

NOMINATION COVER SHEET
2009 Virginia Outstanding Faculty Awards

1. <u>NAME</u>	
Full (Legal): David E. Evans	Preferred First Name: David
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Institution: University of Virginia	Academic Discipline: Computer Science
Rank/Position Title: Associate Professor	Specialization/Field: Computer Security
Year Rank/Title Attained: 2006	Type of Terminal Degree: PhD
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	Home Mailing Address:

- Please check only one box:*
- RESEARCH/DOCTORAL INSTITUTION NOMINEE:
- MASTERS/COMPREHENSIVE/BACCALAUREATE INSTITUTION NOMINEE:
- TWO-YEAR INSTITUTION NOMINEE:
- RISING STAR NOMINEE:
- TEACHING WITH TECHNOLOGY NOMINEE:

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President or Chief Academic Officer

Signature: _____

Printed Name: Arthur Garson, Jr., M.D., M.P.H., Executive Vice President and Provost

Virginia Outstanding Faculty Awards

2009 Call for Nominations

Mission Statement

The central purpose of the University of Virginia is to enrich the mind by stimulating and sustaining a spirit of free inquiry directed to understanding the nature of the universe and the role of mankind in it. Activities designed to quicken, discipline, and enlarge the intellectual and creative capacities, as well as the aesthetic and ethical awareness, of the members of the University and to record, preserve, and disseminate the results of intellectual discovery and creative endeavor serve this purpose. In fulfilling it, the University places the highest priority on achieving eminence as a center of higher learning.

Summary of Accomplishments

TEACHING

David Evans is a gifted, innovative and dedicated teacher. His achievements touch all aspects of what it means to be a great teacher and more. Dr. Evans strives to enable students to be intellectuals and teachers, and all of his actions are committed to these goals. It is these goals along with his teaching skills, creativity, and dedication that have led to his impressive achievements in teaching.

Dr. Evans' teaching has been recognized by the most prestigious awards at the Department, School, and University levels including:

- Computer Science Department Teaching Award, 2001
- University Teaching Fellow, 2001-2002
- ACM Jefferson Undergraduate Teaching Award, 2002
- SEAS Harold Morton Jr. Award for Teaching, 2003-2004
- All-University Teaching Award, 2008

Dr. Evans' educational efforts have also been recognized by two national grants: a National Science Foundation CAREER Award (recognizing both research and teaching), and an NSF Curriculum Development Grant (for incorporating program analysis into introductory courses).

(i) Instruction

Dr. Evans is a fantastic lecturer, able to convey enthusiasm while enabling students to understand challenging ideas and put them in context. His teaching, though, goes far beyond traditional lecturing to encompass innovative teaching approaches ranging from mock trials, carefully constructed puzzles, human demonstrations, and field trips. Dr. Evans has developed several path-breaking courses at the introductory, intermediate, advanced, and graduate levels. All of his courses use the web extensively, and the course websites make nearly all course materials (including assignments, lecture slides, and notes) publically available (see <http://www.cs.virginia.edu/evans/classes/>). Many students at other universities and in high school have taken advantage of these materials to learn the subjects on their own, and several courses at other universities have adopted these materials into their own courses. Two particularly innovative introductory-level courses created by Dr. Evans include:

- **CS150: *Computing from Ada and Euclid to Quantum Computing and the World Wide Web*** (first offered Spring 2002; subsequently offered 4 times by Dr. Evans and by two other professors). This course was originally developed as part of Dr. Evans' University Teaching Fellowship with the goal of teaching the intellectual core of computer science, while providing exciting applications to a variety of problems in many fields, especially those of interest to liberal arts students. Although the course is accessible to students with no computer science background, students in the course end up learning Computer Science in depth (such as understanding the fundamental limits on what computers can do, and the equivalence of different computing models) as well as developing interesting programs (e.g., modeling elections, simulating cipher machines, conducting auctions, and social networking websites).
- **CS205: *Engineering Software*** (first offered as CS201J, Fall 2002; as CS205, Fall 2006; subsequently offered twice by another professor). This course was supported by an NSF curriculum development grant to develop a new software engineering course focused on using lightweight analysis tools to teach students to produce secure and dependable software. The course focused on covering the concepts behind secure and efficient development of large-scale software systems. It incorporated lightweight static analysis tools

from the beginning of the course, and students learned about program verification, invariants, multi-threaded programming and concurrency issues, and type safety.

(ii) Student Development and Learning

Students in Dr. Evans' courses develop unexpected ways of thinking, learn to approach problems in new ways, and gain confidence that they can solve problems that initially seemed inscrutable. Student evaluations (see supplemental documentation) reflect the high value students find in Dr. Evans' courses and how much they appreciate the way he organizes his classes and challenges them to exceed their own expectations. Dr. Evans has supervised over forty senior thesis projects, eight master's students, and three completed Ph.D. dissertations. Two of his recent undergraduate research students, Salvatore Guarnieri (2006) and Adrienne Felt (2008) were finalists for the CRA Outstanding Undergraduate Award, a highly-competitive national award for undergraduate research. The letters from his advisees (see letter excerpts), demonstrate his ability and commitment to bringing out the best in his students, raising their self-confidence to enable them to achieve great things, and inspiring them to work on challenging problems with big societal impacts.

DISCOVERY

The driving goal of Dr. Evans' research is to enable the cost-effective production of complex software that can be trusted for critical applications, even in the possible presence of malicious attackers. This goal involves many traditional research areas, and Dr. Evans' work focuses on promising approaches at the intersection of security and software engineering. The research has had a wide impact on the academic community, industry, and government. Measures of Dr. Evans' research impact include:

- **Citations:** Dr. Evans' papers have been cited over 2000 times (based on Google scholar citation counts) and eight of his papers have each been cited over 100 times.
- **External Funding:** Dr. Evans has received over \$11.8M in research grants from national agencies including \$2.7M as Principal Investigator in National Science Foundation awards.
- **Research Community Interest:** Dr. Evans' papers have been covered in over 100 courses and seminars at universities worldwide; software developed by his research group (including the Splint static analysis tools and the MCL network simulator) is used by hundreds of other research groups; he was selected as program co-chair for the most important conference in his area (*30th IEEE Symposium on Security and Privacy*).
- **Industry Adoption:** Dr. Evans' program analysis tools have been incorporated into three commercial products and most major open source distributions, and the approach he pioneered is widely adopted in the commercial sector (including integration into Microsoft's software development). He is a co-author on four pending patents, including one licensed patent.

The following subsections highlight some of Dr. Evans' major research accomplishments.

