

## Robert Ennis

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- EDUCATION** *Bachelor of Science, Physics*  
*Bachelor of Arts, Psychology* - worked in lab of Dr. Arthur Shapiro during 2008  
Bucknell University, Lewisburg, PA, USA  
2004-2008
- Ph.D., Visual Neuroscience*  
Labs of Dr. Qasim Zaidi and Dr. Barry Lee  
SUNY College of Optometry, New York, NY, USA  
2008-2013
- POSITIONS** *Postdoctoral Researcher, Psychology*  
Lab of Dr. Karl Gegenfurtner  
Justus-Liebig University, Giessen, Germany  
2013-2015
- Postdoctoral Researcher, Psychology*  
Lab of Dr. Katja Doerschner  
Justus-Liebig University, Giessen, Germany  
2015-2022
- Postdoctoral Researcher, Psychology*  
Lab of Dr. Karl Gegenfurtner, in close collaboration with Dr. Katja Doerschner  
Justus-Liebig University, Giessen, Germany  
2022-Present
- MY PAGES** Personal (with research overview): <https://www.allpsych.uni-giessen.de/rob/>  
Github: <https://github.com/rennis250>
- BOOK CHAPTERS** Gegenfurtner K, **Ennis R.** (2014) *Fundamentals of color vision II: higher-order color processing* in AJ Elliot, MD Fairchild, A Franklin (Eds.), Handbook of Color Psychology (pp. 70-109). Cambridge, UK: Cambridge University Press.
- PUBLICATIONS** **Ennis R,** Doerschner K. (2021) The color appearance of curved transparent objects. Journal of Vision, 21(5):1-48.
- Cavdan M, **Ennis R,** Drewing K, Doerschner K. (2021) Constraining haptic exploration with sensors and gloves hardly changes the multidimensional structure of softness perception. 2021 IEEE World Haptics Conference, pp. 31-36.
- Ennis R,** Doerschner K. (2019) Disentangling simultaneous changes of surface and illumination. Vision Research, 158:173-188.
- Ennis R,** Zaidi Q. (2019) Geometrical structure of perceptual color space: mental representations and adaptation invariance. Journal of Vision, 19(12):1-17.
- Ennis R,** Schiller F, Toscani M, Gegenfurtner K. (2018) Hyperspectral database of fruits and vegetables. Journal of the Optical Society of America A, 35(4):B256-B266.

Milojevic Z, **Ennis R**, Toscani M, Gegenfurtner K. (2018) Categorizing natural color distributions. *Vision Research*, 151:18-30.

**Ennis R**, Toscani M, Gegenfurtner K. (2017) Seeing lightness in the dark. *Current Biology*, 27(12):R586-R588.

Dul M, **Ennis R**, Radner S, Lee B, Zaidi Q. (2015) Retinal adaptation abnormalities in primary open-angle glaucoma. *Investigative Ophthalmology & Visual Science*, 56(2):1329-1334.

**Ennis R**, Cao D, Lee B, Zaidi Q. (2014) Eye movements and the neural basis of context effects on visual sensitivity. *Journal of Neuroscience*, 34(24):8119-8129

Zaidi Q, **Ennis R**, Cao D, Lee B. (2012) Neural locus of color afterimages. *Current Biology*, 22(3):220-4.

Shapiro A, Lu ZL, Huang CB, Knight E, **Ennis R**. (2010) Transitions between central and peripheral vision create spatial/temporal distortions: a hypothesis concerning the perceived break of the curveball. *PLoS ONE*, 5(10):e13296.

**CONFERENCE PUBLICATIONS** Doerschner K, **Ennis R**, Börner P, Maile F, Gegenfurtner K. (2023) Color appearance of iridescent objects. London Imaging Meeting: Material Appearance.

**INVITED TALKS** **Ennis R**. (2019) The Color Appearance of 3-D, Thick, Transparent Objects. SUNY Optometry, SIVR Colloquium.

**Ennis R**, Doerschner K. (2018) Disentangling simultaneous transparency and illumination changes. *Human Vision and Electronic Imaging, Society for Imaging Science and Technology*.

**TALKS** Gegenfurtner K, Chen J, Toscani M, Guan S, **Ennis R**, Valsecchi M, Chadwick A, van Doorn A, Koenderink J. (2023) 100 years of luminance. Rauschholzhausen Color Workshop.

Doerschner K, **Ennis R**, Boerner P, Maile F, Gegenfurtner K. (2023) Iridescent color appearance. Rauschholzhausen Color Workshop.

**Ennis R**, Gegenfurtner K, Doerschner K. (2022) Color constancy as a function of similarity in material appearance. *Vision Sciences Society*.

