05321 Abstracts Collection
Belief Change: Perspectives from Artificial Intelligence, Philosophy, and Economics
— Dagstuhl Seminar —

James Delgrande[1], Jérôme Lang[2], Hans Rott[3] and Jean-Marc Tallon[4]

[1] Simon Fraser Univ., CA
`jim@cs.sfu.ca`
[2] IRIT - Toulouse, FR
`lang@irit.fr`
[3] Univ. of Regensburg, DE
`hans.rott@psk.uni-regensburg.de`
[4] Univ. Paris I, FR

Abstract. From 07.08.05 to 12.08.05, the Dagstuhl Seminar 05321 "Belief Change in Rational Agents: Perspectives from Artificial Intelligence, Philosophy, and Economics" was held in the International Conference and Research Center (IBFI), Schloss Dagstuhl. During the seminar, several participants presented their current research, and ongoing work and open problems were discussed. Abstracts of the presentations given during the seminar as well as abstracts of seminar results and ideas are put together in this paper. The first section describes the seminar topics and goals in general. Links to extended abstracts or full papers are provided, if available.

Keywords. Belief revision, iterated belief revision, update, merging, dynamic logic, possibility theory, conditionals, social choice, distance, complexity

05321 Executive Summary – Belief Change in Rational Agents: Perspectives from Artificial Intelligence, Philosophy, and Economics

The area of belief change studies how a rational agent may maintain its beliefs when obtaining or perceiving new information about the environment. This new information could include properties of the actual world, occurrences of events, and, in the case of multiple agents, actions performed by other agents, as well as the beliefs and preferences of other agents. Not surprisingly, this area has been of interest to researchers in different communities.

The initial research in belief change came from the philosophical community, wherein belief change was studied generally from a normative point of view

(that is, providing axiomatic foundations about how rational agents should behave with respect to the information flux). Subsequently, computer scientists, especially in the artificial intelligence (AI) and the database (DB) communities, have been building on these results. Belief change, as studied by computer scientists, not only pays attention to behavioural properties characterising evolving databases or knowledge bases, but must also address computational issues such as how to represent beliefs states in a concise way and how to efficiently compute the revision of a belief state. More recently, the economics and game theory community, in particular the emerging field of cognitive economics, has become active in belief change research, adopting a normative point of view, like philosophers, but paying more attention to the "cognitive plausibility" or "fitness" of the belief change operators.

The goal of the seminar was to bring together researchers from these areas, allowing for the identification and addressing of problems of common interest in this area, as well as providing a means to explore ways in which one area may contribute to another.

Keywords: Belief revision, iterated belief revision, update, merging, dynamic logic, possibility theory, conditionals, social choice, distance, complexity

Joint work of: Delgrande, James; Lang, Jérôme; Rott, Hans; Tallon, Jean-Marc

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/357

05321 – Panel on belief change

This document gathers the panelists' contribution.

Keywords: Belief revision, iterated belief revision, update, merging, dynamic logic, possibility theory, conditionals, social choice, distance, complexity

Joint work of: Levi, Isaac; Bonanno Giacomo; Walliser, Bernard; Dubois, Didier; Rott, Hans; Delgrnade, James, Lang, Jérôme

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/358

How our beliefs contribute to interpret actions

Guillaume Aucher (University of Otago, NZ)

In update logic, the interpretation of an action is often assumed to be independant from the beliefs the agents have about the situation. However this phenomenon is quite common in everyday life. For example, assume there is an urn containing black and white balls but you do not know how many of them there are exactly and assume also that somebody draws a ball from the urn that you do not see. If you believe that there is no particular distribution of white and

black balls in the urn, then you will believe equally that a black or a white ball is withdrawn. But if you believe that there are more black balls than white balls in the urn, then you will believe with a higher probability that a black ball is withdrawn than a white ball is withdrawn. So, the beliefs about the situation (the urn) contribute to interpret the beliefs about the action (the drawing). We then incorporate this kind of phenomenon in update logic. Moreover, we try to model the notions of belief and surprise in a unified framework. We model the notion of surprise, notion which is closely related to the one of belief, by the use of infinitesimals. We model the notion of belief by a subjective probability and show that the AGM postulates of belief revision are fulfilled. Finally, we also deal with actions that change facts of the situation in our framework.

