

## Research Ideas - 2017

I am adding seven (new) entries to a research idea brainstorming list each week, over the course of 2017. Each block of research ideas are organized according to a month-week structure. Where a week overlaps between months, if the week is the fourth in the ending month the list update belongs to that month. Otherwise, the overlap serves as the first week in the beginning month.

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Thus, I encourage you to use these ideas as springboards for your own research. Quote, mix & match, revise...do whatever you feel inspired to do with the entries. I do ask that if a list entry is *italicized*, please do not use that exact entry in your work. An italicized entry means that I am using the idea.

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### January

#### Week 1

To what extent do cybersecurity course objectives in higher education correlate with cybersecurity job openings?

How strongly does visible trends in cybersecurity topics correlate with publishing trends? As well, what degree of academic literature is read?

Why is the negative minority of players more vocal than the positive majority?

What are the most common categories in cyber security jeopardy competitions? Are there common questions?

Do seminal studies in cyber security lab literature experience significant replication? To what extent are quantitative results validated?

Does completing homework produce a statistically significant increase in academic performance?

Why do we need to define a rule against violence/harm for AI (e.g. Asimov's 3rd Law).

## **Week 2**

To what extent do subjects with no less than five years experience programming display a different linguistic reality than subjects who have never programmed?

Does social media produce an operant panopticism and sense of action being over-scrutinized (and, thus, narcissism)?

What does it mean to 'learn'?

What tools exist to objectively measure learning?

To what degree does number of lines of code in an open source project correlate with the number of contributors?

What is the half life of open source contributors (i.e., how long does it take for a contributor to fall off in the number of contributions)?

Why is feature parity the basis of comparison between FOSS software and proprietary software with 'freedom' not being included?

## **Week 3**

What are the characteristics of a 'good' question?

To what extent do multiple academic performance measures converge on the same outcome given identical input?

Why is academic procrastination seemingly a part of "student friendly" undergraduate teaching?

Will artificial general intelligence evolve biomimetic behavior?

Does a rising trend in user accounts give rise to malicious activity?

Can we use response rates as input to genetic computation of 'better' SPAM?

What is the relationship between account creation and receiving account targeted SPAM or phishing email?

## **Week 4**

Does knowing how the (human) brain works physiologically tell us how consciousness works?

Is the difference between a conscious mind and an unconscious mind the amount of (hidden) layers substrating propagation of neural impulses?

Will machine consciousness have the same idea of individuality as primate consciousness?

Is the probability of corruption in an arbitrary sequence of input computationally knowable?

Is there a significant difference between the efficacy of self-study compared to guided study?

Is there a significant difference between the efficacy of synchronous distance learning that includes audio-video of instructor compared to audio only?

What are the necessary components of a conceptual framework for post-transhumanist trust?

## February

### Week 1

Is the risk of executing untrusted code obviated by robust egress network filtering?

What percentage of publicly accessible source code requires a legacy compiler (version) to build?

What differentiates popular open source projects from lesser known but equally 'usable' projects?

At what rate do users search for open source alternatives to commercial software?

Are programming language syntax, semantics, and idioms stored and retrieved from declarative memory or motor memory?

How does variable programming study compare to focused study in learning a first programming language?

To what extent will machine consciousness experience cultural evolution of language?

### Week 2

*Will machine consciousness adhere to the logic, grammar, and rhetoric principles (i.e., the Trivium) found in human consciousness?*

To what extent are the 'logic' and 'grammar' principles of the Trivium present in computational model of the mind?

To what extent is the Trivium an effective model for the expression of internal computational problem solving?

What are the common perceptions of authentication as an assertion of biological identity?

Can a neural network be trained to differentiate between malicious access to a file system object compared to normal access to the same file system object?

How does the CPU usage profile of a virus that infects a particular file system object?

Does a keylogger produce a measurable ghost pattern as a user types?

