Chung-chieh Shan

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Research

I use

- modal **logics**, which model knowledge and quotation,
- delimited **continuations**, which liberate control flow, and
- polymorphic **type systems**, which propagate static assurances,

to

- unify **linguistic side effects**,
- support **natural metaprogramming**, and
- build **theories of mind with bounded rationality**.

Teaching

01:198:500:03, Light seminar: structure and interpretation (Spring 2010)
01:198:314, Principles of programming languages (Fall 2009, Spring 2006)
16:198:503, Computational thinking (Fall 2009)
16:185:500, Cognitive-science proseminar, with Zenon Pylyshyn and others (Fall 2009)
16:198:504, Computational modeling (Spring 2007–9)
Composing meanings as programs (European summer school in logic, language and information; Hamburg, Germany, August 2008)
16:198:530, Principles of artificial intelligence (Fall 2007, Fall 2005)
16:198:500:03, Light seminar: programs as data (Fall 2007)
16:198:500:02, Light seminar: logic and computation (Spring 2007)
01:185:411, Cognitive-science proseminar, with Rochel Gelman and others (Spring 2006–7)
16:615:535/16:185:603, Seminar on questions: semantic and computational issues (Fall 2006)
Continuations: natural language meaning as computation, with Chris Barker (European summer school in logic, language and information; Nancy, France, August 2004)

Education

PhD in computer science 2005, Harvard University
Dissertation: "Linguistic side effects"
Committee: Stuart M. Shieber (advisor), Barbara J. Grosz, Avi Pfeffer, Norman Ramsey

BA in mathematics 1999, cum laude in general studies, Harvard University
Phi Beta Kappa; Harvard College and John Harvard Scholarships

Awards

Best paper (with Oleg Kiselyov) 2009, working conference on domain-specific languages
Beth dissertation award 2006, Association for Logic, Language and Information
Best paper (with Balder D. ten Cate) 2002, ESSLLI student session
First place (with Dylan P. Thurston) 2001, ACM ICFP programming contest

Book chapters

Fun with type functions. Oleg Kiselyov, Simon Peyton Jones, and Chung-chieh Shan. To appear in a Festschrift for Tony Hoare, 2009.

Axiomatizing Groenendijk's logic of interrogation. Balder D. ten Cate and Chung-chieh Shan. *Questions in dynamic semantics*, ed. Maria Aloni, Alastair Butler, and Paul Dekker, 63–82. Elsevier, 2007.

Linguistic side effects. *Direct compositionality*, ed. Chris Barker and Pauline Jacobson, 132–163. Oxford University Press, 2007. Presented since 2002 at the Universities of AZ, BC, CA San Diego, IL Urbana-Champaign, PA, Rochester, UT, VT, and WA; Boston, Brown, Cornell, Harvard, Indiana, Rutgers, and Stanford Universities; City College of New York; DIMACS; MIT; logic and computational linguistics workshop; New England programming languages and systems symposium; Oregon Graduate Institute; direct compositionality workshop.

Refereed journal articles

Finally tagless, partially evaluated: tagless staged interpreters for simpler typed languages. Jacques Carette, Oleg Kiselyov, and Chung-chieh Shan. *Journal of Functional Programming* 19(5):509–543, 2009. Presented since 2008 at the New Jersey programming languages and systems seminar and the University of Waterloo.

Donkey anaphora is in-scope binding. Chris Barker and Chung-chieh Shan. *Semantics and Pragmatics* 1(1):1–46, 2008.

A static simulation of dynamic delimited control. *Higher-Order and Symbolic Computation* 20(4):371–401, 2007.

Explaining crossover and superiority as left-to-right evaluation. Chung-chieh Shan and Chris Barker. *Linguistics and Philosophy* 29(1):91–134, 2006. Presented at the ESSLLI 2004 workshops on syntax, semantics and pragmatics of questions and on semantic approaches to binding theory.

A modal interpretation of the logic of interrogation. Rani Nelken and Chung-chieh Shan. *Journal of Logic, Language and Information* 15(3):251–271, 2006.

On the static and dynamic extents of delimited continuations. Dariusz Biernacki, Olivier Danvy, and Chung-chieh Shan. *Science of Computer Programming* 60(3):274–297, 2006.

Types as graphs: continuations in Type Logical Grammar. Chris Barker and Chung-chieh Shan. *Journal of Logic, Language and Information* 15(4):331–370, 2006. Presented at the New Jersey programming languages and systems seminar, 2004.