Inexpensive Program Analysis. Despite considerable progress in program analysis, typical software development processes make little use of advanced analysis techniques, even when they are producing mission-critical software. Dr. Evans' program analysis research addresses the challenge of making advanced program analysis inexpensive, yet beneficial, to enable widespread adoption of program-checking tools. His early work (both as a graduate student at MIT and at U.Va.) developed annotation-assisted lightweight static analysis, pioneering the use of annotations in lightweight static checking. This resulted in the widely-used LCLint static analysis tool; its successor, Splint, used lightweight static analysis techniques to identify likely security vulnerabilities in source code. These tools are in use at several thousand sites

worldwide, and are incorporated into popular Linux distributions (Debian, FreeBSD, RedHat, etc.) and commercial products (from NEC, Reflective, and Solidware Technologies). Despite the success of annotation-assisted checking, writing correct specifications is still a difficult task, and it is a substantial enough hurdle to prevent many typical developers from benefiting static analysis. As a result, more recent work has tackled the problem of automatically inferring program properties by analyzing execution traces. With Ph.D. student Jinlin Yang, Dr. Evans developed dynamic techniques to automatically infer useful properties to check statically. The techniques were used on a pre-release version of Windows Vista to find several critical bugs.

Security and Privacy in Physical Computing Systems. A growing trend in computing is increasingly rich interfaces between computing devices and the physical world. Instead of performing computations in protected beige boxes with narrow interfaces to the real world, the majority of future computing will be done by devices (such as nodes in sensor networks, wireless laptops, and cell phones) that interact with the world in rich and dynamic ways. Dr. Evans' research explores how this trend impacts programming, security, and privacy. With graduate student Lingxuan Hu, and other students, his research group developed techniques for using properties of the physical world in which computing devices are deployed to improve security. Examples include a technique for localization in mobile networks suitable for inexpensive, low-power devices, and a protocol to detect and mitigate wormhole attacks on wireless networks. This technique detects inconsistencies between the direction from which a signal was received and inferred geographical properties. The protocols and simulator resulting from this work have been used by researchers in over twenty countries.

Privacy and Security for Resource-Constrained Devices. Many emerging microelectronics applications such as RFID tags involve tight constraints on cost, size, and power consumption. Current design approaches and standard cryptographic primitives fail to satisfy the needs of these systems. Nevertheless, these devices are already widely used for applications with serious security and privacy requirements, such as key cards, public transportation tokens, and implantable medical devices. Current implementations resort to ad hoc solutions that fail to provide adequate security and are frequently broken in practice. Dr. Evans is the principal investigator on a recent NSF grant to develop a comprehensive approach for analyzing, designing, and implementing security and privacy on severely resource-constrained devices, focusing on passive RFID systems because they are the most severely constrained devices that are widely used in security applications. With Ph.D. student Karsten Nohl, he has analyzed the privacy and security properties of existing RFID systems, developed new metrics for evaluating privacy of large systems, defined and implemented a new cryptographic primitive, and invented protocol mechanisms to improve privacy with minimal cost. This work has resulted in two provisional patents and has been covered in over one hundred news articles.

Security through Diversity. The current computing monoculture leaves our infrastructure vulnerable to a massive, rapid attack since an attacker who discovers a single vulnerability in a popular program may be able to exploit that vulnerability on millions of machines. One technique to mitigate this threat is to artificially increase software diversity by transforming programs to produce diverse executables. Dr. Evans' research group has investigated techniques for generating artificial diversity in software systems and applying that diversity to improve security. His work on evaluating the security of instruction set randomization revealed the vulnerability of diversity techniques to incremental probing attacks. His collaborative work on N-variant systems invented a framework for deploying diversity techniques in a controlled way, using redundant execution to provide provable security properties without relying on any secrets. The system runs a set of artificially diversified variants in parallel, giving each variant identical inputs and checking that they behave similarly. Any attack that cannot simultaneously

compromise all the variants in the framework will be detected and stopped before secret information is divulged the server is damaged. By invitation, Dr. Evans has given talks on his security through diversity work at several universities in China, and at Harvard, MIT, Berkeley, Purdue, and the USENIX Security Symposium. In addition, his work has resulted in a licensed patent.

KNOWLEDGE INTEGRATION

Dr. Evans' knowledge integration is evidenced by his leadership in creating the Interdisciplinary Major in Computer Science; his success incorporating ideas from other fields into both his teaching and research; and his effectiveness in incorporating research into his courses, even at introductory levels.

(i) Curricular Development; Placing Discipline in Larger Contexts

Interdisciplinary Major in Computer Science. Dr. Evans led the effort to create a new major for students in the College of Arts & Sciences to combine interests in the arts and sciences with a solid computer science major; he is the Founding Director of the *Interdisciplinary Major in Computer Science*. Dr. Evans instigated and chaired a new joint committee composed of faculty from both the Department of Computer Science (in the School of Engineering and Applied Science) and the College of Arts and Sciences, and was the primary author on the proposal to create the new program that was approved in Spring 2006. This program fills an important need in enabling students in the College to major in computing, and sets a precedent as the first program crossing the two largest undergraduate schools at U.Va.

As Founding Director of the program, Dr. Evans led the development of the curriculum (which included the two gateway courses he created), and served as the primary advisor to most students in the program. The program was designed to enable students to study at the intersection of Computer Science and other disciplines in the arts and sciences which are becoming increasingly intertwined with computing. In addition to completing the core computer science curriculum, students in the major complete a series of *integration electives* -- courses in other disciplines with strong connections to computing, such as cognitive science, computational science, and digital humanities. The first group of seventeen students graduated in May 2008, and the program now has fifty-three active majors.

Integration of Other Disciplines in Teaching. Dr. Evans regularly integrates ideas from other disciplines into his computing courses, including biology, linguistics, physics, history, politics, and economics. In his cryptography courses, there are frequent discussions of the legal and societal implications of technology (for example, relating probabilistic cryptanalysis to evidence rules, and the implications of encryption on privacy) and technical assignments nearly always include some societal component or essay question on ramifications. In his introductory computer science courses, Dr. Evans uses problems in biology (e.g., reconstruction phylogenetic trees), astronomy (e.g., simulating physical bodies), politics (e.g., modeling elections), sociology (e.g., group dynamics), and linguistics (e.g., understanding natural languages) to motivate interest in computing. Dr. Evans taught a graduate seminar on Biologically-Inspired Computing which investigated how ideas from immunology, genetics, morphogenesis, and cell signaling can be used in computing systems.