### **Week 3**

Can programmer skill be measured according to what extent solutions to a given type of problem (e.g., search, sort, etc.) are expressed with a richer semantic basis?

What are the pedagogical qualities that comprise a ‘hard’ (rigorous) undergraduate course?

How does cybersecurity research incorporate ‘human factors’ (as defined by Stramler 1973) into empirical investigation of user behavior?

*What elements should be included in a conceptual framework for assuring confidentiality in synthetic cellular communication signaling?*

How effective is completing a ‘hard’ programming challenge in entirety compared to punctuated experience across multiple ‘Easy’ programming challenges?

*To what degree does Meyers-Briggs personality type correlate with doctoral student performance in designing research?*

What is the optimal frequency of laboratory exercise intervention on the learning experience compared to pre-defined KSA units?

### **Week 4**

*What epistemic propositions will artificial general intelligence develop in the context of technologically mediated Trust?*

*In what way(s) will artificial general intelligence generate social epistemic propositions for mediated Trust boundaries with non-AGI entities?*

*To what degree will a synthetic intelligence be able to articulate an epistemological rationale for trusting its knowledge?*

*To what degree will a synthetic intelligence be able to engage in mediated social epistemology?*

*How will a synthetic intelligence describe its own epistemology (e.g. Externalism vs. Internalism)?*

*What mechanisms will a synthetic intelligence develop to assure integrity of environmental stimuli?*

*To what extent will synthetic intelligence develop personality archetype(s) outside of the existing spectrum?*

## **March**

### **Week 1**

What are time management (productivity) best practices for minimizing distraction and maximizing output?

How does multitasking influence time management (productivity) throughput and cognitive load?

What is the relationship between multitasking and cognitive fatigue?

Is there an optimal task (or type of task) to schedule during pomodoro interval breaks?

What factors have a validated, positive effect on productivity throughput?

To what extent does technology have an effect on multitasking throughput and cognitive load?

What validated determinants exist for the objective measurement of task throughput and cognitive load?

### **Week 2**

Does time of day wake up preference affect task productivity?

Is there a specific genetic polymorphism or polymorphisms associated with shortened sleep cycles yielding restorative effects?

To what extent do polyphasic sleep cycles have a positive effect on task productivity compared to monophasic sleep?

What is the optimal time of day wake period for creative task productivity?

Does a validated protocol exist for measuring the minimal amount of sleep necessary to maintain maximum task performance?

How does polyphasic sleep cycling compare to transcranial direct-current stimulation for increasing task performance?

What are the early warning cognitive expressions of sleep debt?

### **Week 3**

Are there any biological signaling mechanisms that have evolved to prevent eavesdropping?

What are common characteristics of biological organism authentication?

How do single-cell organisms identify environmental threats?

What simple rules do individual bacterium follow when avoiding (evading) threats such as bacteriophages?

How do simple multicellular organisms detect duplicated chemical signals?

What is the maximum information threshold present in single cell organism chemical communication pathways?

What are the performance differences between digital communication pathways (e.g. copper, fiber optic, etc.) and biological signal transduction?

### **Week 4**

What are the characteristics of a competent research mentor?

To what extent are the desirable traits of research mentors present in subjects across departmental boundaries?

What are validated quantitative measures of research design competency?

To what degree do various quantitative measures of research competency converge to identical values?

To what extent is there a measurable difference between single competency examination compared to multi-phased examination?

How can professor and student competencies be combined to maximize learning?

What are residency curricular best practices in evaluating faculty research competencies?

## **April**

### **Week 1**

What is an effective assessment schedule for semester length undergraduate computer science courses to maximize learning?

To what extent are more frequent but smaller in scope examinations effective at maximizing learning compared less frequent but larger in scope examinations?

How do undergraduate students perceive flexible ‘contract grading’ curricula compared to traditional curricular scheduling of weekly homework, midterm examination, and final examination?

