ALISTAIR M. C. ISAAC
CURRICULUM VITAE

Department of Philosophy
University of Pennsylvania
433 Cohen Hall
Philadelphia, PA 19104-6304

website: http://www.sas.upenn.edu/~aisaac/
email: aisaac@sas.upenn.edu
phone: 832-545-5810

AREAS OF SPECIALIZATION
Philosophy of Psychology / Cognitive Science / Mind
Philosophy of Science (esp. Modeling, Formal Epistemology)

AREAS OF COMPETENCE
History of Science; Logic; Probability; Game Theory; Philosophy of Language

DISSERTATION
The Informational Content of Perceptual Experience (see abstract on final page)
Committee: Patrick Suppes (co-chair), John Perry (co-chair), Thomas Ryckman, Kenneth Taylor, Persi Diaconis

EDUCATION
Stanford University, Stanford, California
Ph.D. Philosophy, Symbolic Systems Track, September 2010
University of Houston, Houston, Texas
M.A. Philosophy, June 2004
Thesis: *Rethinking Abduction: Connectionist Models of Common Sense*
Harvard University, Cambridge, Massachusetts
B.A. East Asian Studies, *summa cum laude*, June 2000
Thesis: *Information City: Evolution and Perspective in Three Japanese Novels*

ACADEMIC EMPLOYMENT HISTORY
University of Pennsylvania, 2011-present
NSF Post-Doctoral Fellow working with Gary Hatfield on the project "Measurement and Isomorphism in the Psychology of Perception: A Historical Approach to the Problem of Representation"
University of Michigan, 2010-2011
McDonnell Foundation Research Consortium on Causal Learning Post-Doctoral Fellow (in the Philosophy Department)
Stanford EPGY Online High School, 2008-2010
Instructor for core course "Great Ideas in the History of Science" (HSC)

PUBLICATIONS
"Objective Similarity and Mental Representation" forthcoming in *Australasian Journal of Philosophy*.
"Modeling without Representation" forthcoming in *Synthese*.
"Quantifying the Subjective: Psychophysics and the Geometry of Color" forthcoming in *Philosophical Psychology*.
"Logic and Complexity in Cognitive Science" (with Rineke Verbrugge, and Jakub Szymanik) forthcoming in a volume in honor of Johan van Benthem.
"Synchronizing Diachronic Uncertainty" (2011) (with Tomohiro Hoshi) *Journal of Logic, Language, and Information* 20 (2): 137-159.
"Recognizing Deception: A Model of Dynamic Belief Attribution" (2011) (with Will Bridewell) in *Advances in Cognitive Systems: Papers from the 2011 AAAI Fall Symposium*: 50-57.

"Taking Mistakes Seriously: Equivalence Notions for Game Scenarios with Off Equilibrium Play" (2011) (with Tomohiro Hoshi) in *Logic, Rationality, and Interaction* (Springer *Lecture Notes in Artificial Intelligence 6953*): 111-124.
"Logic in Cognitive Science: Bridging the Gap between Symbolic and Connectionist Paradigms" (2011) (with Jakub Szymanik) *Journal of the Indian Council of Philosophical Research* 27 (2): 255-281.
"The Strategic Equivalence of Games with Unawareness" (2010) (with Tomohiro Hoshi) in *Logic and Interactive Rationality*, ed. D. Grossi, L. Kurzen, and F. R. Velázquez-Quesada: 203-225.
"Prospects for Naturalizing Color" (2009) *Philosophy of Science* 76 (5): 902-914.

UNDER SUBMISSION / REVISION

"Natural Meaning is not Factive" under revision for resubmission to *Canadian Journal of Philosophy*.
"Structural Realism for Secondary Qualities" under submission to *Erkenntnis*.
"Physicalist vs. Ecological Accounts of Perceptual Content: Lessons from Timbre" under submission to the Southern Society for Philosophy and Psychology.
"Mindreading Deception in Dialog" (with Will Bridewell) under submission to *Cognitive Systems Research*.

CONFERENCE PRESENTATIONS / INVITED TALKS

"Newtonian Answers to Baconian Questions: Proof by Experiment in Newton's Optical Research"
• *HOPOS* (International Society for the History and Philosophy of Science), June 21-21, 2012.
• *The 27th Boulder Conference on History and Philosophy of Science*, Sept. 23-25, 2011.
"Modeling without Representation"
• *American Philosophical Association, Pacific Division Annual Meeting*, April 4-7, 2012.
"Taking Mistakes Seriously: Equivalence Notions for Game Scenarios with Off Equilibrium Play"
• *The Third International Workshop on Logic, Rationality and Interaction*, Oct. 10-13, 2011.
"Outlining a Computationally Plausible Approach to Mental State Ascription"
• *IACAP* (International Association for Computing and Philosophy), July 4-6, 2011.
"Diachronic Dutch Book Arguments for Forgetful Agents"
• *Munich Center for Mathematical Philosophy*, June 29, 2011.
• *Epistemology Meets Logic, Informally* (at Stanford, CSLI), June 1, 2008.
"Prospects for Naturalizing Color, or 'What's blue and yellow and green all over?'"
• *Philosophy of Science Association 21st Biennial Meeting*, November 7, 2008.
"Diachronic Uncertainty and Equivalence Notions for Models of Extensive Form Games,"
• *ESSLLI* (European Summer School in Logic, Language, and Information) in the Workshop "Logic and Intelligent Interaction: Charting the Technical Contours," Aug. 12, 2008.
"God, Failing to Emerge, Nevertheless Perseveres,"
• *Stanford Mini-Conference on Mind, Emergence, and Deity*, October 28, 2005

