

Christian Scholarship in the Service of Students



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PROFESSOR OF PHYSICS

COLLEGE OF SCIENCES AND MATHEMATICS

BELMONT UNIVERSITY

FACULTY SCHOLARSHIP AWARD PRESENTATION

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Big Picture: My Scholarship is Student-Focused



Preparing students* for the future
in a technological environment undergoing rapid,
profound change.



*at the interface of physics, audio engineering
technology (AET), and computer/data science

Big Picture: Student-Focused Scholarship, pt. 2



“In CSM, we don’t do research for the sake of research, it’s all about the students.”

—Dean Thomas Spence

- Giving students opportunities to do research
- Doing research that forms our understanding of students’ needs -- now and for the future
 - Staying current about the world our students will enter
- Developing ways to meet students’ needs
- Feeding all this back into the classroom

3 Formative Experiences for My Scholarship



D

2013: Audio Engineering Society

Discovery & Application

My first AES conf. Spoke on *integration* of quantum physics & AET.

A

First exposure to machine learning (ML): speaker after me!

I identified 3 technologies that would *change my students' lives*: ML, VR, & Spatial Audio. Started studying ML, got hooked,...am a world authority on ML-audio. Developed **SignalTrain** model. (Have also done bit of VR & SA)

T

2016: Yang-Han Kim's ASA Rossing Prize Lecture SoTL

Education prize at Acoustical Society of America (ASA) conf.

On the importance of *visualization* for teaching acoustics -> My **app**-writing.

I

2017-2019: "Oxford Grant"

Integration

"Bridging the Cultures of Science & the Humanities II (**B2C2**)," run by Scholarship & Christianity in Oxford (SCIO), Templeton + Belmont.

My project, "Christian Responses to the Ascendancy of A.I."

Got "hooked on AI-Ethics" too!

Began receiving invitations to *write*: essays & book chapters.

Inspired my book project on Classification: Philosophy+Psych+ML+...

Context of Discovery & Application



Discovery and Application in Science at small undergraduate college: challenging!

Unlike most science: teams with postdocs, grad students, large equipment budgets (\$100K-\$10M+/yr)...

Unlike graduate & professional schools...

My work in CSM involves...

- Being solo or First Author
- No grad students or postdocs
- No course releases (12 & 12)
- Minimal equipment (\$2K/yr)



Yet Discovery & Application are major parts of my Scholarship!

Giving Undergrads Opportunities to do Research

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Billy Mitchell (now in grad school at UNT Denton):

- ★ Paper: Mitchell & Hawley, “**Exploring Quality & Generalizability in Parameterized Neural Audio Effects**,” JAES Oct 2020.
- ★ 3 Talks: American Physical Society, Group on Data Science, May 8 2020; AES New York, Oct 2020; Spring ASA meeting (accepted but canceled b/c COVID)

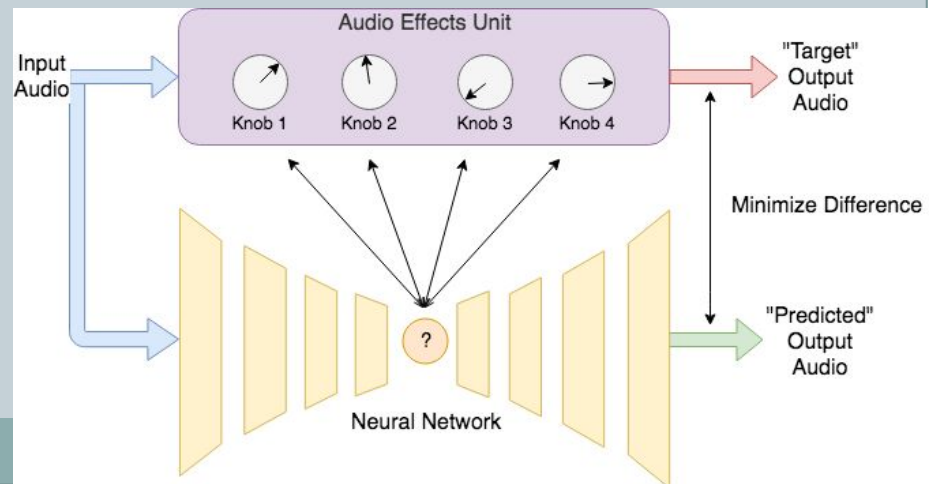
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Ben Colburn (now in grad school at U. Florida):

- ★ 2021: “[Dolby Researchers Train Audio A.I. on Belmont Student’s Recordings](#),”
- ★ Paper: Hawley, Colburn, & Mimitakis: “[**SignalTrain**:] **Profiling Audio Compressors with Deep Neural Networks**,” JAES, Oct 2019.
- ★ SignalTrain LA2A Dataset, 2019.