**Ennis R**, Doerschner K. (2019) The color appearance of three-dimensional, curved, transparent objects. *International Colour Vision Society, Riga, Latvia*.

Doerschner K, **Ennis R**. (2018) The color appearance of transparent, tinted, thick objects. *The Skin of Things, Amsterdam, Netherlands*.

**Ennis R**, Toscani M, Schiller F, Hansen T, Gegenfurtner K. (2016) Giessen's hyperspectral images of fruits and vegetables database (GHIFVD). 39th ECVP, Barcelona, Spain. *Perception*, 45(S2):177.

**Ennis R**, Toscani M, Gegenfurtner K. (2015) Scotopic lightness perception. 38th ECVP, Liverpool, UK. *Perception*, 44(S1):101.

**Ennis R**, Zaidi Q. (2014) The geometry of color similarities. Fall Vision Meeting, Philadelphia, PA, USA. *Journal of Vision*, 14(15):18.

Zaidi Q, **Ennis R**, Cao D, Lee B. (2014) Eye-movements and the neural basis of context effects on temporal sensitivity. *Journal of Vision*, 14(10):201.

**Ennis R**, Zaidi Q. (2013) Geometrical structure of perceptual color space is affine. Vision Sciences Society. *Journal of Vision*, 13(9):295.

## POSTERS

**Ennis R**, Guan S, Toscani M, Gegenfurtner K. (2023) Color experiments in the wild internet? Rauschholzhausen Color Workshop.

**Ennis R**, Gegenfurtner K, Doerschner K. (2023) Color constancy across materials. Rauschholzhausen Color Workshop.

**Ennis R**, Doerschner K. (2019) The colors of 3-D, thick, curved transparent objects. Vision Sciences Society.

Alley L, Toscani M, **Ennis R**, Doerschner K. (2019) Fixations differ for brightness and stiffness judgements. Vision Sciences Society.

**Ennis R**, Doerschner K. (2018) Estimates of surface friction are mostly driven by linear motion. 41st ECVF, Trieste, Italy. *Perception*, 48(S1).

**Ennis R**, Doerschner K. (2017) Unraveling simultaneous transparency and illumination changes. Vision Sciences Society, *Journal of Vision*, 17(10):135.

**Ennis R**, Doerschner K. (2016) Separating surface changes from illumination changes. Vision Sciences Society. *Journal of Vision*, 16(12):218.

**Ennis R**, Toscani M, Gegenfurtner K. (2015) At night even white cats are gray: scotopic lightness perception. Vision Sciences Society. *Journal of Vision*, 15(12):636.

Milojevic Z, **Ennis R**, Gegenfurtner K. (2014) Color classification of leaves. 37th ECVF, Belgrade, Serbia. *Perception*, 43(S1):146.

Milojevic Z, **Ennis R**, Gegenfurtner K. (2014) Color categorization of natural objects. Vision Sciences Society. *Journal of Vision*, 14(10):464.

Radner S, **Ennis R**, Lee B, Dul M, Zaidi Q. (2013) Adaptation abnormalities in Primary Open-Angle Glaucoma. ARVO. *Investigative Ophthalmology & Visual Science*, 54(15):3939.

**Ennis R**, Zaidi Q. (2012) Geometrical investigations of perceptual color space. Society for Neuroscience, New Orleans LA, USA.

**Ennis R**, Lee B, Zaidi Q. (2011) Physiological signature of time-varying color afterimages. Vision Sciences Society. *Journal of Vision*, 11(11):378.

**Ennis R**, Zaidi Q. (2010) Cortical aftereffects of time-varying chromatic stimuli. Vision Sciences Society. *Journal of Vision*, 10(7):395.

Cao D, Lee B, **Ennis R**. (2010) Receptive Field Structure of Primate Parasol Ganglion Cells Defined by Rod and Cone Inputs. ARVO. *Investigative Ophthalmology & Visual*

Science, 51(13):5177.

**Ennis R**, Lee B, Zaidi Q. (2009) The effects of eye movements on contrast detection. Society for Neuroscience, Chicago, IL, USA.

