Eric Spero, PhD

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EDUCATION

Doctor of Philosophy, Computer Science June 2023
Carleton University, Ottawa, Canada
Thesis: *User Interfaces, Mental Models, and Cybersecurity*
Supervisor: Robert Biddle

Master of Arts, Human–Computer Interaction June 2018
Carleton University, Ottawa, Canada
Thesis: *A Non-Linear Electronic Textbook Format to Facilitate Deep Learning*
Supervisors: Robert Biddle, Ali Arya

Bachelor of Cognitive Science (Honours), Cognitive Science Nov. 2014
with specialization in Language and Linguistics
Carleton University, Ottawa, Canada
Thesis: *Construction Grammar and the Argument–Adjunct Distinction*
Supervisor: Ida Toivonen
Graduated with high distinction

HONOURS & AWARDS

Senate Medal for Outstanding Graduate Work (Doctoral) 2023
Carleton University
Faculty-level medal recognizing outstanding doctoral research and thesis quality.

Senate Medal for Outstanding Academic Achievement (Undergraduate) 2014
Carleton University
Awarded to the top 3% of the graduating class in the degree program.

SCHOLARSHIPS

Alexander Graham Bell Canada Graduate Scholarship (CGS-D) 2020–2023
Natural Sciences and Engineering Research Council of Canada (NSERC)
$35,000 CAD per year for three years; Canada's premier national doctoral scholarship in science and engineering.

Ontario Graduate Scholarship (OGS) 2019
Government of Ontario
$15,000 CAD; competitive, merit-based provincial graduate scholarship.

PROFESSIONAL SKILLS

Research: Experimental design (within- and between-subjects); human-participants research (user studies, interviews, focus groups, questionnaire design); usability evaluation (heuristic evaluation, cognitive walkthroughs); UI/UX design and prototyping (including functional prototypes using HTML/CSS/JavaScript); mixed-methods research; literature synthesis; qualitative analysis (thematic analysis, grounded theory); academic and technical communication

Statistical Analysis: Behavioural data analysis; parametric and non-parametric methods; longitudinal and correlated-data analysis (generalized estimating equations; mixed-effects modelling); Bayesian modelling; reproducible analysis workflows in R

Software: R; Python; MATLAB; JavaScript (incl. d3.js); HTML/CSS; Linux administration; Bash; C/C++; Java; SQL; Lisp/ACT-R; LaTeX

WORK EXPERIENCE

Research Fellow Dec. 2024–present
University of Auckland
SECRET Lab
Supervisor: Giovanni Russello
Auckland, New Zealand

- Independently conducted the empirical analysis and interpretation for a large-scale simulated phishing study conducted with a Pasifika government agency
- Developed the conceptual framing and wrote the manuscript, resulting in the SOUPS 2025 paper *Language as Lure: A Naturalistic Study on Pasifika Phishing Susceptibility*
- Provided ongoing research guidance to PhD students across multiple usable-security projects, assisting primary supervisors with research design, analysis, and academic writing.
- Provided ongoing research guidance to PhD students across multiple usable-security projects, including developer-facing security support and AI-assisted phishing detection, assisting primary supervisors with research design, analysis, and academic writing.

Research Associate June 2023–Dec. 2024
Carleton University
HotSoft Research Laboratory
Supervisor: Robert Biddle
Ottawa, Canada

- Extended doctoral research through additional analyses of prior study data, contributing to several follow-up publications
- Conducted statistical analyses of longitudinal phishing-simulation data and presented findings in weekly research meetings and monthly project reports
- Collaborated with Pasifika partners to identify and resolve operational issues during study deployment
- Conducted literature reviews on in-situ developer security support to identify gaps and requirements for a novel security tool.
- Contributed to the supervision of an undergraduate Honours project on a UI tool supporting end-user mental models of website security

Research Assistant May 2019–Apr. 2020
National Research Council Canada
Flight Research Laboratory
NSERC CLUE–funded internship
Supervisor: Andrew Law, PhD (Biomedical Engineering)
Ottawa, Canada

- Analysed functional neuroimaging data from cognitive-performance tasks using MATLAB to explore post-hoc inference of cognitive strategy from behavioural and neural measures
- Adapted ACT-R models of cognitive-performance tasks in LISP and evaluated model outputs against human-subject data to assess model accuracy
- Documented procedures for modifying an Angular-based software simulation of the Centre for Air Travel Research (CATR) airport-terminal facility

Research Assistant May 2018–June 2023
Carleton University
HotSoft Research Laboratory
Supervisor: Robert Biddle
Ottawa, Canada