Discipline in Context. In both his research and teaching, Dr. Evans has consistently put computer science into societal, political, and scientific contexts. For example, in his computer security course, one assignment challenged students to relate technical ideas from the class to the general public in a meaningful way. In response, students created comics, movies, and published two articles in the *Cavalier Daily*. Dr. Evans' work on swarm programming and

computer security is motivated by his examination of biological systems. For example, his swarm computing work (in collaboration with a biologist) developed a programming model for robust systems based on observing how biological systems develop reliably using unreliable cells and communication. His work on security through diversity is motivated by natural mechanisms found for resisting parasites by preserving diversity in immune systems. Dr. Evans was invited to speak about this work at the USENIX Security Symposium, delivering a widely-reported talk titled "*What Biology Can Teach Us About Security.*"

(ii) Meaningful Connections between Discovery and Teaching

Dr. Evans' research is deeply intertwined with his teaching. Even in introductory courses, ideas from research are frequently brought into class to enliven the material, illustrate its impact on real problems, and entice student involvement in research projects. For example, in CS150, students learn about the theoretical impossibility of determining certain properties about arbitrary programs (such as whether or not they will eventually finish executing). This is used to develop an argument that perfectly detecting computer viruses is impossible, and a discussion on how researchers (including Dr. Evans' group) are working on different methods to approximately detect viruses, and problems based on the open challenges in virus detection.

SERVICE

(i) Institution

Dr. Evans has contributed to the University well beyond typical service expectations as both a leader and team member. Examples of his institutional service include:

- Leading the creation of the Interdisciplinary Major in Computer Science and serving as its Founding Director.
- As Chair of the Faculty Recruiting Committee (2006-2007), Dr. Evans led a successful faculty search effort to hire a new assistant professor. Previously, Dr. Evans was a member of the Faculty Recruiting Committee, and helped review hundreds of faculty candidates and hosted several visiting candidates.
- As a member of the department's Graduate Admissions Committee (2000-2002), and Assistant Director of the Graduate Program (2007-2008), Dr. Evans reviewed thousands of graduate applications and recruited many graduate students. As a member of the School's Graduate Curriculum Committee (2007-2008), Dr. Evans reviewed proposals for new graduate courses and programs.
- As Director of the Web Team (2001-2005), Dr. Evans recruited and directed a team of students who developed the department's web site, and assisted other University groups with developing websites.
- As Founder of the U.Va. RoboCup team, Dr. Evans advised a group of students that competed in the 2001 International RoboCup Competition and Conference. Dr. Evans was faculty advisor to a team of students that competed in the ACM World Finals competition.
- As both a formal faculty mentor to two junior professors, and an informal mentor to many of our new faculty, Dr. Evans has helped new professors develop their courses, teaching abilities, and research programs. Notably, he has co-authored funded research proposals with four of U.Va.'s recently-hired faculty; in each case it was the first research proposal the new faculty member had received.

(ii) Community/Society

Dr. Evans has been active in using his research and teaching to serve society by conducting outreach courses and lectures, serving on a state government committee, and transferring technology to industry.

Outreach Activities. Dr. Evans has taught numerous outreach courses and delivered talks to audiences ranging from middle school students to retirees, including:

- *Cavalier Crypto*, University of Virginia Bernard Harris Summer Science Camp (Summer 2008). Two-day cryptography course for visiting 6th grade students.
- *Crypto Challenge*, University of Virginia GEAR-UP program (Summer 2007). Two-day course to visiting middle school students.
- League of Women Voters of Montgomery County, *Hard Facts about Soft Voting*. Blacksburg Town Hall (also broadcast on local television), Blacksburg, VA (November 2006). Invited talk on voting technology.
- *Cryptography in World War II*, Jefferson Institute for Lifelong Learning at the University of Virginia (Spring 2006). Four two-hour classes on the history of cryptography.
- *Dragon Crypto*, Greene County Middle School (Winter 2004). Two-day course for over 200 students at Greene County Middle School using 8th-grade mathematics for cryptography.

Public Service. Dr. Evans was appointed in April 2005 to the *Joint Subcommittee to Study the Certification Process for Voting Equipment and Matters Related to the Performance and Proper Deployment of Voting Equipment* by the Speaker of the House of Delegates. As a citizen member, he provided technical assistance to the committee and helped draft legislation on voting equipment certification, operation, and auditing.

Education and Technology Transfer. Dr. Evans publishes all of his course materials on the web, and many of them have been used in other courses and by individuals (e.g., UC-Santa Cruz built a course from Dr. Evans' CS588 courses, and Georgia Tech, Purdue, University of Washington, University of Georgia, and Embry-Riddle have adopted materials from his courses). Software from his research projects is nearly always made available under an open source license to be used, studied, and adapted by others. Several of his software products are widely used, including the Splint static analysis tool that is included in most Linux distributions and used at thousands of sites in industry to improve code quality and programmer productivity.

(iii) Professional Service

Dr. Evans is an active and influential contributor to the computer security research community, and examples of his service include:

- Selected as a fellow of the *Defense Science Study Group* (2008-2009), a group of 15 professors selected nationwide for a two-year intensive program funded by DARPA that involves studying national defense (including extended visits to dozens of military facilities) and providing advice and guidance to the Department of Defense.
- Appointed Program Co-Chair of the 30th *IEEE Symposium on Security and Privacy* (2009), the most important conference in computer security research.
- Served as Publications Chair, 14th *ACM Conference on Computer and Communications Security* (CCS 2007); Panels Chair, 29th *International Conference on Software Engineering* (ICSE 2007); Organizing Committee, 8th *International Conference on Information and Communications Security* (ICICS 2006); Co-Organizer, *Second International Workshop on Dynamic Analysis* (2004); Co-Organizer, *Conference and Workshop on Coding Theory and Quantum Computing* (2003). He has also served on the program committees for over a dozen major conferences.
- Served as a member of the 2008 site visit team for the National Science Foundation to evaluate the TRUST Science & Technology Center (which includes Berkeley, Carnegie Mellon University, Cornell, Stanford, Vanderbilt), and was an external reviewer for the University of Washington Bothell Computing and Software Systems Program. He has served on seven review panels for the National Science Foundation, and has reviewed proposals for the science foundations of Austria, Israel, and the Netherlands.

David Evans – Personal Statement

It is a tremendous privilege, and a constant challenge, to be a faculty member at the University of Virginia. I strive to make the most of the opportunity by teaching the things that will have the biggest positive impact on students as individuals, as well as enhancing student contribution to society, and also by conducting research addressing long-term, critical problems in ways that can only be done at a research university.

My primary teaching goals are to enable my students to become *intellectuals* (by which I mean people who love to play with ideas) and *teachers* (people who want to share ideas with others and can do so effectively). I am an idealist and an optimist, and believe that achieving those goals helps my students lead more fulfilling lives.