Keywords: Update logic, belief revision, dynamic epistemic logic

Full Paper: http://csweb.otago.ac.nz/postgrads/aucher/publications.html

See also:
[Auc05]   G. Aucher. A combined System for Update Logic and Belief Revision. In M.. Barley and N. Kasabov (Eds.): PRIMA 2004, LNAI 3371 Pages 1-17, 2005.
[Adams75]   E. W. Adams. The Logic of Conditionals. In Synthese Library Volume 86, D. Reidel, Dordrecht, Netherlands, 1975.
[BMS04]   A. Baltag, L.S. Moss,and S. Solecki. Logic for epistemic program. In Synthese Volume 139(2) Pages: 165 - 224.
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[GardRott95]   P. Gardenfors and H. Rott, 1995, 'Belief Revision', in D. M. Gabbay, C.J. Hogger and J. A. Robinson, eds., Handbook of Logic in Artificial Intelligence and Logic Programming 4, Oxford University Press, Oxford 1995.
[Keis86]   H. J. Keisler. Elementary Calculus: An Approach Using Infinitesimal. Prindle, Weber and Schmidt (eds), 1986. Online edition on the website http://www.math.wisc.edu/keisler/calc.html .
[Kooi03]   B.P. Kooi (2003). Probabilistic Dynamic Epistemic Logic. In Journal of Logic,Language and Information Volume 12(4) Pages: 381-408.
[Len03]   W. Lenzen. Knowledge, Belief, and Subjective Probability: Outlines of a Unified System of Epistemic/Doxastic Logic. In: V. F. Hendricks and Al. (eds.), Knowledge Contributors, Dordrecht (Kluwer) 2003, Pages: 17-31.
[Reit01]   R. Reiter. Knowledge in Action: Logical Foundations for Specifying and Implementing Dynamical Systems, MIT Press, 2001.
[vBen03]   J. van Benthem. Conditional probability meets update logic. In Journal of Logic, Language and Information Volume 12(4) Pages: 409 - 421.

Lack of simple characterizations for the distance-based revision

Jonathan Ben-Naim (LIF-CMI - Marseille, F)

Lehmann, Magidor, and Schlechta modeled "distances" between any two valuations by what they called pseudo-distances. Then, given a pseudo-distance, they defined naturally the revision of a set of formulas Γ by a second one Δ as the set of all formulas satisfied in all models of Δ that are closest to the models of Γ. And, they characterized families of such distance-based revision operators by the AGM postulates together with highly non-trivial postulates that deal with iterated revisions. They used an arbitrary big "loop" condition. Yet, simplifying it seems to be impossible, as the present work strongly suggests. Indeed, we will present the distance operators — which transform any two sets of valuations X and Y into the set of all elements of Y that are closest to X according to some pseudo-distance — and show that for some families of them, there is no simple characterization. As there is a strong connexion between the distance operators and the distance-based revision operators, we are quite confident that our results on distance operators can be exploited to show that for families of distance-based revision operators, there is not either a simple characterization. For example, the families investigated by Lehmann *et al.* will probably be concerned and thus their big loop condition cannot be really simplified.

Keywords: Distance-based revision, characterizations

Dynamics and construction of epistemic states

Alexander Bochman (Holon Academic Inst. of Techn., IL)

We provide a conceptual overview of the theory of belief change in epistemic states suggested in [Bochman 2001]. The theory is based on three fundamental operations: contraction, sum and product (merge) of epistemic states. Derived belief and inference change functions generated by these operations are described. In addition, we consider the role and expressing capabilities of these operations in constructing epistemic states.

Keywords: Belief change, contraction, merge, expansion

A simple modal logic for belief revision

Giacomo Bonanno (Univ. of California at Davis, USA)

I propose a modal logic for belief revision based on three operators representing initial beliefs, information and revised beliefs. Three axioms are put forward that express three simple principles: (1) if the agent is informed of something that he considered possible initially, then he incorporates the information in his revised beliefs, (2) if the information received is not surprising then all previous beliefs are maintained (although new beliefs may be added) and (3) any new belief must be deducible from the initial beliefs and the information received. I show that these three axioms characterize the qualitative content of Bayes' rule. I also construct a logic which is sound and complete with respect to the class of frames that satisfy the qualitative Bayes rule. Some interesting theorems are derived for extensions of this logic, for example that the agent initially believes that he later will believe A if and only if he already believes A to start with. I then extend the framework to deal with iterated belief revision and the iterated version of Bayes rule.