## **Week 2**

What is the potential increase in game wins by Twitch.tv streamers with large subscriber bases compared to those with smaller subscriber bases?

How does crowdsourcing of game mechanics details (e.g. looting) to a subscriber base influence the win rate of Twitch.tv streamers?

To what extent is there a cognitive offload associated with a play performance increase for Twitch.tv streamers that have interactive subscribers?

## **Week 3**

## **Week 4**

*To what degree do cognitive tasks associated with common cybersecurity tool use (e.g. Nmap) produce unique EEG patterns?*

*Can a non-invasive brain-computer interface be used to operate common cybersecurity tools (e.g. Nmap)?*

## **May**

## **Week 1**

What is the psychological effect of calling an activity a ‘game’ compared to a ‘competition’?

To what degree does citation count correlate with quality of published research within the citation list?

What is a sufficiently large citation count to be perceived as being a source of learning?

## **Week 2**

How can bidirectional knowledge trust be measured in an artificial intelligence tutoring system?

Why has pedagogical theory evolved over time to be less objectivist and more constructionist?

To what extent does academic assessment have a positive effect on in-class student performance?

How will an artificial intelligence tutor express an epistemology for *knowing* a concept versus an operation?

What effects do free MOOCs have on the instructional design of undergraduate computer science courses?

What are information systems student perceptions of free, online knowledge (e.g., MOOCs, YouTube, MIT Open Courseware) compared to the courses those students complete as part of their degree program?

### **Week 3**

How do game engine mechanisms co-evolve alongside gaming community preferences for game features?

How effective are game AI agents in teaching players game rules while serving as an opponent?

What characteristics of a game AI agent contribute to player perception of difficulty?

What game AI agent attributes contribute to the player perception of life-like behavior?

How do players experience knowledge trust when interacting with autonomous game AI agents?

To what extent can an established game AI agent be used to train a new AI agent? Are behaviors identically reproduced?

How are game AI agents able to express internal knowledge of learned behaviors?

### **Week 4**

What are the most common features associated with word processor files intended to be future-proof readable?

What is the mean lifetime for word processor applications between file format change?

How does a word processing system preserve semantic meaning across file format evolutions?

To what extent are (plain) text files more resistant to data degradation than word processor generated files?

What is a validated measure of *mean* time of data degradation in text files? Does the mean time vary by storage media?

What is the relationship between word processor software decay and data degradation of the files generated by the software?

To what extent do frequently accessed text files incur data degradation compared to infrequently access text files?



## **June**

### **Week 1**

What is an optimal pedagogical framework for teaching undergraduate mathematics in a synchronous online computer science program?

How are students most effectively incentivized to complete homework assignments in a synchronous online undergraduate mathematics course?

Do students perceive online synchronous mathematics courses to be as effective as traditional on-campus courses?

What is an optimal number of homework assignments in an online synchronous mathematics course, including the number of questions per assignment?

To what degree is game-based learning an effective pedagogy for advanced mathematics instruction?

What features would a game engine need to be used as a situated learning platform for teaching advanced mathematics?

To what extent do students use syllabus defined learning outcomes to measure self-efficacy in learning during undergraduate coursework?

### **Week 2**

What are the differences in how students perceive volume of homework assignments in an online synchronous course compared to a traditional on-campus course?

How do students perception of self-efficacy in discrete mathematics homework assignments compare to actual grades on the same assignments?

What are pedagogical best practices for maximizing in-class participation by undergraduate computer science students?

To what extent can undergraduate mathematics be effectively taught using a situated learning pedagogy?

What are the instructional design differences (e.g. assignments, lectures, etc.) between undergraduate and graduate same subject mathematics courses?

What are validated, non-traditional pedagogies for teaching programming to undergraduate students?

What are best practices for structuring assignments from the perspective of undergraduate computer science students?