- Built an early prototype of an 'evidence browser'—a web application to help intelligence analysts manage evidence documents—using JavaScript, Node.js, and MongoDB
- Designed and led a driving-simulation workshop for the SHAD summer enrichment program, facilitating discussions on related HCI research
- Co-led a workshop on using the R programming language in HCI research as part of the NSERC CLUE initiative
- Presented research to incoming HCI graduate students during orientation, introducing them to the program's research landscape
- Conducted structured observations of TA–student interactions during weekly tutorials in Discrete Structures (COMP 1805), collecting quantitative and qualitative data to support course-related educational research

Junior Technical Analyst Apr.–Aug. 2013
Carleton University
Computing and Communication Services, Ancillary Systems
Ottawa, Canada

- Implemented scripts for data-retention and server-configuration tasks using established departmental procedures
- Documented a range of operational workflows and existing scripts for internal technical use
- Made UI updates to Carleton University web systems

SAP Business Analyst Apr.–Aug. 2012
Department of National Defence
Defence Resource Management Information System (DRMIS) — Support
Ottawa, Canada

- Created and revised Business Process Procedures (BPPs) to support training and execution of business processes within DND's SAP-based DRMIS platform
- Interviewed stakeholders to improve the clarity, educational value, and archival usefulness of BPP documentation

RESEARCH PROJECTS LED

Language and Cultural Effects on Pasifika Phishing Susceptibility June 2024–Feb. 2025

- Assumed a leadership role in an ongoing project with a Pasifika government agency; oversaw completion of data collection and led all subsequent analysis and writing
- Conducted the first naturalistic phishing study in a Pasifika context (2,000 participants exposed to four phishing emails over four months), examining how language choice and cultural norms influence phishing susceptibility.
- Analysed multilingual phishing-email outcomes using generalized estimating equations, showing that Pasifika-language phishing emails elicited higher click rates than English versions when framed as personal requests for assistance.
- Interpreted these effects using psycholinguistic accounts of the foreign-language effect and anthropological descriptions of Pasifika cultural norms, arguing that linguistic cues may activate prosocial helping obligations.

***Site Inspector*: Improving Browser Communication of Website Security Information** Feb. 2022–Feb. 2023

- Designed a browser-based UI tool that communicates website identity information from X.509 certificates, exemplifying the SAVE paradigm by increasing visibility into security-relevant system state
- Implemented the tool as a Firefox extension using JavaScript, HTML, and CSS
  - Download link: https://addons.mozilla.org/en-US/firefox/addon/site-inspector/
- Evaluated the tool in a 30-participant user study, finding that it substantially improved users' ability to detect fraudulent websites

Mixed-Methods Evaluation of the *Home–Away* Security Model Aug. 2020–May 2021

- Conducted ten one-on-one interviews to further examine and refine the *Home–Away* model following its initial qualitative development
- Designed and administered a 100-item online questionnaire ($n = 250$) to quantitatively evaluate the model
- Performed thematic analysis of interview data and Bayesian analysis of questionnaire responses (using R and JAGS), providing convergent empirical support for the model
- Demonstrated that the everyday-security *Home–Away* model generalizes to software security practices, informing security-focused UI design

Security Awareness and Visibility Evaluation (SAVE): A New Security Paradigm Feb. 2020–Dec. 2020

- Examined how software UIs conceal security-relevant system behaviour, preventing users from forming accurate mental models.
- Conducted three illustrative case studies showing how lack of visibility leads to insecure decision-making.
- Outlined UI design principles informed by Ecological Interface Design to improve users' perception and interpretation of security-relevant system state.

Design Patterns for Supporting End-User Security: Applying the *Home–Away* Model to Digital Systems Jan. 2020–Aug. 2020

- Developed a catalogue of UI design patterns grounded in mental-model theory and everyday physical-world security behaviour
- Mapped real-world *Home–Away* security practices to digital contexts to support user reasoning about cybersecurity threats
- Authored pattern descriptions (problem, forces, solution, known uses) synthesising findings from prior qualitative studies
- Demonstrated that these patterns correspond to design choices already present in widely used software, highlighting their practical relevance

The *Home–Away* Everyday Security Model Oct. 2019–Nov. 2020

- Conducted a focus group with seven participants at the Pattern Languages of Programs conference and follow-up interviews with ten additional individuals to explore everyday physical security behaviour
- Performed a thematic analysis identifying core behavioural themes—context, dissuasion, pre-/post-checking, monitoring, and insurance—and showing how these organise into a recurring security cycle
- Synthesised these findings into the *Home–Away* model, describing how people manage security risks when transitioning between safe (home) and unsafe (away) contexts