TEACHING EXPERIENCE

Primary Instructor

Philosophy of Mind, University of Pennsylvania (Fall, 2012)
Great Ideas in the History of Science, Stanford EPGY - Online High School (2008 - 2010)

Teaching Assistant

Stanford University
Introduction to Cognitive Science
Introduction to Philosophy
Introduction to Logic
First Order Logic
Introduction to Political Philosophy
University of Houston
Introduction to Logic
Introduction to Ethics

PROFESSIONAL ACTIVITIES AND POSITIONS

Editor *Erkenntnis* special issue on "Game Theory and Communication" (*forthcoming*)
Cognition and Language Workshop coordinator, 2008-2010
In this capacity I also organized these conferences:
Game Theory and Communication, May 28-9, 2010
Language and Power, November 21, 2009
Language, Communication, and Rational Agency, May 30-1, 2009
Spatial Relations: An Interdisciplinary Perspective, March 7, 2009
Symposium on Linguistic Relativity, Oct. 25, 2008
Admissions Committee member, Philosophy Department, 2007-2008
CSLI *Cog Sci Lunch* Coordinator, 2005-2008
Graduate Student Representative, Philosophy Department, 2006-2007
Hume Society (graduate student organization) Co-President, 2005-2006
In this capacity I also organized and coordinated the
Berkeley / Stanford / Davis Graduate Student Conference, April 8, 2006

PROFESSIONAL ORGANIZATIONS

History of Philosophy of Science, since 2012
American Philosophical Association, since 2008
American Association for the Advancement of Science, since 2008
Philosophy of Science Association, since 2007
Association for Symbolic Logic, since 2004

HONORS, AWARDS, AND FELLOWSHIPS

Institute for Humane Studies Fellowship, 2009-2010
Certificate in Cognitive Science, University of Houston, 2004
Cullen Supplemental Fellowship, University of Houston 2002-2004
Noma-Reischauer Undergraduate Essay Prize, 2000 (for senior thesis)
John Harvard Scholarships, 1995-1998
Detur Prize, Harvard University, 1996

GRADUATE COURSES AND SEMINARS (* audit)

History and Philosophy of Science

Philosophy of Psychology (University of Pennsylvania, Gary Hatfield)*
Philosophy and Visual Perception (University of Pennsylvania, Gary Hatfield)*
Newtonian Revolutions (Stanford, George Smith)*
Philosophy of Physics (Stanford, Thomas Ryckman)*
Core Seminar: Philosophy of Science (Stanford, Michael Friedman and Thomas Ryckman)
Quine (Stanford, Dagfinn Follesdal)
History of 17th Century Philosophy (UH, Gregory Brown)
Philosophy of Science (UH, William Austin)
Philosophy of Physics (Harvard, Tim Maudlin)

Cognitive Science / Artificial Intelligence

Evolution and Communication (Stanford, Bryan Skyrms)
Aping: Imitation, Control, and Development of Human Mind (Stanford, Michael Ramscar)
Minds and Machines (Stanford, Solomon Feferman)*
Individual Study: Nonmonotonic Logic and Neural Networks (Stanford, Hannes Leitgeb)
Mind and Brain (Stanford, Patrick Suppes and Dagfinn Follesdal)
Reasoning and Learning in Cognitive Systems (Stanford, Patrick Langley)
Knowledge Representation (Stanford, Johan van Benthem and Yoav Shoham)
Logic, Language, and Information (Stanford, Johan van Benthem)
Finite State Methods in Natural Language Processing (Stanford, Lauri Karttunen)

Introduction to Formal Semantics (Stanford, David Beaver)
English Grammar (Stanford, Ivan Sag)
Introduction to Cognitive Science (UH, Anne Jaap Jacobson)
Pro-seminar in Cognitive Science (UH, Anne Jaap Jacobson
Russell, Turing, and Wittgenstein (UH, Justin Leiber)
Neural Bases of Language (UH, Arturo Hernandez)
Human Nature and Linguistics (UH, Justin Leiber)

Logic and Formal Methods

Recursion Theory (Stanford, Solomon Feferman)
Group Study: Logic and History of Set Theory (Stanford, advisor Solomon Feferman)
Set Theory (Stanford, Sergei Tupailo)
Philosophy of Logic (Stanford, Solomon Feferman)
Proof Theory (Stanford, Solomon Feferman)
Finite Model Theory (Stanford, Solomon Feferman)
Advanced Modal Logic (Stanford, Johan van Benthem)*
Great Ideas in Probability (Stanford, Persi Diaconis and Brian Skyrms)*
Computability (UH, James Garson)
Modal Logic (UH, James Garson)

