BIOGRAPHICAL SKETCH

NAME: Elze, Tobias

POSITION TITLE: Instructor in Ophthalmology, Investigator

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Leipzig University, Leipzig, Germany	Diplom	10/2003	Psychology
Max Planck Institute for Mathematics in the Sciences, Germany	Ph.D.	08/2011	Computer Science
Schepens Eye Research Institute, Harvard Medical School, Boston, MA	Postdoctoral	12/2013	Ophthalmology

A. Personal Statement

I studied Psychology with focus on visual psychophysics at Leipzig University and was subsequently trained in bioinformatics and computational statistics at the Max Planck Institute for Mathematics in the Sciences during my Ph. D. studies. In 2011, I moved to the Schepens Eye Research Institute as a postdoctoral fellow where I had the opportunity to apply my expertise in computational data analysis to the field of ophthalmology. I studied the spatial configuration of glaucomatous visual field loss (e.g. T. Elze, L. R. Pasquale, L. Q. Shen, T. C. Chen, J. L. Wiggs, and P. J. Bex. Patterns of functional vision loss in glaucoma determined with archetypal analysis. *Journal of the Royal Society Interface*, 12(103):20141118, 2015. PMID: 25505132), investigated the optic nerve head region in the context of glaucomatous central vision loss (e.g. M. Wang, H. Wang, L. R. Pasquale, N. Baniasadi, L. Q. Shen, P. J. Bex, and T. Elze. Relationship between Central Retinal Vessel Trunk Location and Visual Field Loss in Glaucoma. *American Journal of Ophthalmology*, 176:53–60, 2017. PMID: 28088508) and the impact of retinal nerve fiber geometry to improve medical diagnosis (e.g. N. Baniasadi, M. Wang, H. Wang, Q. Jin, M. Mahd, and T. Elze. Impact of Anatomical Parameters on Optical Coherence Tomography Retinal Nerve Fiber Layer Thickness Abnormality Patterns. *SPIE Ophthalmic Technologies*, accepted). Apart from that, I have extensive programming experience in the field of vision research. For instance, I developed and maintain the stimulus presentation software FlashDot (http://www.flashdot.info).

B. Positions and Honors

Positions and Employment

2004-2011	Member of the research group “Complex Structures in Biology and Cognition”, Max Planck Institute for Mathematics in the Sciences, Germany
2013-	Instructor in Ophthalmology, Harvard Medical School. Boston, MA
2014-	Investigator, Schepens Eye Research Institute. Boston, MA

Honors

2013: Award for best clinical poster at the Annual Meeting of the Harvard Medical School, Department of Ophthalmology, for “*Finding Patterns in Glaucomatous Visual Field Loss: Components, Prototypes, and Archetypes*”

C. Contribution to Science

1. From the start of my scientific career to my postdoctoral period I have been working on the assessment of display technology for its applicability in vision science. I systematically and comparatively studied the three display technologies Cathode Ray Tube, Liquid Crystal, and Organic Light Emitting Diode and revealed for each of them a number of artifacts, which may impair vision science experiments.
   (a) Tobias Elze and Thomas G. Tanner. Liquid crystal display response time estimation for medical applications. *Medical Physics*, 36(11):4984-4990, 2009. PMID: 19994507
   (b) Tobias Elze and Thomas G. Tanner. Temporal properties of liquid crystal displays: Implications for vision science experiments. *PloS ONE*, 7(9):e44048, 2012. PMID: 22984458
   (c) Tobias Elze, Christopher Taylor, and Peter J. Bex. An evaluation of organic light emitting diode monitors for medical applications: Great timing, but luminance artifacts. *Medical Physics*, 40(9):092701, 2013. PMID: 24007183
2. From 2009 to 2011, I participated in visual neuroscience related research projects on object recognition and on prosopagnosia, i.e. the inability to recognize faces under otherwise unimpaired vision. We identified subtypes of prosopagnosia and investigated both impairments in the recognition of faces and memory related defects and developed a computational model to describe these deficits. Furthermore, we revealed impacts of prior experience on very early stages of visual processing.
   (a) Rainer Stollhoff, Jürgen Jost, Tobias Elze, and Ingo Kennerknecht. The early time course of compensatory face processing in congenital prosopagnosia. *PLoS ONE*, 5(7):e11482, 2010. PMID: 20657764
   (b) Rainer Stollhoff, Jürgen Jost, Tobias Elze, and Ingo Kennerknecht. Deficits in long-term recognition memory reveal dissociated subtypes in congenital prosopagnosia. *PloS ONE*, 6(1):e15702, 2011. PMID: 21283572