SignalTrain:



Giving Undergrads Opportunities to do Research, 2



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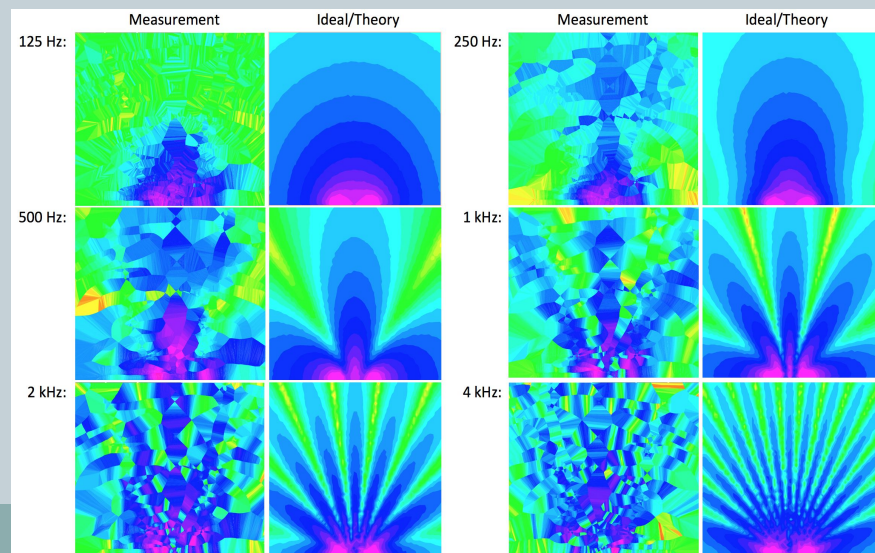
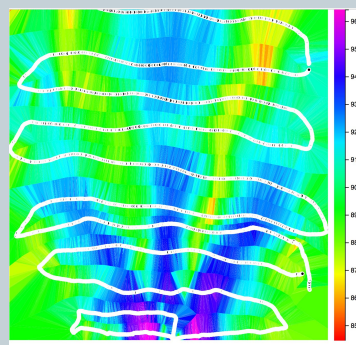
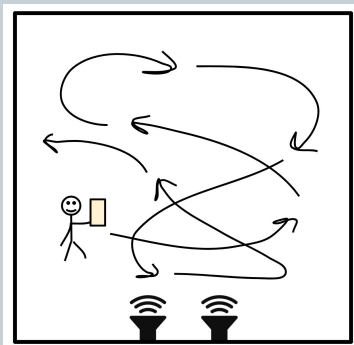
Andrico Mourelatos: (came to Oxford on B2C2, Summer 2019)

- ★ Report: Mourelatos & Hawley, “AI Creeds & Confessions,” AI & Faith Newsletter (Trade/scholarly publication), Oct 2019.

Sebastian Alegre & Brynn Yonker: SURFS 2017

“Sound Fields Forever: Mapping sound fields via position-aware smartphones,” Hawley, Alegre & Yonker (2017)

- ★ Talks at AES New York, ASA New Orleans, Circuit Benders Ball Nashville



Context of Integration & SoTL



Integration and Teaching-& Learning are keys to the mission and “soul” of Belmont.