To help students become intellectuals, I want them to experience the joy and pleasure of discovering a novel solution to a hard problem. Throughout nearly their entire education, students answer questions to which the teacher already knows the answer. This gives the demoralizing impression that learning is about acquiring knowledge so that one can answer questions already answered by others. I like to ask students to solve problems that no one yet knows how to solve. Even in introductory courses, I strive to design problems that give students the feeling that they are discovering and creating something new and exciting. For example, the first assignment in my introductory computer science course involves making photomosaics. Students learn that determining whether it is possible to produce an efficient program that generates optimal, non-repeating photomosaics is an instance of the most famous open problem in computer science.

One student wrote on a solution to a problem in my Cryptology class that, “Personally, I felt *invincible* after solving this.” I want students to solve problems that they initially think are impossible, and to feel invincible when they do. To this end, I present optional challenge problems in my courses, which students often continue to work on after the course ends. One challenge problem, introduced on the first day in my cryptography course, was to decipher a message encrypted using a cipher invented by Thomas Jefferson. No one was able to solve it for over a year, until a student who had graduated over a year ago solved it using his free time while serving in the military.

To help students become teachers, I want students to realize that what they are learning is important and interesting, that they have a duty to share it with others, and that they will enjoy doing so. For an assignment in my cryptography course, students are asked to produce an artifact that conveys a technical idea to the general public. The results greatly exceeded my expectations—two pairs of students published articles in the *Cavalier Daily*; another group produced a movie that included cameo actors and a soundtrack, which I showed to the class and plan to show to future classes; one group of students taught a cryptography course to high school students.

I love lecturing and find preparing for lectures to be one of my most rewarding intellectual activities. I believe that all lectures should tell a story—people pay attention to and remember stories much better than lists. Like good stories, I strive to construct lectures with a clear beginning (introducing characters, the problems they need to solve, and why we should care about them), middle (explaining how they solved them), and end (explaining why it mattered, and building towards what happens next). Although most of my classes follow the traditional lecture format (often punctuated by short breaks where students work in groups on a problem), I

make sure never to get stuck in a routine. I change things such as the location of the class (moving outside or to coffee shops), pacing (usually fast, but sometimes spending three lectures to ensure that everyone gets one crucial idea), medium (often projected slides, but sometimes worksheets, chalk, or voice only), and format (working in groups, or bringing in guests -- typically former students who can relate the lessons to solving problems in the real world).

My teaching motto is something I learned from coaching youth soccer: *let the game be the teacher*. My role is to provide students with the tools they need, motivate them to care about a problem, inspire them to want to do great things, give them the confidence and courage to believe they can, and create the right conditions for them to play, discover and create on their own. When I manage to achieve this, I find that students nearly always exceed my expectations.

My research connects naturally with my teaching, and I view them as both components toward the same mission. Most of the students in my research group are recruited from my classes (from first year undergraduates in my introductory courses to graduate students in my seminar), and they often begin their research work by more deeply exploring a problem they encountered in class. I consider one of the primary outputs of my research efforts to be students able to identify important research problems, find creative approaches for solving them, and can effectively communicate their results both to experts and general audiences. I strive to find research problems that combine technically interesting problems with important societal goals.

For example, our work (supported by a recent NSF grant) seeks to mitigate the risks to society and individuals posed by the upcoming large-scale deployment of RFID tags. RFID tags are tiny logic circuits that are currently deployed in many security-sensitive applications such as key cards, public transportation tokens, and implantable medical devices, and expected to replace bar codes for item-level identification in the next few years. These uses raise serious security (e.g., unauthorized modification on pacemaker settings) and privacy (e.g., tracking individuals and the items they carry) concerns. Because RFID tags rely on power received over radio waves from readers, and many cost only a few cents, their computational power is severely limited, so it is not possible to implement standard cryptography on them. As a result, current implementations resort to ad hoc solutions that fail to provide adequate security and are frequently broken in practice. Our work has demonstrated weaknesses in the largest deployed RFID tag for security applications, and we have worked with the manufacturers to implement a more secure tag. We have also developed a formal model for understanding the privacy lost through various systems, and invented protocols that provide much improved privacy with minimal costs. Our current work is developing new cryptographic building blocks that can be implemented using existing circuitry on most RFID devices to reduce the cost of providing sufficient privacy in RFID devices to nearly zero.

I find computer science to be an intellectually deep and rewarding field, and do my best to convey that to my students, potential future students, and the general community. Although all lives in the developed world have been dramatically improved by computer applications, the newness of computer science, and the breadth of the field, means that most people have little understanding of computing as an intellectual discipline. Computer science is the formal study of processes. Computer scientists study ways to define and predict properties of processes, focusing on understanding how to solve problems in general and universal ways. Computers are the ultimate intellect amplifier – they can mechanize any intellectual activity we can imagine and carry it out at a rate of billions of steps per second. This enables tremendously exciting applications that are revolutionizing science, medicine, business and the arts. In addition, though, the understanding of processes that computing provides leads to fundamental insights and provokes deep questions about our minds, our society, and our universe.

David Evans – Abbreviated Curriculum Vitae

University of Virginia
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Department of Computer Science

emails: evans@cs.virginia.edu
web: <http://www.cs.virginia.edu/evans>
blog: <http://www.jeffersonswheel.org>

Faculty Appointments

Associate Professor of Computer Science, August 2006 – present
Assistant Professor of Computer Science, October 1999 – August 2006
University of Virginia, School of Engineering and Applied Science

Visiting Appointments (while on sabbatical, 2008-2009 academic year)

Visiting Professor, *University of California*, Berkeley, CA, Fall 2008
Visiting Researcher, *Microsoft Research*, Redmond, WA, Spring 2009

Education

Ph.D., Massachusetts Institute of Technology, Computer Science, February 2000
Dissertation: *Policy-Directed Code Safety*, Advisor: Professor John Guttag
SM, Massachusetts Institute of Technology, Electrical Engineering and Computer Science, 1994
SB, Massachusetts Institute of Technology, Electrical Engineering and Computer Science, 1994

Major Awards

University Teaching Fellow, 2001-2002
Computer Science Departmental Teaching Award, 2001
National Science Foundation CAREER Award, 2001-2005
ACM Jefferson Undergraduate Teaching Award, 2002
NSF CCLI Curriculum Development Grant, 2002-2003
SEAS Harold Morton Jr. Award for Teaching, 2003-2004 (presented at graduation)
USENIX Security Symposium, Invited Speaker, 2004
Defense Science Study Group Fellow, 2008-2009
All-University Teaching Award, 2008

Selected Refereed Research Publications

Graduate student advisee co-authors are underlined, undergraduate student co-authors are underlined and starred*, research staff co-authors are underlined and daggered[†]. Citation counts are from scholar.google.com, as of 12 September 2008. My work has been cited over 2000 times. See <http://www.cs.virginia.edu/evans/pubs> for all papers.