Investigating Mental Models of Malware Oct. 2018–Mar. 2019

- Designed and conducted a user study with 40 participants to explore end-user mental models of malware using a diagramming exercise and questionnaire

- Performed a grounded-theory analysis of participant diagrams, identifying systematic misconceptions that could lead to unsafe behaviour

***TreeBook*: A Concept-Centric, Non-Linear E-Textbook Format for Deep Learning** 2015–2018

- Designed a novel e-textbook format that makes conceptual structure explicit to reduce extraneous cognitive load and support deeper learning
- Developed a functional prototype using JavaScript, d3.js, HTML, and CSS
  - Viewable at: https://ericspero.com/treebook
- Designed and conducted a user study with 41 participants comparing the non-linear format to a linear control, demonstrating promising learning benefits

Construction Grammar and the Argument-Adjunct Distinction Sept. 2013–Apr. 2014

- Evaluated a Construction Grammar account of the argument–adjunct distinction within a usage-based, perceptually grounded model of language
- Analysed how constructional representations explain variation in argument structure and the behaviour of adjunct modifiers

TEACHING EXPERIENCE

Course Instructor July–Nov. 2025
COMPSCI 725: Usable Security and Privacy Engineering
University of Auckland
Auckland, New Zealand

- Designed and independently taught a new 76-student postgraduate course examining cybersecurity systems through the interaction of technical mechanisms, user interfaces, and human decision-making
- Structured the course around guided, research-paper–based discussions, modeling expert reasoning about system assumptions, trade-offs, and design constraints imposed by human cognition
- Designed authentic assessments including a research-style usable security study proposal, oral presentation, and final exam
- Fostered inclusive participation through multiple engagement modes, including anonymous in-class written discussion (Mentimeter)
- Received strong student evaluations, with 92% of respondents generally agreeing that the course quality and teaching were high (n=39)

Course Tutor (Instructor Responsibilities) Feb.–June 2025
COMPSCI 727: Cryptographic Management
University of Auckland
Auckland, New Zealand

- Delivered a full guest lecture and chaired four weeks of research-presentation sessions
- Graded oral presentations and research papers and provided detailed feedback

Teaching Assistant Sept. 2015–May 2022
Carleton University
Ottawa, Canada

- *Courses:* Introduction to Programming and Problem Solving (BIT 1400), Intermediate Programming (BIT 2400), Introductory Psychology (PSYC 1000), Introduction to Cognitive Psychology (PSYC 2700), Computing for Arts Students (COMP 1001), Human-Computer Interaction (COMP 3008)
- Explained technical concepts using everyday language and helped students improve their work through tutorials, office hours, email correspondence, and assessment feedback

PUBLICATIONS

Manuscripts Under Review / In Preparation

E. Spero and R. Biddle. Managing security under limited attention: the "Home–Away" model of home and online security, 2026. URL: https://doi.org/10.2139/ssrn.6212349. Manuscript submitted to Behaviour and Information Technology

L. Betts, **E. Spero**, R. Biddle, D. Lottridge, and G. Russello. Enhancing user awareness of email content concealment through renderer-level detection. Manuscript in preparation for submission to IEEE Transactions on Information Forensics and Security (TIFS), 2026

- Contribution: Advisory input and manuscript feedback

J. Recommendable, **E. Spero**, R. Biddle, G. Russello, and D. Lottridge. SoK: in-context human-centred anti-phishing interventions. Manuscript submitted to Symposium on Usable Security and Privacy (SOUPS), 2026

- Contribution: Conceptual framing; analysis support and manuscript feedback

T. Lu, **E. Spero**, M. R. V. Chaudron, R. Biddle, and G. Russello. Security errors in software development: a review of theory-based human factors and interventions. Manuscript submitted to ACM Computing Surveys, 2025

- Contribution: Conceptual structure; manuscript revisions

Y. Xue, **E. Spero**, Y. S. Koh, and G. Russello. MultiPhishGuard: an LLM-based multi-agent system for phishing email detection. Manuscript in preparation for submission to APWG Symposium on Electronic Crime (eCrime) 2026, 2025. URL: https://arxiv.org/abs/2505.23803

- Contribution: Statistical analysis; manuscript writing; expert phishing judgments and rationale annotation

Peer-Reviewed Journal Articles

E. Spero and R. Biddle. Site Inspector: improving browser communication of website security information. *ACM Transactions on Privacy and Security*, Apr. 2025. DOI: 10.1145/3726867

M. Stojmenović, **E. Spero**, M. Stojmenović, and R. Biddle. What is beautiful is secure. *ACM Transactions on Privacy and Security*, 2022. DOI: 10.1145/3533047

- Contribution: Led statistical analysis and interpretation; literature synthesis and manuscript development

