

## Chung-chieh Shan 單中杰

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My office is CoRE 306. My office hours in Fall 2009 are Tuesdays 4:30–5:30pm and Thursdays 3:30–4:30pm (or email me to make an appointment).

### 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

01:198:314, 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  
Apparently noncompositional phenomena in natural languages can be analyzed like computational side effects in programming languages: anaphora can be analyzed like state, intensionality can be analyzed like environment, quantification can be analyzed like delimited control, and so on. We thus term apparently noncompositional phenomena in natural languages *linguistic side effects*. We put this new, general analogy to work in linguistics as well as programming-language theory.

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. In *Questions in dynamic semantics*, ed. Maria Aloni, Alastair Butler, and Paul Dekker, 63–82. Elsevier, 2007.
- Linguistic side effects. In *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 in 2004 at the ESSLLI 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 in 2004 at the New Jersey programming languages and systems seminar, February 27.
- On the dynamic extent of delimited continuations. Dariusz Biernacki, Olivier Danvy, and Chung-chieh Shan. Report RS-05-13, BRICS. [Abbreviated version](#) in *Information Processing Letters* 96(1):7–17, 2005.
- Temporal versus non-temporal “when”. *Snippets* 6:14–15, 2002.

**Refereed conference and workshop papers**

- Characterizing quotation. In *Proceedings from Semantics and Linguistic Theory XIX*, ed. Satoshi Ito and Ed Cormany. Cornell University Press, 2009. (Invited.)
- Embedded probabilistic programming. Oleg Kiselyov and Chung-chieh Shan. In *Proceedings of the working conference on domain-specific languages*, ed. Walid Taha, 360–384. Lecture notes in computer science 5658, Springer, 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. In *Proceedings of the working conference on domain-specific languages*, ed. Walid Taha, 1–19. Lecture notes in computer science 5658, Springer, 2009.
- Lifted inference: normalizing loops by evaluation. Oleg Kiselyov and Chung-chieh Shan. In *Proceedings of the workshop on normalization by evaluation*, 2009. Presented at the New

- Jersey programming languages and systems seminar, October 2.
- Monolingual probabilistic programming using generalized coroutines. Oleg Kiselyov and Chung-chieh Shan. In *Proceedings of the 25th conference on uncertainty in artificial intelligence*, 2009.
- Purely functional lazy non-deterministic programming. Sebastian Fischer, Oleg Kiselyov, and Chung-chieh Shan. In *Proceedings of the international conference on functional programming*, 11–22, 2009.
- Shifting the stage: staging with delimited control. Yuki Yoshi Kameyama, Oleg Kiselyov, and Chung-chieh Shan. In *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. Yuki Yoshi Kameyama, Oleg Kiselyov, and Chung-chieh Shan. In *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. In *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. In *Proceedings of the 9th international symposium on functional and logic programming*, ed. Jacques Garrigue and Manuel Hermenegildo, 64–80. Lecture notes in computer science 4989, Springer, 2008.
- Boosting optimal logical patterns using noisy data. Noam Goldberg and Chung-chieh Shan. In *Proceedings of the SIAM international conference on data mining*, 2007.
- Causal reference and inverse scope as mixed quotation. In *Proceedings of the 16th Amsterdam colloquium*, ed. Maria Aloni, Paul Dekker, and Floris Roelofsen, 199–204. Institute for Logic, Language and Computation, University of Amsterdam, 2007.
- Delimited continuations in operating systems. Oleg Kiselyov and Chung-chieh Shan. In *Proceedings of the conference on modeling and using context*, ed. Boicho Kokinov, Daniel C. Richardson, Thomas R. Roth-Berghofer, and Laure Vieu, 291–302. Lecture notes in computer science 4635, Springer, 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. In *Proceedings of the 5th Asian symposium on programming languages and systems*, ed. Zhong Shao, 222–238. Lecture notes in computer science 4807, Springer, 2007.
- Inverse scope as metalinguistic quotation in operational semantics. In *Proceedings of the 4th international workshop on logic and engineering of natural language semantics*, ed. Kei Yoshimoto, 167–178, 2007. Revised version in *New Frontiers in Artificial Intelligence: JSAI 2007 conference and workshops, revised selected papers*, ed. Ken Satoh, Akihiro Inokuchi, Katashi Nagao, and Takahiro Kawamura, 123–134. Lecture notes in computer science 4914, Springer, 2008.
- Lightweight static resources: sexy types for embedded and systems programming. Oleg Kiselyov and Chung-chieh Shan. In *Draft proceedings of the 8th symposium on trends in functional programming*, ed. Marco T. Morazán and Henrik Nilsson. Technical report TR-SHU-CS-2007-04-1, Department of Mathematics and Computer Science, Seton Hall University, 2007.