**CONTINUING  
EDUCATION**

European Summer School (2014), Visual Neuroscience: From Spikes to Awareness. <https://www.allpsych.uni-giessen.de/rauisch/>

**WEBSITES**

**Ennis R**, Schiller F, Toscani M, Gegenfurtner K. (2018) Giessen's hyperspectral images of fruits and vegetables database (GHIFVD). <http://www.allpsych.uni-giessen.de/GHIFVD/>

Developed the Chronopilot website, based on a colleagues design, for the lab of Dr Knut Drewing (2020). <https://www.chronopilot.eu/>

Developed the lab webpage of Dr. Qasim Zaidi, using a self-built PHP system designed for others to easily update the page after I left the lab (2012): <https://www.sunyopt.edu/labs/Zaidi/index.php>

**AD HOC  
REVIEWER**

Journal of Vision  
Color Research and Application  
Attention, Perception, & Psychophysics  
Journal of Perceptual Imaging  
Vision Research  
Arts (MDPI)  
Brain Sciences (MDPI)  
Vision (MDPI)

**WORK  
EXPERIENCE**

*Textures.com* 2022  
Fixed bugs in the GLTF and xAtlas processor of one of their projects and added some additional features to it. Required working in C++ (Visual Studio) and scripting Blender in Python.

**TEACHING  
EXPERIENCE**

*Color Chats* - Justus-Liebig University Giessen 2013  
Upon arriving at Justus-Liebig University Giessen, I was encouraged by some of my colleagues to organize a meeting to teach the basic concepts of color perception necessary for carrying out experiments. Six of us met once a week for almost two months to informally discuss foundational papers and tutorials that I thought were useful.

*Ph.D. advising assistant* - Justus-Liebig University Giessen 2013-2016  
Assisted in advising a Ph.D. student that focused on color perception. I was tasked with teaching the student how to program in MATLAB with the Psychtoolbox, how to calibrate monitors, how to work in various colorspaces, how to carry out psychophysical experiments and subsequently perform image/data analysis, and how to prepare conference posters and manuscripts.

*Bachelor and Masters thesis advisor* - Justus-Liebig University Giessen 2018-2022  
Advised (mostly in German) a Bachelor Psychology student on an experiment investigating the capabilities of observers to estimate the wind and its effects on other objects. The student learned some Blender in the process and carried out a 3-way within-subjects design. The student also learned the difference between heuristic-based responses to physical events and a system that uses a model of physics to respond to physical events. Since then, have advised another Bachelor student with their the-

sis (material perception in VR), as well as a Masters student with their thesis (color perception of real iridescent objects).

*Matlab teaching* - Justus-Liebig University Giessen 2019-2020  
Taught a mixture of Bachelor and Masters psychology students how to program in the Matlab environment. For most of them, it was their first experience with programming. Many laughs were had along the way.

*Javascript teaching* - Justus-Liebig University Giessen 2020  
Taught people in my lab how to use JavaScript and Three.js to design psychophysical stimuli for online experimentation. The course was held virtually.

## ADDITIONAL EXPERIENCE

*Undergraduate* 2004-2008  
Lab of Dr. Arthur Shapiro

- Learned how to design and program visual stimuli and contrast-based illusions in Adobe Flash and Actionscript (2 and 3)
- Learned the basics of psychophysical experimentation and assisted with experiments
- Learned the basics of color vision and perception in general
- Implemented a physically-based 3D simulation of a curving, spinning baseball to compare with Dr. Shapiro's research on the perception of moving gratings in central and peripheral vision

*Ph.D.* 2008-2013  
Labs of Dr. Qasim Zaidi and Dr. Barry Lee

- Learned how to perform the basics of electrode implant surgery to measure retinal ganglion cell responses to stimuli
- Gained experience in maintaining a file backup and sharing server that is still in use today
- Created the lab webpage using Dr. Zaidi's preferred design (<https://sunyopt.edu/labs/Zaidi/index.php>). It uses a simple, hand-written PHP backend that I built to make it easy for future members of the lab to update the page, which is still in use today
- Learned how to calibrate monitors for color vision research
- Learned the CRS Visage and CRS visual stimulus language
- Programmed a staircase procedure for measuring psychophysical thresholds from scratch

*Postdoctoral Researcher* 2013-2015  
Lab of Dr. Karl Gegenfurtner

- Gained extensive experience in using a Specim hyperspectral camera and with processing the image format, which was necessary after the software broke and no update was available
- Wrote software in various languages for processing and analyzing hyperspectral images, which were shared with the public under the MIT open-source license
- Gained further experience in maintaining Linux and Windows systems for psychophysical experiments, high-performance parallel data analysis, Deep Neural Networks, file backup, webpages, and shared calendars for booking labs
- Gained further experience in writing and maintaining webpages for data archiving and public sharing of analysis software

*Postdoctoral Researcher* 2015-Present  
Lab of Dr. Katja Doerschner

- Gained experience working with 3D printers

- Ran an online WebGL experiment using JSPsych and three.js where observers could see physical simulations of sliding objects in real-time
- Gained experience using Blender for physics simulations and gained experience in scripting Blender
- Gained some experience in training the DeepArt DNN (Gatys, Ecker, & Bethge) to produce variations on artwork for a visual aesthetics experiment
- Gained some experience in programming HMDs (Oculus Rift, HTC Vive Pro) on Linux in Psychtoolbox and in C++ and Rust using the OpenHMD library
- Continued maintenance of servers and computers for various labs at Justus-Liebig University. Number of servers being overseen: 6 (3 Linux, 1 Linux-based NAS, 2 Windows)
- Assisted others in the department with getting comfortable in the Linux command-line if they were new to it
- Developed a web-browser based, real-time, multispectral, physically-based rendering system in Three.js and Aframe to do online color/material perception experiments in VR. It was based on Mitsuba/PBRT and various resources gathered from the ShaderToy community.