David Evans, John Guttag, Jim Horning, and Yang Meng Tan. LCLint: A Tool for Using Specifications to Check Code. In *Proceedings of the SIGSOFT Symposium on the Foundations of Software Engineering*. Dec. 1994. Also published in *ACM SIGSOFT Software Engineering Notes*, Volume 19, Number 5. (192 citations)

David Evans. Static Detection of Dynamic Memory Errors. In *Proceedings of the SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*. ACM. May 1996. Also published in *SIGPLAN Notices*, Volume 31 Number 5. (182 citations)

David Evans and Andrew Twyman. Flexible Policy-Directed Code Safety. In *Proceedings of the IEEE Symposium on Security and Privacy*. May 1999. (167 citations)

David Larochelle and David Evans. Statically Detecting Likely Buffer Overflow Vulnerabilities. In *Proceedings of the 10th USENIX Security Symposium*. August 2001. (234 citations)

David Evans and David Larochelle. Improving Security Using Extensible Lightweight Static Analysis. *IEEE Software*. Volume 19, Number 1. January/February 2002. (195 citations)

Lingxuan Hu and David Evans. Localization for Mobile Sensor Networks. In *Proceedings of the 10th ACM International Conference on Mobile Computing and Networking (MobiCom 2004)*. September 2004. (213 citations)

Anh Nguyen-Tuong⁺, Salvatore Guarnieri^{*}, Doug Greene^{*}, Jeffrey Shirley, and David Evans. Automatically Hardening Web Applications Using Precise Tainting. In *Proceedings of the 20th IFIP International Information Security Conference*. Chiba, Japan. May 2005. Also published in *Security and Privacy in the Age of Ubiquitous Computing*, edited by Ryoichi Sasaki, et al., Springer (IFIP 181), 2005. (76 citations)

Jinlin Yang, David Evans, Deepali Bhardwaj, Thirumalesh Bhat, and Manuvir Das. Perracotta: Mining Temporal API Rules From Imperfect Traces. In *Proceedings of the 28th International Conference in Software Engineering*. May 2006. (56 citations)

Nathanael Paul and David Evans. Comparing Java and .NET security: Lessons Learned and Missed. In *Computers & Security*, Volume 25, Issue 5, July 2006.

Anh Nguyen-Tuong⁺, David Evans, John Knight, Benjamin Cox, and Jack Davidson. Security through Redundant Data Diversity. In *Proceedings of the 38th IEEE/IFPF International Conference on Dependable Systems and Networks*. June 2008.

Karsten Nohl, David Evans, Starbug, and Henryk Plötz. Reverse-Engineering a Cryptographic RFID Tag. In *Proceedings of the 17th USENIX Security Symposium*. August 2008.

Karsten Nohl and David Evans. Hiding in Groups: On the Expressiveness of Privacy Distributions. In *Proceedings of the 23rd International Information Security Conference (IFIP SEC)*. Milan, Italy. Springer-Verlag. September 2008.

Selected Outreach and Education Publications

Christopher Frost^{*}, Michael Peck^{*}, David Evans. Pancakes, Puzzles, and Polynomials: Cracking the Cracker Barrel. *SIGACT News*. March 2004.

Clare Bates Congdon, John Dougherty, David Evans, Mark LeBlanc, Joyce Currie Little, Jane Chu Prey, Vojislav Stojkovic and Paul Tymann. *Computer Science and Bioinformatics*. Math and Bio 2010. The Mathematical Association of America. 2005.

David Evans and Michael Peck^{*}. Inculcating Invariants in Introductory Courses. In *Proceedings of the 28th International Conference in Software Engineering, Education Track*, May 2006.

David Evans. *Malicious Java Applets*. Article in *The Handbook of Information Security*, edited by Hossein Bidgoli. John Wiley & Sons, ISBN 0-471-64833-7. 2006.

David Evans. How Computing Changes Thinking. Essay in *Thinking of Reading: the University of Virginia Reader's Guide*. University of Virginia Press. September 2008.

Major Research Grants (selected from \$11.8M total funded research; Principal Investigator, unless listed as Co-PI)

Practical Use of Formal Techniques, NASA. (\$608K, 2000-2003) (Co-PI)

Programming the Swarm, National Science Foundation (CAREER) (\$285K, 2001-2006)

A Framework for Environment-Aware, Massively Distributed Computing, NSF (\$400K, 2002-6)

Genesis: a Framework for Achieving Component Diversity, DARPA (\$1.1M, 2004-6) (Co-PI)

System Structures for Secretless Security, NSF (\$1.6M, 2005-8) (Co-PI)

CPA: Automatic Inference and Effective Use of Temporal Properties, NSF (\$330K, 2006-9)

CT-ER: Automatic Identification and Protection of Security Critical Data, NSF (\$200K, 2006-8)

CT-ISG: Disk-Level Malware Detection and Response, NSF (\$400K, 2006-9)

Software Exploit Prevention and Remediation via Software Memory Protection, ARDA (National Intelligence Community Enterprise Cyber Assurance) (\$1.2M, 2007-8) (Co-PI)

Helix: A Self-Regenerative Architecture for the Incorruptible Enterprise, Department of Defense Multidisciplinary University Research Initiative (\$4.5M, 2008-2013) (Co-PI)

CT-M: Implementable Privacy and Security for Resource-Constrained Devices, NSF (\$1M, 2008-12)

Excerpts from Letters

Adrienne Felt, U.Va. Computer Science (“CS”) Undergraduate; Graduate Student at University of California-Berkeley

“As my research advisor, Professor Evans introduced me to academic research and gave me the opportunity to pursue my own interests. He has helped me explore different avenues of research and endlessly encouraged me to keep looking and experimenting until I am happy. Instead of just telling me how to solve problems that I encounter, he asks me leading questions until I realize the answer myself....

Professor Evans had a profound impact on my life. Independence, self-confidence and self-motivation have been the biggest lessons I have learned while at the University of Virginia, and they stemmed from his teaching and guidance.”

Jacques Fournier, U.Va. Economics and CS Undergraduate; Echols Scholar

“Professor Evans has a unique ability to interest students in very complex material by showing its usefulness. In a CS200 lecture on cryptography, he told the story of Turing, Titman, Colossus and the braking of the Nazi ciphers during World War II. Our next assignment was to crack a Lorenz-like cipher. We were told that there would be no dropping bombs to motivate us, but there was a prize for the first to crack the code.... From Dave’s classes, I have fond memories of the job of learning new things, which is why I applied to the PhD. program.

