**Accessible Technologies Lab**
*Virginia Tech*
*620 Drillfield Dr. Room 2020*
*Blacksburg, VA, 24061*

August 22, 2019

Hello,

I am writing in application to the GA opening in the Accessible Technologies Lab providing support and training with assistive technologies to interested students, staff, and faculty to aid in their time at the university. I believe the combination of my engineering work implementing accessibility-oriented technologies, my teaching work overhauling an already difficult course with a focus on accessibility, and the ever-growing list of trainings and bootcamps focused on accessibility and facilitation all make me a top-tier choice for the position.

The bulk of my past engineering work exemplifies my adaptability and versatility in addressing an unmet need via whatever tools and technologies provide the best experience for the user. My research experience includes developing a non-invasive Brain-Computer Interface that doesn't hurt to use, in-the-moment fall risk prediction using motion capture, and developing an accessibility mapping infrastructure to provide relevant information both to disabled individuals attempting to navigate campus, and to various administrative offices interested in improving capus accessibility. I am primary inventor behind two patents on augmented reality BCI interfaces for device control in situations preventing the use of hands or voice control. In addition, I've significant experience across the full software/hardware stack and the breadth of operating systems the ATL's clientel may be using, so can both adapt and debug whatever situation may emerge.

As an educator, I have drastically overhauled a two-course sequence to improve course accessibility/approachability across the wide varieties of neurotypes, financial backgrounds, and educational backgrounds of my students. Within my first semester as a TA, I convinced the main instructors to drop tests outright due to the multitude of barriers they impose to student learning. In the subsequent three semesters as the de-facto course instructor, I began recording lectures and uploading them on canvas for students to be able to watch from home and on slower or faster speeds; I of course also used the ATL-provided automatic captioning system as well, and taught my co-instructor to do the same. I adopted an approachable, less-than-formal instructional style and added explicitly non-course-related "advisory" hours to cultivate an atmosphere of mutual respect that the students responded to fantastically.

I am exceedingly excited at the prospect of tackling the problem of accessibility from a user-centric perspective, rather than as the engineer of the tools or the teacher behind the potential problems. As an autistic adult, I often find myself wishing there were offices like the ATL that I could go to for support, and I would be overjoyed to get to provide that support with assistive technologies that students, staff, and faculty need here at Virginia Tech.

Thank you,

**Hani Awni**

*Attached: curriculum vitæ*

# Hani Awni

*Biomechatronicist & Sociotechnical Systems Engineer*

## Education

2017–Present **MS: Mechanical Engineering**, *Virginia Tech*, Blacksburg, VA, *GPA – 4.0*.
Focused on actuation, engineering design, pedagogy, and community organizing.

2015–2017 **BS: Electrical Engineering**, *Univ. of Illinois*, Urbana, IL, *GPA – 3.6*.
Focused on biomechanics and robotics. Participated in the Inaugural Engineering & Social Justice Scholars Program 2016-2017 and advocated for socially-conscious STEM education.

2009–2013 **BS: Brain-Machine Interfacing (CS)**, *Univ. of Illinois*, Urbana, IL, *GPA – 3.2*.
Expanded computer science major with deep background in cognitive science, neuroscience, and signal processing. Third custom degree ever awarded by Engineering College.

### Coursework

2017-Present Automotive Engineering, Wearable Robotics Control Interfaces, Design in Engineering Education and Practice, Facilitating Intergroup Dialogue, Contemporary Pedagogy

2015-2017 Control Theory, State Space Control, Neuromuscular Modeling, Embedded Systems, Biomedical Imaging, Robotics, Engineering & Social Justice, Signal Processing

2009-2013 Neural Network Modeling, Cognitive Psychology, EEG Experiment Design, Computational Neuroethology, Machine Learning, Database Systems, Program Verification

## Research

Title *AccessibilitySLAMNAV: Navigation for All Bodies, Robotic or Human*

Authors/Year Hani Awni, Dr. A. Shew, Dr. A. Asbeck. Underway

Description Adapts open-source software for autonomous robot mapping, localization, and navigation for use as a minimum-cost, DIY-able wearable mapping device & webserver of accessibility information. Provides point-to-point campus-scale naviagtion under user-specified access constraint profile via a human-usable web interface and a robot-usable ROS service interface. Built on ROS, RTABMAP, and move_base.