On the dynamic extent of delimited continuations. Dariusz Biernacki, Olivier Danvy, and Chung-chieh Shan. *Information Processing Letters* 96(1):7–17, 2005.

Temporal versus non-temporal "when". *Snippets* 6:14–15, 2002.

Refereed conference and workshop papers

Generating quantifiers and negation to explain homework testing. Jason Perry and Chung-chieh Shan. To be presented at the 5th workshop on innovative use of NLP for building educational applications, 2010.

Characterizing quotation. *Proceedings from Semantics and Linguistic Theory XIX*, 2009. (Invited.) Presented at Radboud University Nijmegen, 2008. Journal version submitted.

Embedded probabilistic programming. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the working conference on domain-specific languages*, 360–384, 2009. (Best paper award.) Poster at IBM PL Day in Hawthorne.

J is for JavaScript: A direct-style correspondence between Algol-like languages and JavaScript using first-class continuations. Olivier Danvy, Chung-chieh Shan, and Ian Zerny. *Proceedings of the working conference on domain-specific languages*, 1–19, 2009.

Lifted inference: normalizing loops by evaluation. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the workshop on normalization by evaluation*, 2009. Presented at the New Jersey programming languages and systems seminar, 2009, the probabilistic programming workshop, and Northeastern University, 2010.

Monolingual probabilistic programming using generalized coroutines. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the 25th conference on uncertainty in artificial intel-*

ligence, 2009. Presented at the probabilistic programming workshop, 2010.

Purely functional lazy non-deterministic programming. Sebastian Fischer, Oleg Kiselyov, and Chung-chieh Shan. *Proceedings of the international conference on functional programming*, 11–22, 2009. Journal version submitted.

Shifting the stage: staging with delimited control. Yukiyoshi Kameyama, Oleg Kiselyov, and Chung-chieh Shan. *Proceedings of the symposium on partial evaluation and semantics-based program manipulation*, 111–120, 2009. Presented since 2008 at the Universities of Århus and Copenhagen, McGill and Utrecht Universities, IBM PL Day in Hawthorne, and Microsoft Research Cambridge.

Closing the stage: from staged code to typed closures. Yukiyoshi Kameyama, Oleg Kiselyov, and Chung-chieh Shan. *Proceedings of the symposium on partial evaluation and semantics-based program manipulation*, 147–157, 2008.

Embedded probabilistic programming. Oleg Kiselyov and Chung-chieh Shan. Poster at the NIPS*2008 workshop on probabilistic programming, 2008.

Lightweight monadic regions. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the Haskell symposium*, 1–12, 2008.

Pure, declarative, and constructive arithmetic relations (declarative pearl). Oleg Kiselyov, William E. Byrd, Daniel P. Friedman, and Chung-chieh Shan. *Proceedings of the 9th international symposium on functional and logic programming*, 64–80, 2008.

Boosting optimal logical patterns using noisy data. Noam Goldberg and Chung-chieh Shan. *Proceedings of the SIAM international conference on data mining*, 228–236, 2007.

Causal reference and inverse scope as mixed quotation. *Proceedings of the 16th Amsterdam colloquium*, 199–204, 2007.

Delimited continuations in operating systems. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the conference on modeling and using context*, 291–302, 2007. Posters at USENIX technical conference and at CONTEXT.

Finally tagless, partially evaluated: tagless staged interpreters for simpler typed languages. Jacques Carette, Oleg Kiselyov, and Chung-chieh Shan. *Proceedings of the 5th Asian symposium on programming languages and systems*, 222–238, 2007.

Inverse scope as metalinguistic quotation in operational semantics. *Proceedings of the 4th international workshop on logic and engineering of natural language semantics*, 167–178, 2007. Revised version in *New Frontiers in Artificial Intelligence: JSAI 2007 conference and workshops, revised selected papers*, 123–134, 2008.

Lightweight static resources: sexy types for embedded and systems programming. Oleg Kiselyov and Chung-chieh Shan. *Draft proceedings of the 8th symposium on trends in functional programming*, 2007.

A substructural type system for delimited continuations. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the international conference on typed lambda calculi and applications*, 223–239, 2007. Presented at the New Jersey programming languages and systems seminar.

Delimited dynamic binding. Oleg Kiselyov, Chung-chieh Shan, and Amr Sabry. *Proceedings of the international conference on functional programming*, 26–37, 2006.

Lightweight static capabilities. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the programming languages meets program verification workshop*, 79–104, 2006.