Dave is also able to keep students interested by challenging them to solve difficult problems. For example, he challenged us in class to figure out whether the Melissa virus Problem is undecidable, and whether a Turing Machine with a one-side infinite tape is Turing Equivalent....Being challenged to answer these questions in class and succeeding built up my confidence to solve difficult problems....Dave is the Richard Feynman of U.Va.”

Sam Guarnieri, U.Va. CS Undergraduate; Graduate Student at University of Texas

“Professor David Evans is an exceptional teacher because he connects with his students and finds ways to help them understand complex topics. He does not stand in front of a class and read a prepared lecture; he interacts with the students while he explains concepts. He figures out why people have trouble understanding topics and, amazingly, understands how to present the topics in a new light so the students having trouble can understand them. Professor Evans makes it enjoyable to learn complex topics.

I was Professor Evans’s research assistant for my final two years at U.Va. During this time, he taught me what research was and how to do research. I believe the lessons he taught me prepared me for the jump to graduate school where I immediately started working on research projects. Professor Evans worked with me on a project that eventually turned into a published paper. As an undergraduate, the paper was great, but what really impacted me was Professor Evans teaching me how to go from an idea, to doing research, to publishing a paper. I quickly learned it was not straightforward and Professor Evans was always there to help me and teach me new lessons about what research really is. I have worked with more professors now, and I realize that it is rare that a professor can teach someone how to do research without just doing the research for them. I still rely on these lessons I learned when I come to dead-ends in my research now.”

Jinlin Yang, Graduate Student, U.Va.

“Besides being a good advisor, Professor Evans has many extraordinary qualities that make him a role-model for his students. He is definitely one of the most hard-working people I have ever seen. He is very patient, tolerant and encouraging. As an international student, I had great difficulty speaking and writing in English. David has always been very patient about it and helped me improve. He is a great listener and respects his students. Sometimes even when I

have some bad ideas, he is still willing to hear it first and point out my flaws later. He is always very humble even though he is a very intelligent person.”

Virgil D. Gligor, Professor of Electrical and Computing Engineering, University of Maryland

“Dr. Evans’ teaching record (i.e., courses taught, M.Sc. and Ph.D. students supervised and graduated, educational tools developed) is outstanding. His papers have been used in over forty courses (including the University of Maryland) and his tools seem to be a basic staple of many introductory courses in U.S. and abroad.”

Sir Tony Hoare FEng FRS, Professor of Computer Science, Oxford University

“In addition, he is an excellent all-around Computer Scientist, with a wide range of contributions to different and novel aspects of security. His research results are well substantiated by experiment and very clearly written up... David takes justifiable pride in the fact that many of his papers are co-authored with his students. ... They provide models of what a good project and a good paper should be in any branch of engineering science.”

Anita Jones, Lawrence R. Quarles Professor of Engineering and Applied Science, Professor in Computer Science, U.Va.

“Dave is an extraordinary teacher. His teaching accomplishments have been recognized by many awards: University Teaching Fellow (2001), Computer Science Departmental teaching Award (2001), ACM Jefferson Undergraduate Teaching Award (2002), and SEAS Harold Morton Jr. Award for teaching (2004). Dave is innovative in the way that he formulates courses, in challenging lectures, in devising intriguing problem sets, and in involving students interactively in class. I am particularly impressed with the content of the several introductory courses that Dave designed and taught. There was rigor in the information that he delivered to these students. Some of the concepts that he introduced are considered to be quite advanced, requiring a “run-up” of underlying concepts to be able to address the more complex concepts, e.g., recursive functions, computability, photo mosaics and fractals. Dave is particularly adept at leading students to discover that they can accomplish things that they had no idea that they could do. Dave is the kind of faculty that a comprehensive university like U.Va. needs. I have focused on Dave’s entry level courses, but he also crafts challenging graduate courses such as biologically-inspired computing and malware. He implemented a game of jeopardy capable of asking students a sequence of security-related questions. This is the kind of inventive engagement of students that makes Dave an extraordinary teacher.”

John Knight, Professor of Computer Science, U.Va.

“Dave is a wonderful university teacher. Not only does he have an outstanding classroom style but he is a constant source of truly innovative ideas about teaching methods and curriculum content. He has taught a variety of courses since he joined the Department, and received acclaim from the students in all of them. Noting a dearth of courses about computer security, Dave has developed new courses in that area, and he has improved our curriculum considerably as a result.

Dave has given a great deal of thought to the basic philosophy of our curriculum, and he has developed yet another course with the goal of providing a different flavor to the material that the students see. I am delighted with this type of innovation because the result is a great opportunity for the student body and a fresh look at our curriculum from the faculty....Dave is a very valued professional colleague. He is a gifted researcher with a solid research program that is respected by both academics and industry, and he is working in important technical fields.”

Gabe Robins, Professor of Computer Science, U.Va.

“I had the pleasure of sitting in on one of Dave's lectures, and I was very impressed with his teaching style. He takes his teaching duties very seriously, and meticulously prepares for his courses. He uses the Socratic method of teaching, where through carefully crafted questions he gently guides the class into discovering the knowledge that he intends to impart to them. He provides hints as necessary, and keeps the class discussion interactive and on track, while keeping the students fully engaged throughout this process. The students invariably reach the desired conclusions, and greatly enjoy the satisfaction of discovering the results themselves. This is teaching at its very best.

Dave also understands that teaching and research are inherently intertwined. Research creates new knowledge that is used to derive new and better ways to explain various phenomena in the classroom, while teaching often gives rise to new probing questions that can turn into future research topics. Dave has a very visceral appreciation of this powerful synergy between teaching and research, and he works with numerous undergraduates on senior thesis topics that often produce publishable results. Indeed his teaching excellence has been recognized by several teaching accolades already. Dave's course evaluations are superb, and his students rave about his teaching.

Dave has consistently demonstrated true leadership on the teaching and education front...he actively motivates his students through the joy of discovery and invention. Dave's students have responded beautifully to his mentoring with unusually impressive accomplishments, such as publishing articles about science pedagogy, and helping to teach high school students. I am sure that Dave will always continue to be an inspiration to his students and to his colleagues alike.

In summary, Dave's strong combination of skills and accomplishments in teaching and education clearly make him one of our country's best young faculty, and one of the superstar professors and leaders upon which U.Va. will build its future. I recommend David Evans for a U.Va. teaching award in the strongest possible terms.”

Ariel D. Rubin, Professor of Computer Science, Johns Hopkins University

“David puts the most effort into his teaching class of anybody that I know. When he showed me his class materials for his security class, I could not believe how much he had done. For example, he wrote PowerPoint macros to implement the game “Jeopardy” with computer security questions to play with his class the end of the term. He must have spent hours coding that up, but it's just the kind of thing that demonstrates how much he loves what he does. I know that David's students feel like they are among the luckiest ones out there because of the attention that he has given them.”