Miscellaneous

Core Seminar: Philosophy of Language (Stanford, John Perry)
Philosophy of Language (UH, Paul Saka)
Nietzsche (Stanford, R. Lanier Anderson)
Normativity (Stanford, Kenneth Taylor)*
Seminar on Nozick's Invariances (UH, Bredo Johnsen)
Classics in the History of Ethics (UH, David Phillips)
Buddhist Epistemology (Stanford, Wilhelm Essler)
Morality, Reason, and Self-Interest (UH, David Phillips)
Philosophy of Art (UH, Cynthia Freeland)

REFERENCES

Patrick Suppes
Center for the Study of Language and Information
Ventura Hall, Stanford University
Stanford, CA 94305-4115
psuppes@stanford.edu
650-725-6030

Gary Hatfield
Department of Philosophy
University of Pennsylvania
433 Cohen Hall
Philadelphia, PA 19104-6304
hatfield@phil.upenn.edu
215-898-6346

Kenneth Taylor
Department of Philosophy
Stanford University, Bldg. 90
Stanford, CA 94305-2155
ktaylor@stanford.edu
650-723-1840

John Perry
Department of Philosophy
Stanford University, Bldg. 90
Stanford, CA 94305-2155
john@csli.stanford.edu
650-328-3232

Thomas Ryckman
Department of Philosophy
Stanford University, Bldg. 90
Stanford, CA 94305-2155
tryckman@stanford.edu
650-725-9665

(*teaching letter*)
Tomohiro Hoshi
OHS SPCS
Stanford University
220 Panama St.
Stanford, CA 94305
thoshi@stanford.edu
650-721-9348

The Informational Content of Perceptual Experience
(*dissertation abstract*)

What does our perceptual experience tell us about the world? This dissertation develops a general framework for answering this question based on the insight that perceptual experiences *measure* the world. I mean this quite literally: the relationship between any particular domain of perceptual experiences and the domain of properties in the world they are experiences of satisfies the formal requirements of the theory of measurement. Consequently, the content of a particular perceptual experience within this domain can be understood as the outcome of a measurement of some property in the world.

Although this framework for analyzing perceptual content is applicable to any type of perceptual experience, the dissertation focuses on the particular example of color experience. Color science defines possible color experiences in terms of a three dimensional structure: the *color solid*. I argue that the color solid constitutes a *scale* against which surface properties of objects can be measured. I next argue that color terms derive their semantics from the color solid, and not directly from any relationship to surface properties. This explains the use of color terms to describe both surface properties ("grass is green") and *apparent* surface properties ("the forest floor is dappled grey and gold") within a unified semantic framework.

In order to achieve this goal, I develop a detailed theory of natural information. I provide a definition of informational content in terms of descriptive features of the world, without reference to intentionality or external semantic norms. In this sense, the definition is *naturalistic*. This naturalistic definition of informational content allows me to characterize precisely just what a perceptual experience tells one about the world in a non-circular way.

I distinguish two distinct types of natural information. One is exemplified by *natural signs*, e.g. smoke as a sign of fire or clouds as a sign of rain. The informational relationship between a particular experience of color (say, of vermilion) and a particular state of the world (say, the presence of cinnabar) can be characterized in terms of natural signs: an experience of vermilion is a sign of the presence of cinnabar. However, one must be careful here; the complicated contextual effects which determine color experience ensure that an experience of vermilion will be a sign of many other states of the world besides those in which cinnabar is present. This motivates the idea that the total content of a natural sign is given by a vector of the log probabilities of each signified state conditional on the signifying state.

The second type of natural information is *natural measurement*, which characterizes the informational relationship between two causally entangled spaces of possibilities. In an abstract sense, measurement involves a relationship between two such spaces, e.g. the space of possible heights of mercury in a glass tube and the space of possible temperatures. In nature, the space of possible shadow orientations stands in the same formal relationship to the space of possible positions of the sun in the sky, and therefore constitutes a natural measurement. Likewise, the space of possible color experiences measures the space of possible spectral power distributions of light.

A classic challenge for naturalistic theories of content is the problem of how to characterize representational error. My framework suggests a novel solution to this problem. How can bearers of naturalistic content ever *misrepresent* the world if there is no normative standard available by which to evaluate their correctness? A popular response is teleosemantics, which derives the representational function of a mental state from its evolutionary history, and error from a failure to fulfill this function. Unfortunately, the attribution of function on the basis of evolutionary history is extremely contentious within evolutionary biology, motivating the need for an alternate solution.

My own explanation of apparent misrepresentations by perceptual experience follows directly from the analysis of perception as measurement. Most cases of perceptual error are properly understood as instances of *inaccuracy*, i.e. the measured value does not agree with the "true" value in the world. But the source of these perceptual inaccuracies is almost always due to contextual effects. I argue that context *calibrates* a perceptual scale, and it is only when comparing values across differently calibrated scales (e.g. the apparent color of a dress in sunlight and under fluorescent light) that perceptual measurements appear to be in error. This analysis explains away apparent perceptual error in a precise way, thus meeting the demands of empirical adequacy without relying on suspect norms or teleological attributions.