

Elements of Argumentation

Philippe Besnard and Anthony Hunter

**The MIT Press
Cambridge, Massachusetts
London, England**

© 2008 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

For information about special quantity discounts, please email special_sales@mitpress.mit.edu

This book was set in Times New Roman and Syntax on 3B2 by Asco Typesetters, Hong Kong.

Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

Besnard, Philippe, 1958–

Elements of argumentation / Philippe Besnard and Anthony Hunter.

p. cm.

Includes bibliographical references and index.

ISBN 978-0-262-02643-7 (hardcover : alk. paper) 1. Artificial intelligence. 2. Reasoning. 3. Logic. 4. Information technology. I. Hunter, Anthony, 1962– II. Title.

Q335.B489 2008

006.3—dc22

2007032257

10 9 8 7 6 5 4 3 2 1

Index

- Abduction, 87
- ABEL, 232
- Abstract argument framework, 73
- Abstract argumentation, 73
- Abstract systems, 17
- Acceptable, 24
- Accepted argument, 24
- Admissible, 24
- Agent, 9
- Algorithm
 - FirstLevel, 165
 - Generate, 187
 - Generate a tree, 159
 - Generate supports, 158
 - Generate the tree, 160
 - GenerateCompilation, 172
 - Subcuts, 165
 - Undercuts, 165
- Altoment, 182
- Altoment tree, 183
- Analysis of extrinsic factors, 97
- Analysis of intrinsic factors, 97
- Annotated tree, 183
- Antipathy, 147
 - Tree, 149
- Approximate argument, 181
 - Altoment, 182
 - Entailment, 182
 - Miniment, 182
- Approximate tree, 182
- ArguMed, 232
- Argument, 2, 21, 39
 - Approximate, 181
 - Attacking, 63
 - Compilation, 160
 - Contouring, 174
 - Counterargument, 3
 - Defending, 63
 - Judgment, 108
 - Lex, 199
 - Rationalization, 107
 - Rebutting, 2
 - Reward, 229
 - Threat, 229
 - Undercutting, 2
- Argument structure, 66
- Argument tree, 58
 - Complete, 58
 - Labeled, 117
 - Pruned, 120
- Argumentation, 3
 - Abstract, 73
 - Convincing, 144
 - Dialogical, 10, 248
 - Factual, 11
 - First-order, 68
 - Formative, 99
 - Metalevel knowledge, 244
 - Monological, 9
 - Persuasional, 11
 - Persuasive, 247
 - Polemical, 83
 - Positional, 11
 - Practical, 13, 19
 - Provocational, 12
 - Selective, 99
 - Speculational, 12
 - Temporal knowledge, 241
 - Uncertain knowledge, 243
- Argumentation framework, 21
- Argumentation frameworks
 - Preference-based, 201
- Argumentation technology, 230
- Argumentative attitudes, 229
- Arguments
 - Attacking, 127
 - Defending, 127
- Associativity, 258
- Assumption-based argumentation, 223
- Attack, 24
- Attackers, 63, 127
- Attacking argument, 63
- Attacking arguments, 127

- Attacks, 21
- Audience, 3, 131
- Auto-argumentation, 12

- Backing, 4
- Beliefbase, 146
- Binary concernbase, 133

- Canonical undercut, 53
- Categorical information, 6
- Certain information, 6
- Characteristic function, 30
- Checking tools, 230
- Claim, 2, 39
 - Qualified, 4
- ClaimMaker, 231
- Classical consequence relation, 259
- Classical logic, 192, 253
- Classical propositional formulae, 254
- Clause, 255
- CNF, 255
- Coalitions of arguments, 91
- Coherence reasoning, 196
- Coherence systems, 18
- Commutativity, 258
- Comparing arguments, 107
- Compilation, 160
- Complete argument tree, 58
- Complete extension, 25
- Compressing argument trees, 122
- Compression, 123
- Computational complexity, 157
- Concern, 133
- Concernbase, 133
- Condensation, 125
- Condensing argument trees, 124
- Conflict, 16
- Conflict-free, 24
- Conjunctive normal form, 255
- Connective, 253
- Consequence closure, 260
- Consequence relation, 259
- Consequent, 2
- Conservative, 42
- Consistent, 257
- Contour, 176
 - Conjunction, 177
 - Disjunction, 177
 - Outline, 180
 - Partial, 179
- Contouring, 174
- Contradiction, 2, 258
- Cost
 - Simple, 137
- Cost function, 154
 - Homogeneous, 154
- Counterargument, 3, 21

- Dalal distance, 112
- De Morgan's law, 258
- Default logic, 227
- Defeasible logic, 205
- Defeasible logic programming, 213
- Defeasible reasoning, 192, 205
- Defeasible systems, 17, 205
- Defeated, 24, 108
- Defeater, 45
 - Maximally conservative, 49
- Defend, 24
- Defenders, 63, 127
- Defending argument, 63
- Defending arguments, 127
- Degree of antipathy, 98, 147
- Degree of empathy, 98, 147
- Degree of entailment, 146
- Degree of harmony, 97
- Degree of resonance, 98, 142
- Degree of tension, 118
- Degree of undercut, 97, 109
 - Dalal distance, 112
 - Propositional contradiction, 114
 - Reserved atoms, 116
- DeLP, 213, 232
- Democratism principle, 200
- Depth function, 63
- Dialogical argumentation, 10, 248
- Disjunctive normal form, 255
- Distributivity, 258
- DNF, 255
- Duplicates, 64