Against the division of labor in scope and binding. Linguistic Society of America, 2005.

A computational interpretation of classical S4 modal logic. Presented at the New England programming languages and systems symposium, 2003, and at the 3rd intuitionistic modal logics and applications workshop, 2005.

Functional pearl: backtracking, interleaving, and terminating monad transformers. Oleg Kiselyov, Chung-chieh Shan, Daniel P. Friedman, and Amr Sabry. *Proceedings of the international conference on functional programming*, 192–203, 2005.

Binding alongside Hamblin alternatives calls for variable-free semantics. *Proceedings from Semantics and Linguistic Theory XIV*, 289–304, 2004.

Delimited continuations in natural language: quantification and polarity sensitivity. *Proceedings of the 4th continuations workshop*, 55–64, 2004.

Functional pearl: implicit configurations—or, type classes reflect the values of types. Oleg Kiselyov and Chung-chieh Shan. *Proceedings of the Haskell workshop*, 33–44, 2004.

A logic of interrogation should be internalized in a modal logic for knowledge. Rani Nelken and Chung-chieh Shan. *Proceedings from Semantics and Linguistic Theory XIV*, 197–211, 2004.

Polarity sensitivity and evaluation order in type-logical grammar. *Proceedings of the North American chapter of the Association for Computational Linguistics*, 2:129–132, 2004.

Shift to control. *Proceedings of the 5th workshop on Scheme and functional programming*, 99–107, 2004.

A continuation semantics of interrogatives that accounts for Baker's ambiguity. *Proceedings from Semantics and Linguistic Theory XII*, 246–265, 2002.

The partition semantics of questions, syntactically. Chung-chieh Shan and Balder D. ten Cate. *Proceedings of the European summer school in logic, language and information student session*, 255–269, 2002. (Best paper award.)

Question answering: from partitions to Prolog. Balder D. ten Cate and Chung-chieh Shan. *Proceedings of TABLEAUX 2002: automated reasoning with analytic tableaux and related methods*, 251–265, and *Proceedings of NLULP-02: the 7th international workshop on natural language understanding and logic programming*, 2002.

A unified explanation for crossover and superiority in a theory of binding by predicate abstraction. Chung-chieh Shan and Chris Barker. North East Linguistic Society poster, 2002.

Monads for natural language semantics. *Proceedings of the European summer school in logic, language and information student session*, 285–298, 2001.

A variable-free dynamic semantics. *Proceedings of the 13th Amsterdam colloquium*, 204–209, 2001.

Fred: artificial neural networks evolving in virtual worlds. *Proceedings of the international symposium on artificial neural networks*, 1994.

Other papers

Isolating untrusted JavaScript code using transactions. Mohan Dhawan, Chung-chieh Shan, and Vinod Ganapathy, 2010.

Position paper: the case for JavaScript transactions. Mohan Dhawan, Chung-chieh Shan, and Vinod Ganapathy, 2010.

Functional un|unparsing. Kenichi Asai, Oleg Kiselyov, and Chung-chieh Shan, 2009. Presented at the symposium in honor of Mitchell Wand. Journal version submitted.

ICFP 2008 poster session. Benjamin Pierce, Colin Runciman, and Chung-chieh Shan. Technical report 640, Department of Computer Science, Rutgers University, 2008.

Interpreting quotations. Presented at the Rutgers linguistics colloquium, 2007, and at the Semantics Research Group, 2008.

Interpreting types as abstract values. Oleg Kiselyov and Chung-chieh Shan. Lecture notes for the Formosan Summer School on Logic, Language, and Computation, 2008.

Dependent open terms and the evaluation contexts that bind them. Oleg Kiselyov and Chung-

chieh Shan, 2007.

Lightweight static guarantees. Oleg Kiselyov and Chung-chieh Shan. Poster presented at USENIX technical conference, 2007.

Non-adjacent probabilities: must they inform word learning? Dana L. Chesney and Chung-chieh Shan. Poster presented at Association for Psychological Science convention, 2007.

Words by the numbers (submitted). Dana L. Chesney and Chung-chieh Shan, 2007.

Sexy types in action. *ACM SIGPLAN Notices* 39(5):15–22, 2004.

Other talks

Lightweight static capabilities. Oleg Kiselyov and Chung-chieh Shan. Utrecht University computer science, 2009, and Stanford University computer science, 2010.

Mandarin Chinese wh-indefinite scope by mixed quotation. Cornell linguistics, 2010.