Jack Stankovic, BP America Professor of Computer Science, U.Va.

“What impresses me about Dave's teaching is that he is extremely demanding yet is able to convey difficult challenges in a manner that has students achieving more than they thought possible and taking away a feeling that this was the best course they ever had. This sentiment is conveyed over and over in all levels of courses that Dave teaches. I believe that only truly gifted instructors are able to accomplish such a result. It is also obvious that to achieve these results Dave works very hard at preparing lectures in an innovative style that uses a story-line and makes him highly available to undergraduates with extensive office hours. Such dedication is central in helping students achieve at such high levels.”

Additional Documentation and Evaluation of Professional Activities

Student Achievement

Numerous students have won prestigious national and University awards as a result of their work with Dr. Evans. The CRA Outstanding Undergraduate Award is the most important national award recognizing demonstrated excellence in computing research for undergraduate students. Dr. Evans is the only faculty member in the Commonwealth to have ever supervised a finalist for this award, and he has been the primary advisor and mentor for two of them!

Honorees include:

- Adrienne Felt, Computing Research Association (CRA) Outstanding Undergraduate Award, Finalist 2008
- Salvatore Guarnieri, CRA Outstanding Undergraduate Award, Finalist 2006
- Ami Malaviya, CRA Outstanding Undergraduate Award, Honorable Mention 2005
- Jonathan McCune, CRA Outstanding Undergraduate Award, Honorable Mention 2003

Other notable awards received by Dr. Evans' students include:

- Karsten Nohl, Department of Electrical and Computer Engineering's Louis T. Rader Graduate Research Award recognizing outstanding research by a Computer Engineering Ph.D. student (2008)
- Adrienne Felt, Outstanding Student Award for the School of Engineering and Applied Science from the Virginia Engineering Foundation (2008)
- Jonathan McCune, Louis T. Rader Award for interdisciplinary research (2003)
- Jonathan Calandrino, Louis T. Rader Award for interdisciplinary research (2002)

Selected Comments from Student Evaluations

CS150 (CS200): *Computing: From Ada and Euclid to Quantum Computing and the World Wide Web* (Spring 2002, Spring 2003, Fall 2005, Spring 2007)

- "Dave Evans is the most dedicated professor I have ever had. It is clear that he enjoys teaching and enjoys the material. His love and interest in computer science is contagious. Best and most worthwhile course I have taken in my four years of college."
- "I have learned more in this class than in any of my other classes, and I can easily say that this class balances practical and intellectually interesting material better than any other I have taken."
- "David Evans is the best professor I've had at the University since starting last fall. He is extremely intelligent, but willing and able to communicate at the students' level. He pushes us to levels we think we cannot reach and surprises us when we do reach them. His class is not only one of the most representative of the liberal arts, but it teaches us how to think in ways I never have and covers topics that graduate students are probably learning. Keep the class, and keep Dave!"
- "I really enjoyed this class. It was very different from almost any other class I have taken at the University. It promoted lots of hands on experience and learning by doing. Although I confess to feeling very confused at some points in the course I think this course has really challenged me and changed the way I think."
- "David Evans continues to be an amazing instructor (I had taken a class with him last semester). He is always available to his students, very fair as a grader, and extremely willing to help students in any way possible. He is extremely valuable to the Computer Science department."

CS205 (CS201J): *Engineering Software* (Fall 2002, Fall 2003, Fall 2006)

- “Professor Evans is a truly unique professor. I wish there were more instructors at this school that strived to give their students great personal attention and presented the class material in such an interesting way. Great course!”
- “This was by far the best course that I have taken so far in the E-school. I have never worked so hard and learned so much. Dave is an incredible professor; he is very accessible and fair.... The format of this course worked very well. Learning how to program in java was difficult at first, but overall was not a problem. I also liked the fact that we discussed and learned about other programming languages as well. Overall, I would say that this course was extraordinarily effective in teaching principles of good design. I would recommend this course to all of my friends. It was definitely one of the most challenging courses that I have ever taken.”

CS551: *Security and Privacy on the Internet* (Fall 2000)

- “This course was, by far, the most interesting and best taught course I have taken in my life. While I am interested in computer security, what set this course apart from others was the quality of teaching. Professor Evans was able to entertain the students while still conveying the information. In addition to what was presented in class, links to additional resources were always provided for students who wanted to investigate a particular subject further than was necessary for the class. Finally, he was able to make the course even more interesting by addressing current issues when they were in the news (election protocols, trick or treat).”
- “Evans did a fantastic job with this course. Although most all of my real learning took place when I tried to tackle his problem sets, his lectures were great, I would never miss one. They served to introduce me to the general ideas and also to get me excited about the topic material in general through humor and examples of how it affected me...”

CS558: *Cryptology: Principles and Applications* (Fall 2001, Spring 2005)

- “The levels of commitment to the course and the students that Prof. Evans shows, as well as his knowledge of the subject, are unparalleled....As I overheard some other students comment, in a few years, Dave will be the Ken Elzinga of the E-school. He relates to his students very well, and is very approachable....I would recommend this course to anyone at the school who wants to learn, but is not afraid of lots of hard work.”
- “This is the best course I have taken so far in college. I found it to be consistently challenging but never overburdening. I would actually look forward to doing the homework. The professor made a subject that could have been very dry interesting and exciting.”
- “This is without question the best class I have taken at this University. The professor did a phenomenal job with the organization and development of the material. Problem Sets were at the same time challenging and intriguing, enticing the student to put forth extra effort to gain a greater understanding of the material....”

Summary of Quantitative Teaching Evaluations

Dr. Evans’ teaching evaluations are consistently among the highest in the School of Engineering and Applied Science, despite the fact that he teaches some of the most demanding required courses in our curriculum. The following table summarizes his course and instructor ratings (which are averages of responses to several questions, where 5 is the best possible response).