*Postdoctoral Researcher*

2022-Present

Lab of Dr. Karl Gegenfurtner

- Sophos Central administrator for our department
- Supporting administrator for the online component of our ExPra educational system (where Bachelor psychology students get their first experience running psychophysical experiments). Translated all experiments to JavaScript and p5.js for online data collection during Covid-19 lockdown
- Developed a system in TypeScript, based on p5.js, to simplify the design and creation of online psychophysical experiments. It uses a JSON based stimulus and experiment specification format, so that users do not have to waste time programming repetitive experiment loops.

## COMPUTER SKILLS

*Languages/Environments:* MATLAB/Octave/Psychtoolbox, Observable (new user), R, Python, Rust, Processing/p5.js, Go, (some) PHP, HTML/CSS, JavaScript/TypeScript, GLSL, (some) SQL, Bash/KSH/ZSH/rc command-line shells, (some) CUDA for working with Nvidia's Optix, C/C++

*Operating systems:* Windows/Cygwin/MSYS, Linux (Ubuntu/Fedora/Archlinux), MacOS, Unix (in particular, OpenBSD), (some) Plan9

*Libraries:* experience with Arrayfire, FFTW, and VIPS (image processing suite); Python's science and plotting packages (e.g., NumPy/SciPy/Matplotlib/Seaborn)

*Various software & tools:* Blender, Mitsuba, gnuplot, (some) Radiance, (some) OpenSCAD, (some) SPSS, Pico-8, many command-line tools, GIMP/Inkscape

*Version control:* active user of git since 2009 and Github user since 2011, and also familiar with mercurial and Bitbucket/Gitlab

*Document preparation:* LaTeX, troff/nroff/groff, Markdown/Pandoc, Unix man pages, Microsoft Office/Libreoffice/Keynote

*Text editors:* VSCode, Sublime Text, vim, Emacs, sam, Acme, and others

*Rendering theory:* knowledge of and experience with implementing raytracers and raymarchers on the CPU and GPU; have read various tutorials on the theory behind

rendering, including the standard reference, Physically-based Rendering Theory

*Programming language theory*: basic experience with implementing lexers, parsers, interpreters, compilers, and byte-code virtual machines; have built a functional, but basic, Lisp implementation following an online tutorial (<https://github.com/kanaka/mal>)

*Computer graphics*: OpenGL; knowledge of some demoscene effects

*Video games*: experience with implementing Pacman and Super Mario Bros. clones; during the 2019 Revision demoscene party, two friends and I created a side-scrolling spaceship shooting game in the Pico-8 environment, where the enemies were generated according to one friend's idea, which used the rules of Conway's Game of Life (<https://www.pouet.net/prod.php?which=81147>)

*Computer security*: active user of SSH, GPG, HTTPS enforcing-plugins, and encryption

*Cloud computing*: 9 years of experience maintaining an active ownCloud instance

## LANGUAGES

- English - native speaker
- German - B2 certificate from the Goethe-Institut, and have been living in Germany for 10 years and speaking German on a daily basis here

## HONORS

- Boy Scouts of America - Eagle Scout

## ACTIVITIES AND INTERESTS

- All forms of art and design
- Hiking, camping, climbing, walking and talking
- Comedy; anything funny
- I love kettlebells (currently training for my instructor certification)
- I also love Animal Flow
- Obscure and old computers/operating systems
- Guinea pigs and cats
- Novice bread baker
- Old video games and some new (do not play so often, though)
- Obscure history about computers and science
- Boardgames (chess, backgammon, Settlers of Catan, etc.), card games (in particular, Set and Magic), roleplaying games (DnD)
- Classical music, electronic music, jazz, and older rap/hip-hop (I like some newer work, too!)
- Poetry, comic books, short stories, novels, books in general
- Trying to learn more math (at the moment, more statistics and differential geometry)
- Movies (sci-fi, comedy, horror, drama, documentary) and TV shows (comedy, drama, sci-fi, documentary) - currently working my way through all of Star Trek