeles, CA.

Balaban, H., Drew, T., Luria, R. (2018) “An object-based pointer system in working memory.” Talk presented at Vision Sciences Society, St. Petersburg, FL.

**Nicora, G., Alonso, D., Rand, K., Creem-Regehr, S., Drew, T. (2018)** “Exploring the utility of incidental fixations in dynamic real-world visual search through mobile eye tracking ” Poster presented at Vision Sciences Society, St. Petersburg, FL.

**Jones, C., Williams, L., Drew, T. (2018)** “Does this grab your attention? A comparison of attention and memory resources deployed during search for artificial and real world objects.” Poster presented at Vision Sciences Society, St. Petersburg, FL.

**Williams, L., Drew, T. (2018)** “Are rejected distractors maintained in working memory? Evidence from the Contralateral Delay Activity.” Poster presented at Vision Sciences Society, St. Petersburg, FL.

**Williams, L., Drew, T. (2018)** “Now, where was I? Investigating the utility of eye-tracking feedback during interrupted search tasks.” Poster presented at International Meeting of the Psychonomic Society, Amsterdam, Netherlands.

**Williams, L., Drew, T. (2017)** “Repeated Target Search: Does the Nature of the Target Determine the Rate of Transfer into Long-Term Memory?” Poster presented at Psychonomics Annual Meeting: Vancouver, BC.

**Williams, L., Drew, T. (2017)** “Does interruption prevalence influence the magnitude of the interruption cost in volumetric medical image search?” Poster presented at the Annual Objects, Perception Attention and Memory conference, Vancouver, BC.

**Jones, C., Williams, L., Drew, T. (2107)** “Hey, Remember Me? A Comparison of Memory Resources Used In Artificial Stimuli and Real World Objects.” Poster presented at Utah Neuroscience Snowbird Symposium.

**Alonso, D., Balaban, H., Luria, R., Drew, T. (2017).** Did someone press the reset button? Neural evidence for the resetting process in visual working memory during multiple object tracking. Poster presented at Utah Neuroscience Snowbird Symposium.

Drew, T., Vaskevich, A., Luria, R. (2017) “Distractor memory during visual search is unaffected by dwell time.” Talk presented at Psychonomics Annual Meeting: Vancouver, BC.

Drew, T., **Williams, L.**, Aldred, B., Heilbrun, M. & Minoshima, S. (2017). “The cost of distraction: quantifying the effects of interruptions during diagnostic radiology using mobile eye tracking.” Talk presented at Medical Image Perception Society: Houston, TX

**Williams, L.** & Drew, T. (2017). "Interruptions in radiology: Is there a tradeoff between speed and accuracy?" Talk presented at Medical Image Perception Society: Houston, TX.

McEntee, M. F., Drew, T., Aizenman, A. M., Carrigan, A., Ekpo, E., Wolfe, J. M. (2017). "Examining the 'gambler's fallacy' in radiology." Talk presented at Medical Image Perception Society: Houston, TX.

**Hunsaker, D.**, Tenney, E., & Drew, T. (2017). Tracking eye movement in emotionally charged negotiations. Talk presented at International Association of Conflict Management Conference, Berlin, Germany.

Balaban, H., Drew, T., Luria, R. (2017). "Breaking the objects-to-representations correspondence in working-memory leads to a resetting process." Talk presented at American Psychological Science Annual Meeting: Boston, MA.

**Ostlund, B.D.**, **Williams, L.**, Conradt, E., and Drew, T. (2017). "Allocating attention to threat: Pupil dilation and fearfulness in infancy." Paper presented as part of a paper symposium at the biennial meeting of the Society for Research in Child Development: Austin, TX.

Balaban, H., Drew, T., Luria, R. (2017). "Visual working memory resetting is triggered by a loss of objects-to-representations correspondence." Talk presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Drew, T. & **Reback, I.** (2017). Low target prevalence exacerbates problems with Computer-Aided Detection (CAD) during visual search." Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

**Williams, L.** & Drew, T. (2017). "Electrophysiological Correlates of Individual Differences in Visual Search." Talk presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Gil-Gómez, B., Drew, T., Rin, D., Wolfe, J. M. (2017). "Target prevalence in a visual search task differentially modulates lure effects from visual working memory." Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

**Alonso, D. F.**, **Thomas, J.**, Drew, T. (2017). "Distractor Zap: Exploring the Nature of Hybrid Search Tasks Through Eye Tracking." Poster presented at Rocky Mountain Psychological Association: Salt Lake City, UT.