(c) Rainer Stollhoff, Ingo Kennerknecht, Tobias Elze, and Jürgen Jost. A computational model of dysfunctional facial encoding in congenital prosopagnosia. *Neural Networks*, 24:652-664, 2011. PMID: 21458953

(d) Tobias Elze, Chen Song, Rainer Stollhoff, and Jürgen Jost. Chinese characters reveal impacts of prior experience on very early stages of perception. *BMC Neuroscience*, 12:14, 2011. PMID: 21269486

3. In addition to the achievements described above, I contribute to the field of the optimal assessment of data in research and in clinical diagnosis. In my PhD thesis, I described important hardware and software issues related to the accurate presentation of visual stimuli and revealed that a majority the specification of short stimulus durations in the visual psychophysics literature was erroneous. My works helped to change the way that short stimuli are specified in the visual psychophysics literature today. From my postdoctoral period on, I have been contributing to the theory of optimal adaptive sampling and scheduling, i.e. the optimal placement of the next clinical or experimental measurement depending on the history of measurements of the patient in order to get the maximal information gain w.r.t. the respective disease. Apart from that, I programmed and maintain the open source software FlashDot for generating and performing experiments in vision research.

   (a) Tobias Elze. Achieving precise display timing in visual neuroscience experiments. *Journal of Neuroscience Methods*, 191(2):171-179, 2010. PMID: 20600318

   (b) Tobias Elze. Misspecifications of stimulus presentation durations in experimental psychology: A systematic review of the psychophysics literature. *PLoS ONE*, 5(9):e12792, 2010. PMID: 20927362

   (c) Stephan Poppe, Philipp Benner, and Tobias Elze. A predictive approach to nonparametric inference for adaptive sequential sampling of psychophysical experiments. *Journal of Mathematical Psychology*, 56(3):179-195, 2012. PMID: 22822269

   (d) Provisional patent PCT/US2016/037880 (2016): *Optimal Adaptive Scheduling of Clinical Assessments* (co-inventor, together with John Ackermann and Peter Bex)

4. Currently, I mainly work in the field of ophthalmology with a focus on structural and functional aspects of eye diseases. I am the PI of two research projects. One project studies the relationship between glaucoma and myopia. The second project aims to develop a novel staging system for dry AMD. Using methods from the field of machine learning, I developed a new classification scheme of patterns of glaucomatous vision loss. Furthermore, together with colleagues, I developed a mathematical model for the spatial representation of visual fields (patent).

   (a) Tobias Elze, Louis R. Pasquale, Lucy Q. Shen, Teresa C. Chen, Janey L. Wiggs, and Peter J. Bex. Patterns of functional vision loss in glaucoma determined with archetypal analysis. *Journal of the Royal Society Interface*, 12(103):20141118, 2015. PMID: 25505132

   (b) Patent PCT/US2014/052414 (2015). *Spatial Modeling of Visual Fields* (co-inventor, together with Philipp Benner and Peter Bex)

   (c) Hui Wang, Mengyu Wang, Neda Baniasadi, Qingying Jin, and Tobias Elze. Combining Retinal Nerve Fiber Layer Thickness with Individual Retinal Blood Vessel Locations Allows Modeling of Central Vision Loss in Glaucoma. *Proc. SPIE 10045, Opthalmic Technologies XXVII,* 100451M (February 8, 2017); doi: 10.1117/12.2251132