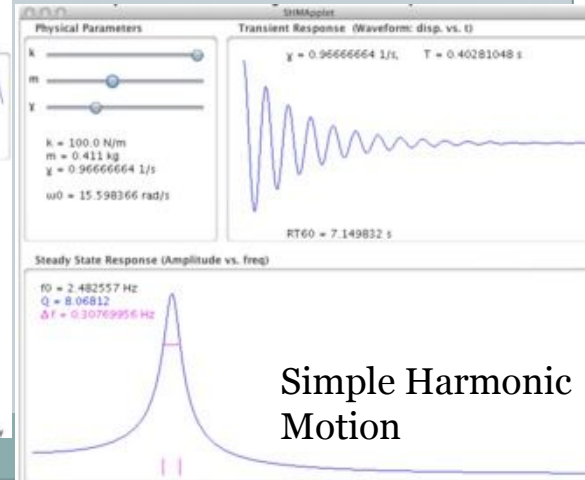
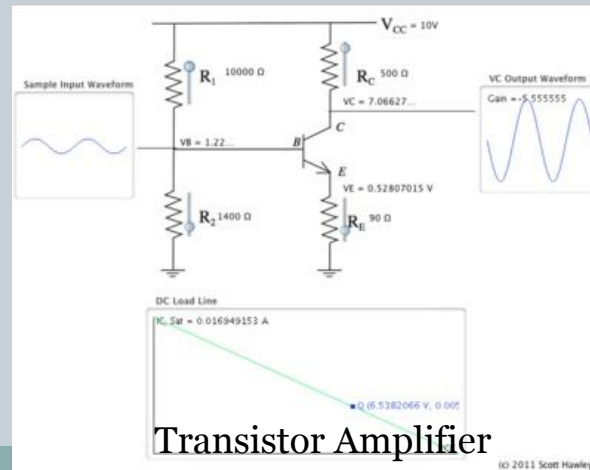
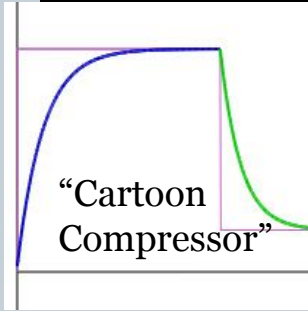
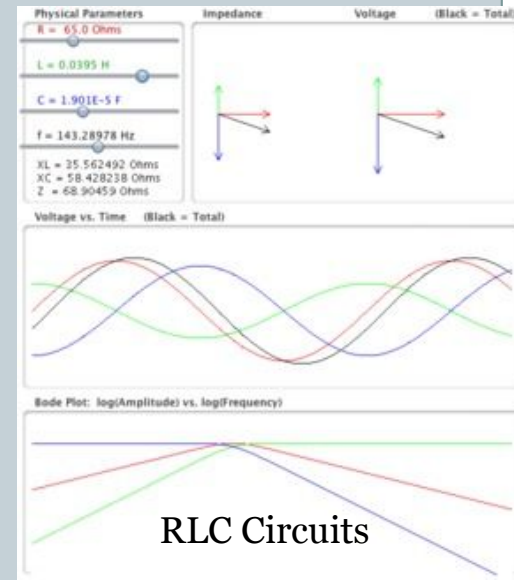
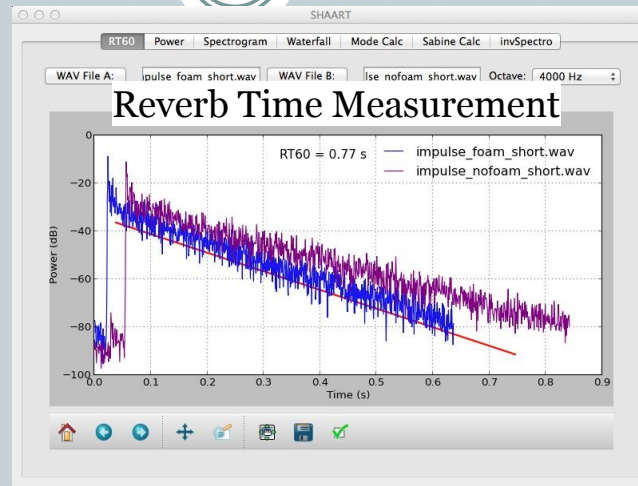
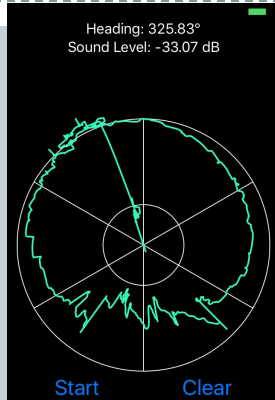
“Faith & Science”: Belmont & CSM actively encourage faculty & students to integrate their whole worldviews: in classes; via events such as invited speakers for Faith & Science Chapel services; via clubs, e.g. **Science & Religion Club of Belmont** (Faculty advisor: Hawley)

My SoTL *integrates* my tech & teaching: online & app-building...

“Reflections on the Development of Interactive Learning Tools”

Belmont Scholarship of Teaching & Learning (SoTL) Workshop,

2016



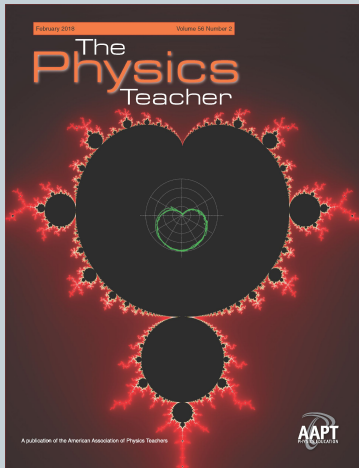
Impact & Reach



International:

- ★ *The Physics Teacher*: Cover, Feb. 2018
- ★ *Acoustics Today*: “Most popular article of 2020!”
- ★ Rumsey’s AES Article - First 1.5 pages on SignalTrain
- ★ Dolby (Barcelona): SignalTrain “**current state of the art**”
- ★ Art+Logic Incubator Lab: Winner
- ★ FaithTech 2020 Writing Contest: Winner
- ★ *AIGrant.org*: Finalist 2x
- ★ *Citizenship in a Networked Age (UK+US)*: Advisor
- ★ Promotion-tweets from UK, Germany, US: Bryson, Edwards, Meier-Hann, Schaefer, Howard
- ★ *TandemLaunch/TONZ.ai (Montreal+UK)*: Faculty Board member
- ★ Currently assigned #4 of *Theopolis Institute’s* 6-essay “Conversation” on Digital Public Sphere, US+UK.

Impact & Reach: "Press" Examples



FEATURE ARTICLE

Modeling audio effects

Francis Rumsey
Consultant Technical Writer

Dynamic range compression (DRC) is a common audio effect used in music production, and it is commonly understood to be a non-linear process. The technique usually involves a compressor that has a variable gain control, the amount of gain being determined by the level of the audio signal. It is possible to construct a digital version of a compressor that does not require the use of a variable gain control. This paper describes a method for modeling the compression effect of a compressor using a neural network. The model is trained on a set of audio signals, and the results are compared to those of a commercial compressor. The model is shown to be able to replicate the behavior of a compressor, and the results are compared to those of a commercial compressor.

ARTICLE ABSTRACT

Dynamic range compression (DRC) is a common audio effect used in music production, and it is commonly understood to be a non-linear process. The technique usually involves a compressor that has a variable gain control, the amount of gain being determined by the level of the audio signal. It is possible to construct a digital version of a compressor that does not require the use of a variable gain control. This paper describes a method for modeling the compression effect of a compressor using a neural network. The model is trained on a set of audio signals, and the results are compared to those of a commercial compressor. The model is shown to be able to replicate the behavior of a compressor, and the results are compared to those of a commercial compressor.

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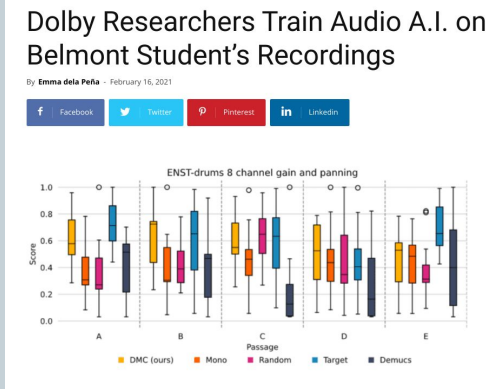
Acoustical Society of America
@acousticsorg

Now for the most popular Acoustics Today article of 2020! Have you read this one?

No 1 - "Synthesis of Musical Instrument Sounds: Physics-Based Modeling or Machine Learning?" by @drscotthawley, Vasileios Chatziioannou, & @achmorrison @BelmontUniv @mdwwien @JolietJrCollege

ARTICLE ABSTRACT

Synthesis of musical instrument sounds is a challenging task. This paper compares physics-based modeling and machine learning approaches. The machine learning approach is shown to be more effective in replicating the complex timbres of musical instruments.



Lilian Edwards @lilianedwards · Nov 10, 2018

Fantastic piece from unlikely source on why AI is always inherently technosolutionist but might give us help like AI monks and Jesus chatbots. Really, unsummarisable. hedges.belmont.edu/~shawley/Theop... @mchardcastle

Lilian Edwards @lilianedwards · Nov 10, 2018

'...assumption that societal problems we face ...all result of a lack of intelligence and/or data, and perhaps also a lack of "morality." The application of AI (to solve) these problems =a hypothesis that these problems admit a technical solution. This hypothesis is probably wrong

Relevant people

Lilian Edwards @lilian... Following

Chair of Law, Innovation and Society at Newcastle. GDPR nerd. #girlswot. DMs open. Views personal, do not represent those of Newc Uni

Scott H. Hawley (no relation to Josh) @drscotthawley

Prof. of Physics @BelmontUniv

Numerical modeling / Teaching audio engineers / Machine Learning / AI & Society / Sci & Religion

My Scholarship is Highly Interdisciplinary



and Inter-Boyer-Category*

physics + audio+
computer science +
data + philosophy +
theology +...

“Deep Learning & AI
Ethics” course Fall 2021
co-lists as PHY/DSC/BSA
3895!

*Re. categories: My
book-in-progress is on
Classification by humans &
machines!