**Reback, I.** & Drew, T. (2017). "Low Target Prevalence Exacerbates Problems with Computer-Aided Detection (CAD) During Visual Search." Poster presented at Rocky Mountain Psychological Association: Salt Lake City, UT.

**Williams, L.** & Drew, T. (2017). "Electrophysiological Correlates of Individual Differences in Visual Search." Talk presented at Rocky Mountain Psychological Association: Salt Lake City, UT.

Drew, T. (2016). "Exploring the utility of online feedback during visual search." Talk presented at Psychonomics Annual Meeting: Boston, MA.

Cain, M. S. & Drew, T. (2016). "Cause or correlate? Exploring the effect of working memory on subsequent search misses." Talk presented at Psychonomics Annual Meeting: Boston, MA.

**Williams, L. & Drew, T. (2016).** “Exploring the Role of Working Memory in Visual Search: Repeating Targets Does Not Diminish the Relationship Between Search and Working Memory Capacity.” Poster presented at Psychonomics Annual Meeting: Boston, MA.

**Alonso, D. F., Jones, C., Thomas, J., Drew, T. (2016).** “Now you track me, now you don’t: Neural measures of tracking through object occlusions”. Poster presented at Utah Neuroscience Snowbird Symposium.

Aldred, B, Heilbrun, M., Wiggins, R. H., Minoshima, S., Drew, T. (2016). “The cost of distraction: Quantifying the effects of telephone interruptions on the diagnostic radiologist using mobile eye tracking.” Scientific Presentation to be presented at Radiological Society of North America: Chicago, IL.

Aizenman, A. M., Drew, T., Georgian-Smith, D., Wolfe, J. M. (2016) “Patterns of eye movements in breast tomosynthesis and full field digital mammography: an eye-tracking study.” Scientific Presentation to be presented at Radiological Society of North America: Chicago, IL.

Wen, G., Aizenman, A., Drew, T., Wolfe, J.M., Markey, M.K., and Haygood, T.M. (2016) “Computational Assessment of Visual Search Strategies in Volumetric Medical Images.” Poster presented at Workshop on Natural Environments Tasks and Intelligence: Austin, TX.

Drew, T., Aldred, B, Heilbrun, M., Minoshima, S. (2016) “Quantifying the costs of telephone interruptions during diagnostic radiology: A mobile eye-tracking study.” Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

**Williams, L. & Drew., T. (2016)** “Lost in Space: The Cost of Interruption During Search Through Volumetric Medical Images.” Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Gil-Gómez, B., Drew, T., Rin, D., Wolfe, J. M.(2016) “Paradoxical speeding of visual search by the inclusion of WM and LTM lures.” Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Boettcher, S.E.P., Drew, T., Wolfe, J.M. (2015). “Partitioning hybrid memory and visual search: Exploring the ability to search for the right target in the right place.” Poster Presented at 7th Bernstein Sparks Workshop: Active Perceptual Memory: Berlin, Germany.

Drew, T. (2015). “An electrophysiological measure of tracking through occlusion.” Invited Talk presented at Society for Psychophysiological Research Annual Meeting: Seattle, WA.

Drew, T. (2015). “Searching for Feature-Based Surround Suppression in Inattentional Blindness.” Talk presented at Cognitive science meeting for interdisciplinary learning (CSAIL): Hood River, OR.

Drew, T., Aizenman, A. M., Thompson, M., Kovacs, M. D., Trambert, M., Reicher, Wolfe, J. M. (2015). “Image shuffling saves time in mammography.” Talk presented at Medical Image Perception Society: Ghent, Belgium.