Self-applicable probabilistic inference without interpretive overhead for bounded-rational theory of mind. Oleg Kiselyov and Chung-chieh Shan. UC Berkeley, IFIP Working Group 2.11 (program generation), University of Rochester, MIT, 2009, Stanford University linguistics, Microsoft Research New England, and Tufts University, 2010.

Bounded-rational theory of mind for conversational implicature. Oleg Kiselyov and Chung-chieh Shan. Texas Linguistics Society (UT Austin) and Logical Methods for Discourse (LORIA), 2009.

Donkey sentences as program generators. University of Århus, 2008.

Functional un-unparsing. University of Århus, 2008.

Theory of mind and bounded rationality without interpretive overhead. Oleg Kiselyov and Chung-chieh Shan. University of Amsterdam and University of Århus, 2008.

Reasoning about contexts in Henkin models. Chris Barker and Chung-chieh Shan. Workshop on lambda calculus and formal grammar, 2008.

Embedding languages. Rutgers computer science, 2007.

Quotation and effects in natural language: three applications. Oleg Kiselyov and Chung-chieh Shan. IFIP Working Group 2.11 (program generation), 2007.

Quoting side effects. 13th annual Reflections | Projections computing conference, ACM UIUC, 2007.

Language machines. DIMACS Research Experience for Undergraduates seminar, 2006.

Mutable bindings in evaluation contexts. Lightning talk, Workshop on Mechanizing Metatheory, 2006.

On Anna Szabolcsi's paper "Proof-theoretic semantics". Rutgers semantics workshop, 2005.

Interaction meanings and intermeaning actions. Rutgers semantics reading group, 2005.

Students

Advisor: Masters: Anupam Mediratta (graduated 2007). PhD: Jun Dai, Chathra Hendahewa, Joe Wegehaupt.

Supervisor for independent study and research: Undergraduate: Aaron Borden, Michael Burbea, Liron Greenstein, Patrick Hickey, Rachel Ostrand, Adam Pantel, Avi Rashin, Andrew Van Sant, Robert Zinkov. Masters: Anupam Mediratta, Ryan Wagner. PhD: Dana L. Chesney, Jun Dai, Noam Goldberg, Carlotta Pavese, Jason Perry, Joe Wegehaupt.

PhD qualifying committee: Computer science: David DeVault, Carlos Diuk, Kooksang Moon, Irina Rozenbaum, Wei Zheng. Linguistics: John Manna. Communication, Information and Library Studies: Ying-Hsang Liu.

PhD committee: Computer science: David DeVault, Tracey Lall, Tom Walsh. Linguistics: Xiao Li. Communication, Information and Library Studies: Ying-Hsang Liu.

Professional activities

Editorial board: *Semantics and Pragmatics*.

Program committee: AISC (international conference on artificial intelligence and symbolic computation) 2010. ESSLLI (European summer school in logic, language and information) 2010. FLOPS (international symposium on functional and logic programming) 2010. Haskell symposium 2010. NASSLLI (North American summer school in logic, language and information) 2010. UAI (conference on uncertainty in artificial intelligence) 2010. APLAS (Asian symposium on programming languages and systems) 2009. IFL (implementation and application of functional languages) 2009. Continuation Fest 2008 (chair). GPCE (generative programming and component engineering) 2008. ICFP (international conference on functional programming) 2008 (poster chair). Haskell workshop 2007. PLPV (programming languages meets program verification workshop) 2007. Scheme and functional programming workshop 2007.

Reviewer: *Information and Computation*, *Information Processing Letters*, *Journal of Functional Programming*, *Journal of Semantics*, *Journal of Logic, Language and Information*, *Language Resources and Evaluation*, *Linguistics and Philosophy*, *Logical Methods in Computer Science*, *Research on Language and Computation*, *Science of Computer Programming*, *Transactions on Programming Languages and Systems*, Association for Computational Linguistics, Computer Science Logic, Intelligent Text Processing and Computational Linguistics, Logic in Computer Science, Logic for Programming Artificial Intelligence and Reasoning, Partial Evaluation and Program Manipulation, Principles of Programming Languages, Semantics and Linguistic Theory, ESSLLI and NASSLLI student sessions, ESSLLI workshop on semantic approaches to binding theory, NLUCS, USENIX VM.

Member: Association for Computing Machinery. Association for Logic, Language and Information. IFIP TC2 working group on program generation.

University committee: undergraduate curriculum, undergraduate advising, graduate admissions, and publicity in Computer Science; bicycle/pedestrian.

April 15, 2010