Title *Body Modeling and Inverse Dynamics: A Modeling Toolkit*

Authors/Year Hani Awni, Dr. Rama Ratnam. 2017

Description Presents a Mathematica toolset for constructing a symbolic physics model of any arbitrary rigid body layout. Produces $\mathbf{M}, \mathbf{C}$ of whole-body dynamics and $\mathbf{T}, \mathbf{J}$ of each body segment. Requires only AP Physics-level geometric reasoning to use.

Title *Open-Source Simulink Model of Planar Arm Motion for Real-Time Control.*

*497 Thorngate Ln. – Riverwoods, Illinois 60015*
*(224) 715 5995 • hani.awni@gmail.com*
*socialjustice.engineering/about*

Authors/Year Hani Awni, Dr. M. Hernandez. 2016 (Available by Request)

Description Implemented and documented 2 DOF Simulink model for planar arm motion with realistic muscle behavior. Superior to formerly-used OpenSIM models due to differentiable & discontinuity-free muscle lengths across entire range of motion.

Title *Towards A Brain Computer Interface Based on the N2PC Event Related Potential.*

Authors/Year Hani Awni, J. Norton, S. Umunna, Dr. K. Federmeier, and Dr. T. Bretl. 2013

Description Demonstrates feasibility of an EEG-driven BCI of my own design, based on the heretofore unused N2pc event related potential. Unlike the more common P300Spellers or SSVEP-Spellers, this BCI does not involve a flashing interface, thus improving comfort for extended use. 1st Senior thesis. Presented at IEEE EMBS NER 2013.

## Current Projects

08/2017–Present **SocialJustice.Engineering: Complicating the Model**, *Hani Awni*.

Draws and explores interrelationships between engineering culture, societal conflict, power struggles, and STEM-dominating mythologies in search of a more potent engineering practice absent the influence of the heteropatriarchy. Targets engineering audience by challenging unquestioned assumptions, inspecting popular bifurcations, and, generally, complicating models.

Status Ongoing. Writing underway.

Link `socialjustice.engineering`

03/2017–Present **Open Repository of Social-Justice-Focused Senior Design Project Proposals for CS & ECE**, *Hani Awni*.

Repository of example project proposals at the undergraduate senior thesis level tackling issues of social justice. Provides realistic, undeniably-implementable technical proposals addressing problems commonly deemed a-priori a "social problem" by the engineering community. Project proposals are designed to encourage human-centered design, empower budding engineers to tackle classically 'off-limits' problems like online harassment, doxxing, or astroturfing, and demonstrate to the existing engineering community how reasonably addressable these problems are in reality.

Status Ongoing. Collaborations underway with UIUC ECE and CS departments. Accumulating & populating additional project proposals will never end.

Link `ppr.socialjustice.engineering`

04/2014–Present **Automated Externalized Executive Function**, *Hani Awni*.

Circumvents numerous unwanted symptoms of mental illness, including impaired executive functioning due to depression and ADHD, difficulty initiating day, difficulty maintaining social bonds, persistent imposter syndrome, and difficulty forming narratives of personal productivity, in the form of a digital personal assistant allowing hierarchical project definition & tracking inspired by GTD productivity methodology and mindfullness-DBT. Semiautomatically reduces entire library of tasks consituting projects, in light of current priorities and available time and context, into current task for immediate execution while forcing focus.

Status Ongoing. Basic project/task tracking implemented, automation underway.

## Experience

### Lab Experience

08/2017–Present **Researcher**, Dr. Asbeck's Assistive Robotics Lab, Blacksburg, VA.
- Modular EMG sleeve: Redesigning project for simpler, more usable design for incorporation into robotic exoskeletons.

08/2016–08/2017 **Researcher**, Dr. Ratnam's Healthcare Engineering Lab, Urbana, IL.
- Created & used recording software in small team to capture elderly subjects in realistic apartment environments despite occlusion.
- Created analysis pipeline to estimate realistic biomechanically-valid body motion from noisy Kinects, force sensors, and IMUs.
- Collaborated across numerous disciplines and institutions, including Dr. Sosnoff's Fall Prevention Lab and the Jump Trading Medical Simulation Center in Peoria.