Semester: Course	Instructor Rating	Course Rating	Enrollment (Responses)
S00: CS 655	4.48	4.19	24 (24)
F00: CS 551	4.44	3.93	46 (31)
S01: CS 655	4.29	3.64	9 (5)
F01: CS 588	4.39	3.85	37 (23)

S02: CS 200	4.67	4.03	9 (6)
F02: CS 201J	4.56	3.81	27 (19)
S03: CS 200	4.42	4.00	35 (26)
F03: CS 201J	4.46	3.68	63 (38)
S04: CS 200	4.42	3.57	25 (20)
S04: CS 551	4.94	4.97	9 (6)
S04: CS 851	4.98	4.96	6 (6)
F04: CS 851	4.62	4.23	14 (9)
S05: CS 588	4.34	4.01	17(14)
F05: CS 150	4.67	3.99	26 (14)
S06: CS 216	4.14	3.78	96 (65)
F06: CS 205	4.83	4.23	10 (6)
S07: CS 150	4.33	3.92	54 (29)
F07: CS 851	4.24	3.86	14 (7)
S08: CS 302	4.15	4.09	83 (50)
Average	4.50	4.03	67.5%

Selected Invited Colloquia (see <http://www.cs.virginia.edu/evans/talks/> for slides)

University of Richmond Computer Science Seminar, *1000 Things Every Self-Respecting Computer Scientist Should Know*, Richmond, VA, 10 November 2003.

Johns Hopkins University Information Security Institute Seminar, *What Biology Can Teach Us About Security*, Baltimore, MD, 14 November 2003.

USENIX Security Symposium, *What Biology Can Teach Us About Security*, San Diego, CA, August 2004. A summary of the talk is in *USENIX ;login.*, Vol 29, No 6, December 2004.

University of Delaware (SIGNET Seminar), *Wireless Security in the Real World: Using Physical Properties to Mitigate Wormhole Attacks*, 15 September 2004.

University of Virginia Institute of Mathematical Science, Seminar on Applications of Mathematics, *No Matter Where You Go, There You Are: Secure Localization Techniques for Mobile Wireless Networks*, Charlottesville, VA, 2 December 2004.

SRI Workshop on the Verification Grand Challenge, *Static/Dynamic Analysis: Past, Present and Future*, Menlo Park, CA, 22 February 2005. (Invited panel presentation)

Purdue University Center for Education and Research in Information Assurance and Security (CERIAS), *Where's the FEEB?: The Effectiveness of Instruction Set Randomization*, West Lafayette, IN, 9 March 2005.

MIT Computer Science and Artificial Intelligence Laboratory, *Stealing Secrets and Secretless Security Structures*, Cambridge, MA, 23 June 2005.

Harvard University, *Stealing Secrets and Secretless Security Structures*, Cambridge, MA, 27 June 2005.

University of Texas at San Antonio, *The N-Variant Systems Framework: Polygraphing Processes for Secretless Security*, San Antonio, TX, 4 October 2005.

SDWest 2006, *Promising Breaks and Breaking Promises: Program Analysis in Theory and Practice*, Santa Clara, CA, 17 March 2006. (90-minute class for industry).

Chinese Academy of Sciences, Institute of Software, *N-Variant Systems: A Secretless Framework for Security through Diversity*, Beijing, China, 29 May 2006.

Beijing Institute of Technology, *N-Variant Systems: A Secretless Framework for Security through Diversity*, Beijing, China, 30 May 2006.

North Carolina State University, *Disk-Level Behavioral Virus Detection*, Raleigh, NC, 5 March 2007.

Air Force Scientific Advisory Board. *N-Variant Systems*, Arlington, VA, 29 March 2007.

Johns Hopkins University, *Feasible Privacy for Lightweight RFID Systems*, Security and Privacy Applied Research Seminar, Baltimore, MD, 17 October 2007.
University of California Berkeley, *Redundant Computing for Security*, TRUST Seminar, Berkeley, CA, 25 September 2008.

Selected Media Coverage (see <http://www.jeffersonswheel.org> for links to many articles)

Dr. Evans and his research group are frequently covered in the local and international press. In particular, his group's work on security and privacy issues for RFID systems and social networking have been the subject of several hundred articles in the past year, raising both public and industry awareness of the important privacy risks of these technologies.

Local and University Media

Daily Progress. *Coaches preparing players for RoboCup2001*, 8 August 2001.

U.Va. Top News Daily. *Computer Students Offer Novel Look at Jefferson's Rotunda*, 29 May 2002.

Monticello News. *Electronic Wheel Cipher is Added to Monticello Site*, 30 April 2004.

Radio Interview: AM Charlottesville (AM 1260), 27 October 2004. (Spyware).

TV: NBC29 News at Sunrise and Today Show Cut-in, 22 December 2004. (Cellphone Malcode).

Radio: AM Charlottesville (AM 1260), 14 January 2005. (Windows Vulnerabilities).

Arts & Sciences Magazine. *Computer Science for College Students*. 18 August 2006.

U.Va. Today. *MURI Award Aims to Dramatically Improve System Security*. September 11, 2007.

Cavalier Daily. *\$4.6 million grant to enable network security research*. September 13, 2007.

U.Va. Today. *U.Va. Engineering School Student Probes Facebook's Vulnerabilities*. January 30, 2008.

WVIR (NBC 29) TV News, *Should the Voting Machines be Scrapped?* 4 February 2008.

U.Va. Today. *Group Demonstrates Security Hole in World's Most Popular Smartcard*. 26 February 2008.

U.Va. Today. *Influencing Eternity: University of Virginia to Honor Outstanding Teachers*. 23 April 2008.

National and International Media

Linux Gazette. *Static checking of C programs with LCLint*. Issue 51, March 2000.

Linux Journal. *The Code Analyser LCLint*. May 2000.

ZDNet: eWeek. *Combating the Plague of Insecurity*. 9 August 2000.

CNet News. *Passwords: The Weakest Link*. 22 May 2002.

Forbes Magazine. *Attack of the Clones*. 10 June 2002.

The Wall Street Journal. *Web Privacy Services Complicate Feds' Job*. 3 July 2003.

Technology Review. *From Artificial Intelligence to Artificial Biology?* November 2003.

TechNewsWorld. *Security: What's Good About Computer Viruses*. 5 March 2004.

Network World Fusion. *Security Holes Force Firms to Rethink Coding Processes*. 19 April 2004.

New York Times. *Will Code Check Tools Yield Worm-Proof Software?* 26 May 2004.

Information Security Magazine. *BIOLOGY: Back to Nature?* July 2004.

Salon. *Computer, Heal Thyself*. 12 July 2004.

New Scientist. *Unnatural Selection*. 21 July 2006.

Voice of America. *Radio Interview on Electronic Voting*. 7 November 2006.

CNet.com. *Exclusive: The Next Facebook Privacy Scandal*. 23 January 2008.

Boston Globe. *T-Card has Security Flaw, Says Researcher: Cracked Code Could Lead to Counterfeits, Study Team Warns*. 6 March 2008.

Boston Herald. *Research: CharlieCard is Far From Hack-Proof*. 6 March 2008.

The Chronicle of Higher Education. *Computer-Science Researchers Expose Security Vulnerability of Some Electronic Key Cards*. 21 March 2008.