Keywords: Belief revision, information, Bayes' rule, iterated revision

Extended Abstract: http://drops.dagstuhl.de/opus/volltexte/2005/330

Full Paper: http://www.econ.ucdavis.edu/faculty/bonanno/PDF/BelRev.pdf

A preliminary investigation into similarities and differences between epistemic and deontic change

Jan M. Broersen (Utrecht University, NL)

The AGM postulates evolved from ideas about deontic change. Nevertheless, the issue of dynamics has not received much attention in the deontic logic literature. I compare notions, theories and ideas from deontic logic with those from epistemic logic. It turns out that it is easier to come up with similarities than with differences. Still there are some interesting points to be made. The investigation suggests that there can be a fruitful exchange of ideas between the two areas.

Keywords: Deontic logic, belief logic, conditionals, temporal logic

Probabilistic Abduction Without Priors

Didier Dubois (IRIT - Toulouse, F)

This paper considers the simple problem of abduction in the framework of Bayes theorem, i.e. computing a posterior probability of an hypothesis when its prior probability is not available, either because there are no statistical data on which to rely on, or simply because a human expert is reluctant to provide a subjective assessment of this prior probability. The problem remains an open issue since a simple sensitivity analysis on the value of the unknown prior yields empty results. This paper tries to survey and comment on various solutions to this problem: the use of likelihood functions (as in classical statistics), the use of information principles like maximal entropy, Shapley value, maximum likelihood. We also study the problem in the setting of de Finetti coherence approach, which does not exclude conditioning on contingent events with zero probability. We show that the ad hoc likelihood function method, that can be reinterpreted in terms of possibility theory, is consistent with most other formal approaches. However, the maximal entropy solution is significantly different.

Keywords: Conditional probability, Bayes Theorem, imprecise probability, entropy, possibility theory, maximum likelihood

Joint work of: Dubois, Didier; Gilio, Angelo; Kern-Isberner, Gabriele

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/328

Belief merging and judgment aggregation II: Some links with distance-based approaches in social choice theory

Daniel Eckert (Universität Graz, A)

The use of distances establishes a link between belief merging and preference aggregation in social choice theory, which is shown to consist in the rationalization of a social choice by some distance minimization problem.

Keywords: Belief merging, judgment aggregation, social choice, distances

A roadmap of belief bases

Eduardo Fermé (University of Madeira - Funchal, P)

In this talk I will present new maps between different kind of base contraction functions.

Keywords: Belief bases, partial meet contraction, kernel contraction, ensconcement

On updates with integrity constraints

Andreas Herzig (IRIT - Toulouse, F)

In his paper "Making Counterfactual Assumptions" Frank Veltman has proposed
a new semantics for counterfactual conditionals. It is based on a particular up-
date operation, and we show that it provides a new and interesting way of updat-
ing logical databases under integrity constraints which generalizes in particular
Winslett's PMA.

Keywords: Updates, PMA, prime implicants
Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/334

Iterated Belief Revision: A Computational Approach

Yi Jin (TU Dresden, D)

The classic AGM theory studies mathematically idealized models of belief revi-
sion in two aspects: the properties (i.e., the AGM postulates) a rational revision
operator should satisfy; and how to mathematically construct concrete revision
operators. In scenarios where new information arrives in sequence, rational re-
vision operators should also respect postulates for iterated revision (e.g., the
DP postulates). When applications are concerned, the idealization of the AGM
theory has to be lifted, in particular, beliefs of an agent should be represented
by a finite belief base. In this talk, we present a computational base revision op-
erator, which satisfies the AGM postulates and some nice postulates for iterated
revision. We will also give a formal assessment of the base revision operator in
terms of its computational complexity and degree of syntax irrelevance.

Keywords: Iterated belief revision, belief base revision, computational com-
plexity
Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/359

Degrees of Belief

Isaac Levi (Columbia Univ. - New York, USA)

A discussion of three kinds of degree of belief: subjective (credal) probability,
degree of belief in the maximizing sense (expected epistemic utility) and degree
of belief in the satisficing sense (Shackle type degrees of belief). The relations
between these concepts and full belief (absolute certainty) and other qualitative
assessments of belief (mere belief or plain belief) will be considered.