01/2011–05/2013, 05/2015–05/2016 **Research Engineer**, Dr. Hummel's Cognitive Modeling Lab, Urbana, IL.
- Expanded LISA model of human abstract reasoning to better reason about complex situations and develop doubt in hypothetical situations using analogies.
- Designed & implemented experiment interfaces and structure to best test working theories of relational visual perception, attention, and memory.
- Aided Phd. students in coding, data analysis, and interpretation of relevant theories.

08/2012–05/2013 **BCI Researcher**, Dr. Bretl's Applied Controls Lab, Urbana, IL.
- Researched and implemented novel EEG Brain-Computer Interface, the N2PCSpeller.
- Recruited and ran subjects to collect data to test and optimize N2PCSpeller.

01/2010–05/2012 **Lab Tech/Analyst**, Dr. Federmeier's Neurolinguistics Lab, Urbana, IL.
- Assisted graduate students both with writing experiment code and with data mining of ERP results despite abundance of noise and artifacts.
- Aided in subject preparation and running in EEG experiments for high subject throughput.
- Ensured comfortable atmosphere for subjects despite otherwise abnormal circumstances.
- Taught new lab assistants and grad students efficient procedures in use of lab equipment.

### Service

08/2016–12/2016 **STEM Outreach Facilitator**, UI:Chicago, Chicago, IL.
- Taught 8th graders from Chicago Public Schools how to use MIT's Scratch visual programming language to empower students for future possible STEM careers.
- Established rapport with a small handful of 8th graders despite differing backgrounds to make college less intimidating and foreign.
- Introduced several advanced students to more powerful programming environments like NetLogo and demonstrated modeling animal behavior with their current capabilities.

11/2014–Present **Visiting Lecturer & Panelist**, Libertyville High School, Libertyville, IL.
- 3+ times per year, presented to multiple AP CS classes in Libertyville to demystify post-high-school life in light of industry life.
- Clarified the breadth of CS subfields, overviewed engineering majors, and characterized variety & vitality of various STEM industries and careers.
- Answered questions from current high schoolers about their futures and abolished common myths about life, emotional vulnerability, social connection, metal health, and adulthood.

05/2010–08/2010 **Engineering Camp Counselor**, WYSE Summer Camp, Urbana, IL.
- Managed groups of 20-30 High School seniors and juniors through multiple presentations of different engineering majors
- Led groups on campus tours, gave extensive advice on adapting to college life, and concretized realities of college freedoms
- Taught high schoolers through a weeklong programming project in Lego Mindstorms to create robots that navigated an obstacle course.

### Vocational

05/2016–08/2016 **EEG Data Analyst**, Daqri, Los Angeles, CA.
- Invented 4 ERP-driven applications for Augmented Reality interactions. Co-invented additional 2 as second author. Currently in preparation for patent app submission.
- Constructed labratory-grade real-time EEG recording, streaming, and analysis stack.
- Design and implement interface between the OpenBCI NodeJS library and SCCN's LabStreamingLayer to enable multidevice synchronization and BCILAB-driven analytics using the low-cost OpenBCI EEG device.
- Research, analyze and interpret sleeping EEG data using Python's SciPy library.

01/2014–05/2015 **Solo Neuroengineer & House Captain**, Self-Employed, San Francisco, CA.
- Helped direct the setup and growth of a 25-person intentional community focused in interdisciplinary intellectual interchange in San Francisco.
- Resolved or mediated inter-resident conflicts pursuant to overarching community goals.
- Worked on myriad neuroengineering projects, including Moodband, a wearable for EEG-based emotional state visualization; ley*, a MFQ-scheduler-inspired to-do system; Respectable, a social-graph analysis tool; and an Abalone AI competition.
- Self-taught and took online courses in chaos, complexity theory, and medical neuroscience.
- Researched possible BCIs and wearables, especially in the contexts of potential game designs, mental health, biological robots, and behavioral reinforcement.

05/2013–12/2013 **Software Engineer**, Palantir Technologies, Palo Alto, CA.
- Expanded and maintained graphing web interface in Javascript and backend Java.
- Designed, developed, and implemented additional features to core product in Java Swing.