Peer-Reviewed Conference Papers

E. Spero, L. Betts, I. Seow, E. Fuatimau, R. Biddle, D. Lottridge, and G. Russello. Language as lure: a naturalistic study on Pasifika phishing susceptibility. In *Twenty-First Symposium on Security and Privacy (SOUPS) 2025*, Seattle, WA, USA. USENIX, 2025. URL: https://www.usenix.org/conference/soups2025/presentation/spero

L. Betts, **E. Spero**, D. Lottridge, R. Biddle, and G. Russello. Detecting malicious email content concealment with text similarity metrics. In *Pacific Asia Conference on Information Systems (PACIS) 2025*, Kuala Lumpur, Malaysia. AIS, 2025. URL: https://aisel.aisnet.org/pacis2025/security/security/6

- Contribution: Statistical analysis and visualization support; manuscript feedback

E. Spero and R. Biddle. Out of sight, out of mind: UI design and the inhibition of mental models of security. In *New Security Paradigms Workshop (NSPW) 2020*, Online, USA. ACM, 2020. DOI: 10.1145/3442167.3442174

E. Spero and R. Biddle. Home and away: UI design patterns for supporting end-user security. In *2020 European Conference on Pattern Languages of Programs (EuroPLoP)*, Virtual event, Germany. ACM, July 2020. DOI: 10.1145/3424771.3424780

E. Spero, M. Stojmenović, S. Chiasson, and R. Biddle. Control and understanding in malware and legitimate software. In *2019 APWG Symposium on Electronic Crime Research (eCrime)*, Pittsburgh, PA, USA. IEEE, Nov. 2019. DOI: 10.1109/eCrime47957.2019.9037597

M. Stojmenović, **E. Spero**, T. Oyelowo, and R. Biddle. Website identity notification: testing the simplest thing that could possibly work. In *17th International Conference on Privacy, Security and Trust (PST)*, Fredericton, Canada. IEEE, Aug. 2019. DOI: 10.1109/PST47121.2019.8949048

- Contribution: Statistical analysis support; results interpretation

E. Spero, M. Stojmenović, A. Arya, and R. Biddle. Learning with trees: a non-linear e-textbook format for deep learning. In *Learning and Collaboration Technologies. Designing Learning Experiences*. 21st International Conference on Human-Computer Interaction (HCII), Orlando, FL, USA. Springer, July 2019. ISBN: 978-3-030-21814-0. DOI: 10.1007/978-3-030-21814-0_31

Peer-Reviewed Poster Papers

Z. Husein, E. Spero, and R. Biddle. Do passkey explanations discourage adoption? In *Proceedings of HCI International 2026*. Springer, 2026

E. Spero, M. Stojmenović, Z. Hassanzadeh, S. Chiasson, and R. Biddle. Mixed pictures: mental models of malware. In *17th International Conference on Privacy, Security and Trust (PST)*, Fredericton, NB, Canada. IEEE, Aug. 2019. DOI: 10.1109/PST47121.2019.8949030

E. Spero, M. Stojmenović, and R. Biddle. Helping users secure their data by supporting mental models of VeraCrypt. In *HCI International 2019 - Posters, Part I*, Orlando, FL, USA. Springer, July 2019. DOI: 10.1007/978-3-030-23522-2_27

Non–Peer-Reviewed Conference Papers

E. Spero and R. Biddle. Security begins at home: everyday security behaviour and lessons for cybersecurity research. In *26th Conference on Pattern Languages of Programs (PLoP)*, Ottawa, ON, Canada. ACM, Oct. 2019. URL: https://dl.acm.org/doi/10.5555/3492252.3492279

CONFERENCE PRESENTATIONS

Indigidata Aotearoa	Nov. 2025
Symposium on Usable Privacy and Security (SOUPS)	Aug. 2025
Pacific Asia Conference on Information Systems (PACIS)	July 2025
New Security Paradigms Workshop (NSPW)	Oct. 2020

Annual Meeting of the Cognitive Science Society (CogSci) (poster) July 2020
Symposium on Electronic Crime Research (eCrime) Nov. 2019
International Conference on Human-Computer Interaction (HCII) July 2019

OPEN-SOURCE AND SYSTEMS ENGAGEMENT

- Author of the *foreground* patch for the dwm window manager (https://dwm.suckless.org/patches/foreground/; implemented in C)
- Operated self-hosted email (Postfix/Dovecot), web (Apache/Nginx), and XMPP (Prosody) services
- Submitted kernel and system-level bug reports to upstream projects (e.g. https://bugzilla.kernel.org/show_bug.cgi?id=215880)
- Volunteer technical support within the Gentoo Linux community (Discord)