OMB No. 0925-0001 and 0925-0002 (Rev. 10/2021 Approved Through 09/30/2024)

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.

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| NAME: Ramamurthy, Mahalakshmi |
| eRA COMMONS USER NAME (credential, e.g., agency login): Maha.Ramamurth |
| POSITION TITLE: Postdoctoral Scholar |

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.)*

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| INSTITUTION AND LOCATION | DEGREE (if applicable) | START DATE MM/YYYY | COMPLETION DATE MM/YYYY | FIELD OF STUDY |
| Elite School of Optometry, BITS Pilani, Chennai. | BSc | 08/2004 | 09/2008 | Optometry |
| University of Waterloo, Ontario | MSc | 05/2009 | 11/2011 | Vision Science and Optometry |
| University of Massachusetts, Boston | PhD | 09/2012 | 12/2017 | Developmental and Brain Sciences |
| Harvard Medical School, Boston | Postdoc | 01/2018 | 10/2018 | Visual Rehab Lab |
| Stanford University, California | Postdoc | 10/2019 | Current | Brain Development and Education Lab |

### A. Personal Statement

I am a postdoctoral scholar working with Dr. Jason Yeatman. With a background in optometry, vision science, psychophysics and cognitive neuroscience my long-term goal is to study the intersection of basic visual mechanisms and various neurodevelopmental disorders and to extend this understanding in creating effective early screening tools, and in advancing evidence-based therapeutic and remediation programs. Inherent to this interest is the need for developmental data in large and demographically diverse populations. I strongly believe that such inclusive research not only contributes to scientific advancements but can go beyond to bridge health and education disparities. I joined the Brain Development and Education lab at Stanford after taking a medical break. During my break, I had the opportunity to run a vision screening camp for a school for differently abled children. Many children with a learning disability are misunderstood to have a vision problem making optometrist the first people to diagnose the disability but intervention stops at that point. This kindled my curiosity and I soon discovered the lack of converging understanding on the role of visual processing in dyslexia that in turn limits the possibility of evidence-based intervention. I was deeply interested in understanding the role of vision and attention in dyslexia. Over the past three years, I developed visual measures based on the most cited hypothesis in the dyslexia literature [1,2,4]. These measures were designed such that they inform us about the hypothesized construct in an ecologically relevant paradigm for reading. I developed a validation scheme where measures are first deployed on the adult population and various behavioral and eye tracking aspects of the measure are characterized. The measures are built on a browser-based platform (using PsychoPy© and jsPsych©) where they are validated against the laboratory-based measurements. All the web-based visual measures have timing parameters optimized to ensure measurement validity. Over the past year, I have focused on optimizing these visual measures to make them adaptive, short, and reliable for kindergarten and first grade children. My goal in the current project is to leverage this battery of visual measures to understand how visual deficits are linked to the development of reading disorders. The web-based assessments are designed to be deployed to a large and diverse population of unprecedented scale. Our partnership with the Multitudes (state-wide project to develop a dyslexia screener) provides us the feasibility to collect large longitudinal data where we can explore how kindergartener’s performance on the visual measures predicts future reading ability. In parallel, I will investigate the relationship between eye-tracking metrics in natural reading and neural markers in a cross-sectional study design.

1. Ramamurthy,Mahalakshmi., White,Alex L., Yeatman,Jason D,. Children with dyslexia show no deficit in exogenous spatial attention but show differences in visual encoding. [Preprint]. 2023 February 06. DOI: 10.31219/osf.io/s53ke
2. Ramamurthy M, White AL, Chou C, Yeatman JD. Spatial attention in encoding letter combinations. Sci Rep. 2021 Dec 17;11(1):24179. PubMed Central PMCID: PMC8683492.
3. Ramamurthy M, Blaser E. The ups and downs of sensory eye balance: Monocular deprivation has a biphasic effect on interocular dominance. Vision Res. 2021 Jun; 183:53-60. PubMed PMID: 33684826.
4. Yeatman JD, Tang KA, Donnelly PM, Yablonski M, Ramamurthy M, Karipidis II, Caffarra S, Takada ME, Kanopka K, Ben-Shachar M, Domingue BW. Rapid online assessment of reading ability. Sci Rep. 2021 Mar 18;11(1):6396. PubMed Central PMCID: PMC7973435.