05/2008–08/2011 **Database Architect Intern**, Baxter Credit Union, Vernon Hills, IL.
- Designed, coordinated, and implemented expansions to database processing capability.
- Collaborated with non-technical employees throughout the company to clarify the aims of various projects and subsequently implemented projects according to their specifications.
- Trained and led team of new interns in T-SQL programming on several database-improvement projects.

## Leadership and Membership

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|---|---|
| Undergrad | ACM, IEEE, Undergraduate Neuroscience Society, BioMedical Engineering Society |
| High School | WYSE(Captain), JETS(Captain), Science Bowl(Captain), Math Team(President) |

## Skills

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|---|---|
| Basics | LaTeX, Windows, Mac OSX, Linux, Unity Engine, Office Suite, Git |
| Programming | Python, C, JavaScript/NodeJS, Matlab, Java, C++, Ocaml, NetLogo, Mathematica, SQL |
| Frameworks | ROS, Simulink, PEG, Google App Engine, Jupyter Notebooks, LabStreamingLayer |

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## Interests

- Augmentative Biotechnology
- Social Justice & STEM
- Robotic Exoskeletons
- Emergent Intelligence
- Neuroengineering
- Interdisciplinarianism
- Progressive Transhumanism
- Complex Systems
- Consciousness Pudding on a Sea of Automation

## Partial Past Projects List

09/2016–05/2017 **Biomechanically-Valid Motion Capture despite Occlusion using Kinects and IMUs**, *Hani Awni & Drew Douglass*.

Complete, approachable system for localizing elderly patients navigating furnished apartments. Designed to capture in tight, confined spaces throughout a motion despite occlusion by combining multiple Kinects. Designed for integration with whole-body inverse dynamics system.

Status Blocked. Visual capture and body parameterization complete. Composite system pending inverse dynamics solver implementation for verification.

01/2017–03/2017 **'Twelve Thousand Years of STEM' Display**, *Cheyenne Syring & Hani Awni*.

Challenges eurocentric narratives of science, technology, and engineering that purport science "began in the Age of Enlightenment" by highlighting the multitudes of non-western pre-existing or ongoing scientific and technological developments across many domains of science and engineering. Will take the form of multiple-poster display situated in a highly-visible semi-permanent installation directly outside of the main Engineering Department advising center in UIUC's Engineering Hall.

Status Hiatus. Project lead overburdened with other priorities.

10/2016–05/2017 **Toward a Feminist Social Network**, *Hani Awni & Online Collaborators*.

Helping steer an in-development open-source twitter competitor, known as Mastodon, toward prioritizing tools for facilitating healthy interaction between users by providing code reviews, feature requests, and sparking community dialogue with the dominant devs. Coordinating with like-minded community members in moderation, feature design, and performing causal analysis of how the technology and the dominant social expectations might be tuned or reconcieved around the needs of activists and community organizers.

Status Paused. Pending W3C's release of the new ActivityPub protocol for substantially more modifiable structure.

01/2016–05/2016 **Analogical Reasoning May Explain Racists Calling Idris Alba "Too Street"**, *Hani Awni, S. Wilner (Advisor), Dr. J. Hummel (PI)*.

Demonstrates that pure analogical reasoning, as implemented in LISA, a neural-network model of human abstract relational reasoning, is sufficient to cause disbelief in a hypothetical African-American Bond after exposure to numerous extant James Bond film plots. Second phase demonstrates how even small amounts of minority representation both prevent such disbelief to reexposure and facilitate positive reactions to minority representation along new dimensions of identity.

Status Hiatus. Deprioritized while translating additional Bond plots into propositional logic.

08/2015 - 12/2015 **Low Cost MicroUAVs: Off-the-Shelf Remote-Control Beetles**, *Hani Awni*.

Adapts the Maharbiz lab's work with Jade Flowering beetles as RC UAVs to work with off-the-shelf microcontrollers and radios. Uses ATTiny microcontroller and HM11 BLE module to substantially reduce electronics cost to less than $\$0.25$ per beetle by scaling up the beetle to carry the heavier payload. Needs Hercules, Atlas, or Goliath beetles or similar.

Status Blocked. Electronics/Firmware complete, yet testing delayed pending access to large beetles and lab. Will resume if I ever live in Southeast Asia.