- A substructural type system for delimited continuations. Oleg Kiselyov and Chung-chieh Shan. In *Proceedings of the international conference on typed lambda calculi and applications*, ed. Simona Ronchi Della Rocca, 223–239. Lecture notes in computer science 4583, Springer, 2007. Presented at the New Jersey programming languages and systems seminar, February 16.
- Delimited dynamic binding. Oleg Kiselyov, Chung-chieh Shan, and Amr Sabry. In *Proceedings of the international conference on functional programming*, 26–37, 2006.
- Lightweight static capabilities. Oleg Kiselyov and Chung-chieh Shan. In *Proceedings of the programming languages meets program verification workshop*, ed. Aaron Stump and Hongwei Xi, 79–104. Electronic notes in theoretical computer science 174(7), Elsevier, 2006.
- Against the division of labor in scope and binding. Presented at the Linguistic Society of America 79th annual meeting, 2005.
- A computational interpretation of classical S4 modal logic. Presented at the New England programming languages and systems symposium, June 6, 2003, and the 3rd intuitionistic modal logics and applications workshop, June 30, 2005.
- Functional pearl: backtracking, interleaving, and terminating monad transformers. Oleg Kiselyov, Chung-chieh Shan, Daniel P. Friedman, and Amr Sabry. In *Proceedings of the international conference on functional programming*, 192–203, 2005.
- Binding alongside Hamblin alternatives calls for variable-free semantics. In *Proceedings from Semantics and Linguistic Theory XIV*, ed. Kazuha Watanabe and Robert B. Young, 289–304. Cornell University Press, 2004.
- Delimited continuations in natural language: quantification and polarity sensitivity. In *Proceedings of the 4th continuations workshop*, ed. Hayo Thielecke, 55–64. Technical report CSR-04-1, School of Computer Science, University of Birmingham, 2004.
- Functional pearl: implicit configurations—or, type classes reflect the values of types. Oleg Kiselyov and Chung-chieh Shan. Technical report TR-15-04, Division of Engineering and Applied Sciences, Harvard University. Abbreviated version in *Proceedings of the 2004 Haskell workshop*, 33–44. Association for Computing Machinery, 2004.
- A logic of interrogation should be internalized in a modal logic for knowledge. Rani Nelken and Chung-chieh Shan. In *Proceedings from Semantics and Linguistic Theory XIV*, ed. Kazuha Watanabe and Robert B. Young, 197–211. Cornell University Press, 2004.
- Polarity sensitivity and evaluation order in type-logical grammar. In *Proceedings of the 2004 human language technology conference of the North American chapter of the ACL*, ed. Susan Dumais, Daniel Marcu, and Salim Roukos, 2:129–132. Association for Computational Linguistics, 2004.
- Shift to control. In *Proceedings of the 5th workshop on Scheme and functional programming*, ed. Olin Shivers and Oscar Waddell, 99–107. Technical report 600, Computer Science Department, Indiana University, 2004.
- A continuation semantics of interrogatives that accounts for Baker’s ambiguity. In *Proceedings from Semantics and Linguistic Theory XII*, ed. Brendan Jackson, 246–265. Cornell University Press, 2002.
- The partition semantics of questions, syntactically. Chung-chieh Shan and Balder D. ten Cate. In *Proceedings of the ESSLLI-2002 student session*, ed. Malvina Nissim, 255–269. 14th European summer school in logic, language and information, 2002. (Best paper award.)
- Question answering: from partitions to Prolog. Balder D. ten Cate and Chung-chieh Shan. In *Proceedings of TABLEAUX 2002: automated reasoning with analytic tableaux and related methods*, ed. Uwe Egly and Christian G. Fermüller, 251–265. Lecture notes in computer

science 2381, Springer, 2002. Also in *Proceedings of NLULP-02: the 7th international workshop on natural language understanding and logic programming*, ed. Shuly Wintner. Datalogiske skrifter 92, Department of Computer Science, Roskilde University, 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, November 8–10, 2002.

Monads for natural language semantics. In *Proceedings of the ESSLLI-2001 student session*, ed. Kristina Striegnitz, 285–298. 13th European summer school in logic, language and information, 2001.

A variable-free dynamic semantics. In *Proceedings of the 13th Amsterdam colloquium*, ed. Robert van Rooy and Martin Stokhof, 204–209. Institute for Logic, Language and Computation, University of Amsterdam, 2001.

Fred: artificial neural networks evolving in virtual worlds. In *Proceedings of the international symposium on artificial neural networks*. National Cheng-Kung University, Taiwan, 1994.