Drew, T. (2015). “Searching for Feature-Based Surround Suppression in Inattentional Blindness.” Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Wolfe, J. M., Cain M. S., Ehinger, K. A., Drew, T (2015) Guided Search 5.0: Meeting the challenge of hybrid search and multiple-target foraging." Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Gil-Gómez, B., Drew, T., Rin, D., Wolfe, J. M.(2015). "Active working memory tasks interfere with inefficient search but NOT with efficient search, guided by bottom-up salience." Poster presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Drew, T., Wolfe, J. M., Birdwell, R., Georgia-Smith, D. (2014). "Comparing search in breast tomosynthesis and 2D mammograms: an eye-tracking study." Talk presented at American Roentgen Ray Society : San Diego, CA.

Drew, T. Wolfe, J. M. (2014). "Shuffling your way out of change blindness." Talk presented at Vision Sciences Society Annual Meeting: St. Petersburg, FL.

Wolfe, J. M., Drew, T., Vo, M. L. H. (2014). "You don't know where your eyes have been and that could be problem." Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Aizenman, A., Drew, T., Georgia-Smith, D., Wolfe, J. M.,(2014). "Comparing search strategy in breast tomosynthesis and 2D mammogram: an eye tracking study. " Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Gil-Gómez, B., Drew, T., Quirós, M., Wolfe, J. M. (2014). "Updating for free? Span and Updating tasks modulate Visual Search in a similar manner." Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T., Wolfe, J. M. (2013). "Sequential versus simultaneous Computer Aided Detection (CAD): How do different forms of CAD influence eye movements and behavior?" Talk presented at Medical Image Perception Society: Washington DC.

Wolfe, J. M., Olwal, A., Drew, T. (2013). "Understanding and attempting to improve search in volumetric space: how do radiologists search chest CT scans?" Talk presented at Medical Image Perception Society: Washington DC.

Drew, T., Wolfe, J. M. (2013) "Searching for many targets: What can eye-movements tell us about hybrid visual and memory search?" Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Boettcher, S., Drew, T., Sherman, A., Wolfe, J. M. (2013). "Hybrid search meets the Attentional Blink: How does searching through memory influence blink magnitude?" Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T., Vo, M., Wolfe, J. M. (2012). "The invisible gorilla strikes again: Sustained inattention blindness in expert observers." Poster presented at OPAM Conference: Minneapolis, MN.

Drew, T., Sherman, A., Wolfe, J. M. (2012). "Temporal hybrid search: Searching through time rather than space." Poster presented at Psychonomics Conference: Minneapolis, MN.

Drew, T., Sherman, A., Wolfe, J. M. (2012). "How does memory search interact with the attentional blink?" Talk presented at European Society for Visual Perception: Sardinia, Italy.

Drew, T. Wolfe, J. M. (2012). "Hybrid search in the temporal domain: Monitoring an RSVP stream for multiple targets held in memory" Talk presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T., Vo, M., Seltzer, S., Jacobson, F. L., Wolfe, J. M. (2011). "Searching in three dimensions: How do radiologists search through volumetric space?" Electronic poster presented at Radiological Society of North America: Chicago, IL.

Wolfe, J. M., Drew, T., Vo, M., Evans, K., Jacobson, F. L., Ryan, J (2011). "What can you see in a single glance and how does this guide search in radiology?" Educational exhibit presented at Radiological Society of North America: Chicago, IL.

Drew, T., Cunningham, C., Wolfe, J. M. (2011). "Helping computer aided detection (CAD) algorithms help you: increasing the behavioral benefit of a given CAD signal." Poster presented at European Society for Visual Perception: Toulouse, France.

Drew, T., Cunningham, C., Wolfe, J. M. (2011). "When and why does computer aided detection (CAD) interfere with visual search?" Poster presented at Medical Imaging Perception Society Meeting: Dublin, Ireland.

Drew, T., Cunningham, C., Wolfe, J. M. (2011). "Why don't Computer Aided Detection (CAD) algorithms help experts as much as they should?" Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Cunningham, C., Drew, T., Wolfe, J. M. (2011). "When and why does Computer Aided Detection (CAD) interfere with visual search?" Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T., Horowitz, T., Wolfe, J. M., Vogel, E. K. (2010). "Neural measures of interhemispheric information transfer during attentive tracking." Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Vogel, E. K., McCollough, A., Drew, T., Horowitz, T. (2010). "Probing the spatial distribution of attention to targets and distractors in multiple object tracking." Talk presented at Vision Sciences Society Annual Meeting: Naples, FL.