- Echo, 135
- Editing tools, 230
- Elitism principle, 200
- Empathy, 147
 - Tree, 149
- Entailment, 146, 182, 258
- Entailment tree, 182
- Enthymeme, 41
- Entity, 9
- Equivalent arguments, 45
- Ex falso quodlibet, 17
- Existential quantifier, 261
- Extension
 - Complete, 25
 - Grounded, 31
 - Preferred, 26
 - Stable, 26
- Extrinsic factors, 97
 - Audience, 131
 - Believability, 144
 - Resonance, 133

- Fact, 4
- Factual argumentation, 11

- Falsity, 254
- First-order argumentation, 68
- Formative argumentation, 99
- Function
 - Antipathy, 147
 - Atoms, 254
 - Attackers, 63
 - Claim, 39
 - Cn, 260
 - Compilation, 163
 - Defenders, 63
 - Depth, 63
 - Empathy, 147
 - Entailment, 146
 - MaxWidth, 176
 - Naive querying, 175
 - Nodes, 63
 - Parent, 63
 - Retension, 118
 - Root, 63
 - Siblings, 63
 - Subject, 63
 - Support, 39
 - Tension, 118
 - Tree antipathy, 149
 - Tree empathy, 149
 - Width, 63
- Generating tools, 230
- Grounded extension, 31
- Harmony in argumentation, 238
- Harmony of arguments, 91
- Higher impact argumentation, 132
- Hypothetical information, 8
- Idempotency, 258
- Implementations, 232
- Inconsistency, 16
- Inconsistent formula, 258
- Information
 - Categorical, 6
 - Certain, 6
 - Hypothetical, 8
 - Metalevel, 244
 - Objective, 7
 - Subjective, 8
 - Temporal, 241
 - Uncertain, 7, 243
- Information:Inconsistent, 16
- Initiating argument, 63
- Interpretation, 257
- Intrinsic factors, 97
 - Degree of undercut, 109
 - Harmony, 238
 - Judging, 108
 - Judge function, 108
 - Judging argument trees, 108
 - Justification, 2
- Label-based pruning of argument trees, 120
- Label-free pruning of argument trees, 119
- Labeled argument tree, 117
- LDR, 205
- Lex argument, 199
- Literal, 255
- Logic for defeasible reasoning, 205
- Logical connective, 253
- Lowercontour, 176
- Maximally conservative defeater, 49
- Maximally conservative undercut, 51
- Measuring inconsistency, 238
- Metalevel knowledge, 244
- Minimal inconsistent subsets, 161
- Miniment, 182
- Model, 257
- Monological argumentation, 9
- More conservative than, 42
- More convincing argumentation, 144
- Node function, 63
- Non-monotonic reasoning, 192
- Objective information, 7
- One-to-many argumentation, 12
- One-to-one argumentation, 13
- OSCAR, 232
- Outline contour, 180
- Overzealous undercut, 119
- Partial contour, 179
- Partial lowercontour, 178
- Partial uppercontour, 178
- Persuasive argumentation, 11
- Persuasive argumentation, 247
- Polemical argumentation, 83
- Positional argumentation, 11
- Practical argumentation, 13, 19, 77
- Preferences, 200
 - Democratism, 200
 - Elitism, 200
- Preferred extension, 26
- Proponent, 3
- Propositional formulae, 254
- Propositional logic, 253
- Provocational argumentation, 12
- Pruned argument tree, 120
- Pruning
 - Label-based, 120
 - Label-free, 119
- Pruning of argument trees, 119

- Qualified claim, 4
- Rationalization
 - Compression, 122
 - Condensation, 124
 - Pruning, 119
 - Shifting commitment, 127
- Rationalization techniques, 100
 - Using extrinsic factors, 132
 - Using intrinsic factors, 107
- Rationalizing arguments, 107
- Rebut, 2
- Rebuttal, 2, 4, 46
- Rebutting argument, 2
- Refuted, 24
- Resonance, 142
 - Argument tree, 136
 - Weighted sum of echo, 136
- Reward argument, 229
- Room 5, 232
- Root argument, 63
- Root function, 63

- Satisfaction, 257
- Selective argumentation, 99
- Self-argumentation, 12
- Self-attacking, 23
- Shift, 178
- Shifting, 127
- Shifting commitment, 127
- Siblings, 63
- Specificity-based preferences, 207
- Speculational argumentation, 12, 87
- St. Anselm's argument, 101
- Stable extension, 26
- Subject, 63
- Subject function, 63
- Subjective information, 8
- Support, 2, 39

- Tautology, 257
- Temporal knowledge, 241
- Threat argument, 229
- Tools
 - Checking, 230
 - Editing, 230
 - Generating, 230
- Tree
 - Altoment, 183
 - Annotated, 183
 - Antipathy, 149
 - Approximate, 182
 - Empathy, 149
 - Entailment, 182
- Truth, 254

- Uncertain information, 7
- Uncertain knowledge, 243

- Undefeated, 24, 108
- Undercut, 2, 46
 - Canonical, 53
 - Maximally conservative, 51
 - Overzealous, 119
- Undercutting argument, 2
- Underlying logic, 191
- Universal quantifier, 261
- Unwarranted, 108
- Uppercontour, 176

- Valid formula, 257
- Valid inference, 259

- Warrant, 4
- Warrant criteria, 191
- Warranted, 108
- Width function, 63

- Zeno, 232