### **Week 3**

*What is the optimal game type for teaching graduate level quantitative data analysis?*

*What are the most common learning outcomes as indicated in graduate level quantitative data analysis syllabi?*

*To what degree do graduate students prefer to generate primary data in a case study based quantitative data analysis course compared to using secondary data?*

*How do working professional graduate students perceive game-based case studies in a quantitative data analysis course?*

*What are common issues encountered by graduate students in a quantitative data analysis course that uses game-based case method instruction?*

*What quantitative data analysis topics are appropriate for case study based graduate course?*

*What are appropriate academic assessment measures for an online, case method driven graduate quantitative data analysis course?*

#### **Week 4**

*What are the publishing trends in gamification of computer science undergraduate education in the United States?*

*To what extent is game theorycrafting used to teach undergraduate students research methods?*

*How has the amount of published research using World of Warcraft as the primary research context varied alongside subscription numbers?*

*What player behaviors (e.g., movement, cooperation, weapon choices, cover use, open camping) in action battle royal type games most often lead to victory?*

*What player behaviors are perceived as ethical violations within the virtual world of action battle royal games?*

*To what extent are there ethnological differences between PvE-centric MMORPG players and PvP action battle royal players?*

*To what degree does theorycrafting in PvE-centric MMORPG games influence the behavior of casual players?*

#### **July**

##### **Week 1**

*How does the perception of information permanency vary across demographic categories?*

*To what degree are some categories of personal information more permanent than others?*

*What difference exists between perception of personal information permanency compared to the permanency of information generated by others*

*To what extent do we perceive personal information to be revisable but others' information to be permanent?*

*How do users perceive information trust related to autonomous computing systems?*

*To what extent are users aware of technology as a knowledge mediator in socially constructed knowledge?*

*What variance exists between demographic categories in the view of technology as a mediator of socially constructed knowledge?*

## **Week 2**

*To what extent are cybersecurity undergraduate students more likely to conform to group ethical decisions compared to graduate students?*

*Are undergraduate cybersecurity students more or less likely to object to an authority asking them to commit a harmful computing act than non-cybersecurity students?*

*What are the prominent ethical theoretical frameworks in cybersecurity pedagogical literature?*

*To what extent do undergraduate cybersecurity degree programs require coursework in critical thinking and ethics?*

*What pedagogy or pedagogies have a statistically significant effectiveness in teaching secure coding?*

*To what extent is there a measurable difference between undergraduate students that analyze code for security vulnerabilities and undergraduate students that develop patches for pre-defined vulnerabilities in code?*

*How does cognitive bandwidth capacity correlate with undergraduate students' selection of degree major and extracurricular activities?*

## **Week 3**

*To what extent does absence of vocational education in cybersecurity contribute to the increasing workforce labor gap?*

*How can the growth of employment opportunities within field of cybersecurity be described according to taxonomic constructs?*

What advantages would vocational education in cybersecurity hold compared to academic education in the same topic?

How can the necessary entry-level skills for entering the cybersecurity workforce be described in a dependency chart and what is the associated optimal build order?

To what extent does cybersecurity skill development depend upon ultimate vocational goal?

What decision-making processes are used by undergraduate STEM program students to determine their first vocation?

How common is lateral job movement between specialties within the cybersecurity profession?

#### **Week 4**

How do undergraduate faculty determine an optimal pedagogy for cybersecurity coursework?

To what extent are adjunct faculty aware of prominent cognitive learning theories?

What factors do adjunct undergraduate faculty in a cybersecurity degree program consider when designing a new course?

To what degree are undergraduate cybersecurity curricula consistent with the classical framework of an *academy*?

To what extent are *grammar, logic, and rhetoric* present in established Community of Practice disciplines compared to cybersecurity?

How can the lower division of the Liberal Arts be mapped to modern STEM academic curricula?

What are common learning outcomes for an undergraduate cybersecurity curriculum as defined by existing professionals?

#### **Week 5**

*What are the common theories of ethics emergent in cybersecurity education literature?*