### B. Positions and Honors

Positions and Scientific Appointments

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| 2020 | Member, Flux – A society for developmental cognitive neuroscientist aiming to advance the understanding of human brain development by serving as a forum for professional and student scientists, CA |
| 2019 | Postdoctoral Scholar, Stanford University, Pediatrics, Stanford, California |
| 2019 | Member, Member, Stanford Maternal and Child Health Research Institute, Stanford, CA |
| 2019 | Member , SPARK society - a society of Cognitive Scientists of color that improves the visibility of its membership and creates mentorship opportunities for junior cognitive psychologists of color, CA |
| 2018 - 2018 | Postdoctoral fellow, Schepens Eye Research Institute, Harvard Medical School, Boston, MA |
| 2012 - 2012 | Engineering Assistant, Industrial research lab, Christie Digitals private limited, Waterloo |
| 2011 - 2012 | Research assistant, University of Waterloo, Ontario., Waterloo |
| 2008 - 2009 | Visiting Lecturer, Human Physiology – School of Optometry, Sri Jayendra Saraswathi Institute of Medical Sciences & Research, Chennai |
| 2008 - 2009 | Lecturer, General Anatomy & Ocular Anatomy, Elite school of Optometry, Brila Institute of Technology, Chennai |

Honors

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| 2020 | Two-year postdoctoral fellowship , Stanford Maternal and Child Health Research Institute |
| 2015 | Dissertation Proposal grant award, University of Massachusetts, Boston |
| 2015 | Linking Circuits Perception and Behavior - student award, Cold Spring Harbor course on Vision |
| 2014 | Travel Award, Vision Science Society |
| 2013 | Joseph. H. Healey grant , University of Massachusetts, Boston |
| 2012 | Dean of Science Award for outstanding research, University of Waterloo |
| 2012 | Graduate Research Studentship, University of Waterloo |
| 2011 | University of Waterloo Graduate Scholarship & Graduate Experience Award, University of Waterloo |
| 2010 | University of Waterloo Graduate Scholarship & Graduate Experience Award, University of Waterloo |
| 2009 | International Master’s Student Award , University of Waterloo |
| 2008 | Excellence in Human Anatomy- Cooper Award, Elite School of Optometry, Brila Institute of Technology |
| 2008 | Excellence in Pediatric Optometry, Elite School of Optometry, Brila Institute of Technology |
| 2007 | Dr. S. Srinivasan Award for the Best Project of the Year, Elite School of Optometry, Brila Institute of Technology |
| 2007 | Essilor Award in Dispensing Optics, Elite School of Optometry, Brila Institute of Technology |
| 2005 | Appreciation award for, “Literature search on the Duochrome test”., Elite School of Optometry, Brila Institute of Technology |