(d) Mengyu Wang, Hui Wang, Louis R. Pasquale, Neda Baniasadi, Lucy Q. Shen, Peter J. Bex, and Tobias Elze. Relationship between Central Retinal Vessel Trunk Location and Visual Field Loss in Glaucoma. *American Journal of Ophthalmology*, 176:53–60, 2017. PMID: 28088508

Complete list of peer-reviewed publications in My Biblography:

http://www.ncbi.nlm.nih.gov/sites/myncbi/tobias.elze.1/bibliography/48357357/public/?sort=date&direction=descending

D. Research Support

Completed:

Lions Foundation Grant Tobias Elze (PI) July 1, 2015—June 30, 2016
A Novel Method for Diagnosing Initial Onset of Glaucomatous Vision Loss
In this project, we apply bioinformatical methods to detect and analyze the spatial configuration of early glaucomatous vision loss and accompanying optical coherence tomography retinal nerve fiber layer thickness estimations around the optic nerve head and develop a computer algorithm to distinguish early glaucomatous vision loss from measurement noise or artifacts.
Role: PI

Lions Foundation Grant Tobias Elze (PI) July 1, 2016—June 30, 2017
Diagnosing Glaucoma in the Presence of Myopia
Myopia has been identified as a confounder for glaucoma diagnosis. In this project, we combine large data sets of optical coherence tomography retinal nerve fiber layer (RNFL) thickness measurements and visual fields and develop statistical models to improve the detection of true glaucomatous vision loss and true glaucomatous RNFL thinning in the presence of myopia.
Role: PI

Grimshaw-Gudewicz Foundation Grant Tobias Elze (PI) July 1, 2016—June 30, 2017
A Novel Staging System for Dry Age-related Macular Degeneration
In this project, we aim improve the clinical grading of nonexudative age-related macular degeneration (dry AMD). First, we aim to re-segment retinal layers on B-scans of macular spectral-domain optical coherence tomography (SD-OCT) measurements of dry AMD patients by a novel, customized 3-D active contour method in order to improve the detection drusen and geographic atrophy (GA) compared to conventional methods. Second, we will apply our novel drusen/GA detection scheme to a large longitudinal data set of SD-OCT scans of dry AMD patients, invoke statistical learning procedures to transform the data into a lower-dimensional space, and finally develop a novel staging scheme based on our improved drusen/GA definitions using the transformed data.
Role: PI

Current:

Institutional Startup Fund Tobias Elze (PI) September 1, 2014—August 31, 2017
Startup fund to establish a lab at Schepens Eye Research Institute.
Role: PI

Research to Prevent Blindness Grant Tobias Elze (PI) January 1, 2017—December 31, 2017
Association between retinal structure and age-related impairments
In this project, we develop methods to use eye imaging in order to detect impairments associated with age related diseases, such as glaucoma and AMD, at earlier stages than currently possible, ideally even prior to the manifestation of the respective impairment.
Role: PI

NIH R21-EY027882-01 Russell Woods (PI) March 1, 2017—February 28, 2019
Impact of Peripheral Islands in the Visual Field on Functional Ability in Patients with Retinitis Pigmentosa
In this project, we study the peripheral islands of the visual fields of retinitis pigmentosa patients. We investigate their frequency, spatial configuration, and their role w.r.t. the quality of life of the patients.
Role: Co-Investigator

BrightFocus Foundation Grant Tobias Elze (PI) July 1, 2017—June 30, 2019
Computational Investigation of Glaucoma Progression
In this project, we develop novel computational methods to assess the progression of glaucoma in retinal structure, visual function, and their combination. Machine learning techniques are applied to large data sets of Humphrey visual fields and optical coherence tomography measurements of glaucoma patients from different hospitals to re-define, predict, and quantify disease progression over time.
Role: PI