## Other papers

Functional unlparsing. Kenichi Asai, Oleg Kiselyov, and Chung-chieh Shan, 2009. Presented at the symposium in honor of Mitchell Wand.

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, October 12, 2007, and at the Semantics Research Group, March 21, 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.

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 annual convention, 2007.

Higher-order modules in System  $F_\omega$  and Haskell. May 15, 2006.

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

From shift and reset to polarized linear logic. 2003.

Quantifier strengths predict scopal possibilities of Mandarin Chinese *wh*-indefinites. Presented at Harvard University linguistics, April 9, 2003.

Markup optimisation by probabilistic parsing. Chung-chieh Shan and Dylan P. Thurston, 2001. First-place winner in the ACM International Conference on Functional Programming programming contest.

Meanings of multiple-*wh* questions. 2001.

Model selection for belief networks when learning with incomplete data. 2001.

Random-self-reducibility in the polynomial hierarchy. 1998.

Hierarchical distributed election protocols. Steve Chien and Chung-chieh Shan, 1997.

## Other talks

Bounded-rational theory of mind for conversational implicature. Oleg Kiselyov and Chung-chieh Shan. Texas Linguistics Society, 2009.

Self-applicable probabilistic inference without interpretive overhead. Oleg Kiselyov and Chung-chieh Shan. UC Berkeley, IFIP Working Group 2.11 (program generation), University of Rochester, and MIT, 2009.

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

Functional un-unparsing. University of Århus, 2008.

Grammaticalizing mixed quotations. Radboud University Nijmegen, 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.

**Other projects**

McBride A BIB<sub>T</sub>E<sub>X</sub> bibliography style that follows the “Documentation Two” specifications in the *Chicago Manual of Style*. 2002–2004.

longtable A modified version of L<sub>A</sub>T<sub>E</sub>X’s longtable package that fixes many bugs. 2003.

psbind A program that trims and reassembles pages in a PostScript document for *n*-up printing. If you dislike how psnup leaves too much white space in its output, this program is for you. 2001–2003.

Miss Protocol An ongoing advice column on computer technology. 2000–2003.

split-linguist A filter to split up digest messages from the LINGUIST mailing list. 2001–2002.

A Haskell 98 implementation of Guy L. Steele, Jr., *Building interpreters by composing monads*, in *POPL ’94: conference record of the annual ACM symposium on principles of programming languages*. 2001.

bif2bnt A Web service to convert Bayes nets from BIF format to BNT format. 2000.

fmt2 A program that reformats Chinese text in Big-5 encoding. It breaks lines intelligently using an algorithm similar to that of T<sub>E</sub>X. 1998–2000.

The first movement of a sonatina in C major 1999.

Course Decision Assistant Geoffrey Mainland, Chung-chieh Shan, and Alex Wong. An online searchable course catalog for Harvard University. 1996–1999.

Change my signature A Web service that lets anyone change the signature file I use in my personal email messages and Usenet postings. 1997.

huhebi: the self-organizing narrative An early experiment in hypertext collaboration. 1995.

The Microsoft conspiracy Chung-chieh Shan and Kaihsu Tai. An early experiment in non-hypertext collaboration. Taipei: Informationist. 1995.

Miscellany Academic: academia advice, computational linguistics, computer science, gesture recognition, paper lookup, research ideas, terminology lookup, typesetting. Other: bicycle, comics recommendations, deaf people, digital piano selection advice, food recipe, midnight ambiance, sexual orientation, silicon wall clock, string collection, theatre accessibility, twelve days of the invasion.

**Professional activities** **Editorial board:** *Semantics and Pragmatics*.

**Program committee:** European Summer School in Logic, Language and Information, 2010. International Symposium on Functional and Logic Programming, 2010. North American Summer School in Logic, Language and Information, 2010. Asian Symposium on Programming Languages and Systems, 2009. Implementation and Application of Functional Languages,

2009. Continuation Fest, 2008. Generative Programming and Component Engineering, 2008. International Conference on Functional Programming, 2008. Haskell workshop, 2007. Programming languages meets program verification workshop, 2007. Workshop on Scheme and functional programming, 2007.

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

**Other**

**experience**

Chief technology officer, Idiom Technologies (Waltham, MA), 1999–2000.

Research intern, Mitsubishi Electric Research Laboratory (Cambridge, MA), summer 1998. (Mentor: Matthew Brand)

Research intern, Center for the Neural Basis of Cognition (Pittsburgh, PA), summer 1997. (Mentor: Tai Sing Lee)

Software design engineer, Microsoft Corporation (Redmond, WA), summer 1996.

November 15, 2009