### C. Contribution to Science

1. Early Career: My undergrad project was on the clinical validity of a widely used test in optometric practice. The bichrome test is used to test the end point of subjective refraction and uses the principle of chromatic aberration in the human visual system. The objective of this study was to compare the effect of changing the background and foreground of the bichrome test on the end point of subjective spherical refraction. The study empirically showed no statistical difference between the two versions although the contrast reversed version was better for the color deficient group and therefore was clinically more relevant. All screening devices were recommended to be manufactured with contrast reversed to be able to cater to a wider population. This work was recognized as the best undergraduate thesis and published as a conference paper in the Frontiers in Optics. These early experiences molded my thinking and taught me the research process – from the inception of a question, to testing it with the right methodology.
   1. Ramamurthy M, Varadharajan S. a. Ramamurthy. M., Varadharajan. L. S (2010) Effects of Changing Duochrome’s Foreground and Background on the End Point of Subjective Spherical Refraction. In Frontiers in Optics. Optical Society of America. 2010 January.
2. Graduate Career: My masters’ thesis involved studying a practical problem with flat panel displays using applied psychophysics. All flat panel display monitors have variations in color and brightness as the viewing angle changes. My experiments showed that human observers were more sensitive in the blue-green range of the color spectrum and that correlated with the shifts noted in these displays. This meant that the industrial color calibration standards were not based on human observer data and needed to be modified to be visually satisfying. This work was published and awarded the Dean of Sciences award from the University of Waterloo for its creativity and design. With extensive training on applied psychophysics and motivated by my clinical experience/observations on various neurological developmental disorders I pursued my PhD in Developmental and Brain Sciences, University of Massachusetts. My doctoral research directly impacted in the treatment of amblyopia (a neurodevelopmental disorder). A new counter-intuitive form of plasticity was reported in adult humans (called short-term effects) where the deprived eye gains sensitivity post deprivation and many studies were purporting this as the new treatment for Amblyopia (lazy eye, a neurodevelopmental disorder). In my thesis, I investigated the time course of the deprivation effect by monocularly depriving participants for 10 hours and showed that these short-term effects are present up until 5 hours, and then they saturate. This inflection reflected the point at which the rapid homeostatic (defense mechanism to maintain stability) response has saturated, and is overtaken by a slower, opposing mechanism – meaning that without studying the underlying mechanism a treatment based on short-term effects is detrimental to patients with Amblyopia. I further showed that the response of the visual system is not specific to just perturbations in stimulus properties but is also sensitive to higher level obliteration like ecological relevance of the received information. Together, these studies inform the field on the mechanisms behind the counterintuitive plasticity where the deprived eye undergoes a temporary boost in contrast gain and why this phenomenon shouldn’t guide occlusion treatments for amblyopia.
   1. Ramamurthy M, Blaser E. The ups and downs of sensory eye balance: Monocular deprivation has a biphasic effect on interocular dominance. Vision Res. 2021 Jun;183:53-60. PubMed PMID: 33684826.
   2. Ramamurthy M, Blaser E. Assessing the kaleidoscope of monocular deprivation effects. J Vis. 2018 Dec 3;18(13):14. PubMed PMID: 30572342.
   3. Ramamurthy M, Blaser E. New rules for visual selection: Isolating procedural attention. J Vis. 2017 Feb 1;17(2):18. PubMed PMID: 28245497.
   4. Ramamurthy M, Hovis J, Zsivanov D, Lakshminarayanan V. Color shifts at different viewing eccentricities on flat-panel rear projection displays in steps of perceptibility threshold units. Journal of Modern Optics. 2013 August; 60(14):1151-1158. Available from: http://www.tandfonline.com/doi/abs/10.1080/09500340.2013.806682 DOI: 10.1080/09500340.2013.806682
3. Postdoctoral Career: During my medical break in India that lasted for over 11 months, I spent time volunteering at the spastic society of India observing visual performance in differentially abled children. Majority of children with learning disabilities are thought that their disability is due to a vision problem and oftentimes the first person to detect a learning disability is an optometrist. These children clearly present with no visual deficit but sadly treatment ends there since the state-of-art on remediation programs for learning disabilities is almost none in India and seems to be no better world-wide. This experience motivated me to look for a position to study learning and reading disabilities. This also made me realize that despite decades of research, very little is known about basic visual mechanisms in such disorders and often the findings are not generalizable. Studying these mechanisms in a large, diverse, and representative population is one way we, responsible scientists, can bridge existing health and education disparities. My work at the Brain Development and Education lab at Stanford has primarily been on investigating the role of visual attention in dyslexia. Some of the longstanding hypotheses in the literature that link various deficits to reading ability are inconclusive largely due to small sample size, variations in the paradigms and the lack of clear operationalization of constructs tested. This contributes to a major knowledge gap in the field in understanding what visual factors (processing and cognitive) are causal and what visual factors are reliable co-morbidities to reading development. During my training, I have developed ecologically relevant paradigms to measure visual attention, visual encoding, error patterns when encoding a string of visual objects, task generic attention, and visual motion sensitivity. I have validated visual encoding and visual attention measures for robustness in skilled readers (adult population) and extended the paradigm as a gamified task to children. I also received training on using item response theory to model how the ability to perform these visual measures changes across different age-groups and have successfully utilized data-informed design changes to my current paradigm and to make it adaptive and reliable for younger children (4-5yrs, paper in preparation). In addition, I have developed a pipeline to investigate eye-tracking measures and a with-in subject design to study how visual attention and eye movement patterns are interrelated. I envision in academia.
   1. Ramamurthy,Mahalakshmi., White,Alex L., Yeatman,Jason D,. Children with dyslexia show no deficit in exogenous spatial attention but show differences in visual encoding. [Preprint]. 2023 February 06. DOI: 10.31219/osf.io/s53ke
   2. Ramamurthy M, White AL, Chou C, Yeatman JD. Spatial attention in encoding letter combinations. Sci Rep. 2021 Dec 17;11(1):24179. PubMed Central PMCID: PMC8683492.
   3. Yeatman JD, Tang KA, Donnelly PM, Yablonski M, Ramamurthy M, Karipidis II, Caffarra S, Takada ME, Kanopka K, Ben-Shachar M, Domingue BW. Rapid online assessment of reading ability. Sci Rep. 2021 Mar 18;11(1):6396. PubMed Central PMCID: PMC7973435.

### D. Scholastic Performance

Scholastic Performance

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| YEAR | COURSE TITLE | GRADE |
| TODO | | |
| 2012 | PSYDBS 610 Behavioral Neuroscience | A |
| 2013 | PSYCLN 670 Advanced Statistics | A |
| 2013 | PSYDBS 620 Cognitive Neuroscience | A |
| 2014 | PSYDBS 771 Matlab for Behavioral Sciences | A |
| 2014 | PSYDBS 621 Dev. Cogn. Neuroscience | A |
| 2014 | PSYDBS 797 Special Topic:Mechanisms of Attention | A |
| 2015 | PSYDBS 795 Independent Study | A |