Lester, B., Drew, T., Vogel, E. K. (2010). "Electrophysiological evidence of interhemispheric resource recruitment during visual working memory." Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T., Horowitz, T. S., Wolfe, J. M., Vogel, E. K. (2009). "Attention to objects and motion during multiple object tracking." Talk presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T. & Vogel, E. K. (2009). "Neural measures of selecting multiple objects." Poster presented at Cognitive Neuroscience Society Annual Meeting: San Francisco, CA.



Drew, T., Horowitz, T. S., Vogel, E. K. (2008). "Attentional enhancement during multiple object tracking" Talk presented at Cognitive science meeting for interdisciplinary learning (CSAIL): Hood River, OR.

Drew, T., Horowitz, T. S., Wolfe, J. M., Vogel, E. K. (2008). "Online measurement of dynamic changes in tracking load." Poster presented at Vision Sciences Society Annual Meeting: Naples, FL.

Drew, T., Horowitz, T. S., Wolfe, J. M., Vogel, E. K. (2008). Online measurement of dynamic changes in tracking load. Poster presented at Cognitive Neuroscience Society Annual Meeting: San Francisco, CA.

Drew, T. & Vogel, E. K. (2007). "Neural measures of voluntary and involuntary changes in tracking load." Talk presented at Cognitive science meeting for interdisciplinary learning (CSAIL): Hood River, OR.

Drew, T. & Vogel, E. K. (2007). "An electrophysiological measure of tracking through occlusion." Talk presented at Vision Sciences Society Annual Meeting: Sarasota, FL.

Drew, T. & Vogel, E. K. (2006). "An electrophysiological measure of multiple object tracking: correlations with visual working memory." Talk presented at Cognitive science meeting for interdisciplinary learning (CSAIL): Hood River, OR.

Drew, T. & Vogel, E. K. (2006). "An electrophysiological measure of multiple object tracking." Poster presented at Vision Sciences Society Annual Meeting: Sarasota, FL.

Drew, T. & Vogel, E. K. (2006). "Repeat mask reduction: demonstration of a novel effect." Poster presented at Cognitive Neuroscience Society Annual Meeting: San Francisco, CA.

Drew, T. & Vogel, E. K. (2005). "Repeated masks are less effective." Poster presented at Cognitive science meeting for interdisciplinary learning (CSAIL): Hood River, OR.

Drew, T. & Vogel, E. K. (2005). "Repeated masks are less effective." Poster presented at Vision Sciences Society Annual Meeting: Sarasota, FL.

Shapiro, K. & Drew, T. (2004). "Conceptual masking in the attentional blink paradigm." Poster presented at Vision Sciences Society Annual Meeting: Sarasota, FL.

Drew, T. & Gordon, P. C. (2002). "Unconscious perception and the attentional blink." Poster presented at the North Carolina Cognition Group annual meeting: Raleigh, NC.

## **Mentoring**

### Current Lab Members:

**David Alonso:** (2nd Year Graduate student)

**Ryan Murdoch:** (1st Year Graduate student)

### Lab Alumni:

**Lauren Williams:** (Graduate student) - NSF GRFP and GROW fellowship recipient, Rahaminoff Travel Grant recipient (BSF), B. Jack White Award (Utah)

**Grace Nicora:** (Masters Student)

2/4/21

Dissertation Committee Member:

Jonna Turrill, Chad Moffitt, James Coleman, Lacey Padilla, Rachel Hopman, Brendan Ostlund, Erica Barhorst, Spencer Castro, Brady Decouto  
Roger Strong (Harvard), Giorgio Marinato (Università Di Trento)

Undergraduate Research Opportunities Program:

Patrick Stewart (x2), Isabel Reback (x2), Chris Jones, Steffi Falla (x2), Victoria Wilson (x2), Jacob Bedke (x2), Taren Rohovit (x2), Kobe Cornelison, Dylan Hutchinson

Honors students:

Patrick Stewart

Francis Family Foundation-Undergraduate Research Scholarships:

Steffi Falla

Human Factors Certificate Program:

Seuyong Yoon, James Guthrie, Taren Rohovit

Summer Program for Undergraduate Research:

Alexis Torres, Kobe Cornelison