Keywords: Inductive expansion, credal probability, maximizing and satisficing,
full belief
Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/327

Merging by correcting mistakes

Paolo Liberatore (Università di Roma I, I)

Belief integration methods are often aimed at deriving a single and consistent knowledge base that retains as much as possible of the knowledge bases to integrate. The rationale behind this approach is the minimal change principle: the result of the integration process should differ as less as possible from the knowledge bases to integrate. We show that this principle can be reformulated in terms of a more general model of belief revision, based on the assumption that inconsistency is due to the mistakes the knowledge bases contain. Current belief revision strategies are based on a specific kind of mistakes, which however does not include all possible ones. Some alternative possibilities are discussed.

Keywords: Merging, minimal change principle

Quota and Gmin merging operators

Pierre Marquis (Université d'Artois - Lens, F)

Two families of merging operators are considered: quota operators and Gmin operators. Quota operators rely on a simple idea: any possible world is viewed as a model of the result of the merging when it satisfies "sufficiently many" bases from the given profile (a multi-set of bases). Different interpretations of the "sufficiently many" give rise to specific operators. Each Gmin operator is parameterized by a pseudo-distance and each of them is intended to refine the quota operators (i.e., to preserve more information). Quota and Gmin operators are evaluated and compared along four dimensions: rationality, computational complexity, strategy-proofness, and discriminating power. Those two families are shown as interesting alternatives to the formula-based merging operators (which selects some formulas in the union of the bases).

Keywords: Belief merging, strategy-proofness, complexity

Joint work of: Everaere, Patricia; Konieczny, Sébastien; Marquis, Pierre

See also: Proceedings of 19th International Joint Conference on Artificial Intelligence (IJCAI'05), Edimburgh, 2005 (424-429).

Reasoning with inconsistent ontologies

Thomas Meyer (National ICT Australia - Sydney, AU)

Description logic reasoners are able to detect incoherences (such as logical inconsistency and concept unsatisfiability) in knowledge bases, but provide little support for resolving them. We briefly discuss different approaches to resolving inconsistencies and then detail an approach which recasts techniques for propositional inconsistency management into the description logic setting. We show that the additional structure afforded by description logic statements can be used to refine these techniques and provide high-level decision procedures for the knowledge integration strategies discussed.

Keywords: Description logics, knowledge integration, belief revision

Iterated Belief Change and the Levi Identity

Abhaya Nayak (Macquarie Univ. - Sydney, AU)

Most works on iterated belief change have focussed on iterated belief revision, namely, on how to compute $(K \star x) \star y$. However, historically, belief revision has been defined in terms of belief expansion and belief contraction that have been viewed as primary operations. Accordingly, what we should be looking at are constructions like: $(K + x) + y$, $(K - x) + y$, $(K - x) + y$ and $(K - x) - y$. The first two constructions are relatively innocuous. The last two are, however, more problematic. We look at these sequential operations. In the process, we use the Levi Identity as the guiding principle behind state changes (as opposed to belief set changes).

Keywords: Iterated belief change, iterated belief contraction, Levi Identity

Joint work of: Nayak, Abhaya; Goebel, Randy; Orgun, Mehmet; Pha, Tam

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/331

Beyond the Rational Explanation

Alexander Nittka (Universität Leipzig, D)

In recent work, we proposed a method of reconstructing an agent's epistemic state from observations of its revision history. These observations contained information of what the agent believed after receiving which input. In this presentation we intend to illustrate an extension of the work - allowing the observations to contain additional information of what the agent did *not* believe after a revision step. We will show that the BR-framework we assumed is only partially satisfactory for handling the extended observations.

Belief merging and judgment aggregation I: A survey

Gabriella Pigozzi (King's College London & PPMGroup Univ. of Konstanz, GB)

The aggregation of individual judgments on logically interconnected propositions into a collective decision on the same propositions is called judgment aggregation. When majority voting is applied to some propositions (the premises) it may however give a different outcome than majority voting applied to another set of propositions (the conclusion). Starting from this so-called doctrinal paradox, the paper surveys the literature on judgment aggregation and establishes the link to social choice theory, in particular Arrow's theorem. It is shown that the two suggested escape-routes from the paradox (the premise-based procedure and the conclusion-based procedure) are not satisfactory methods for group decision-making, while the application of a well known belief merging operator can dissolve the paradox.

Keywords: Judgment aggregation, social choice, doctrinal paradox, belief merging

Belief merging, judgment aggregation and some links with social choice

Gabriella Pigozzi (King's College London & PPMGroup Univ. of Konstanz, GB)

In this paper we explore the relation between three areas: judgment aggregation, belief merging and social choice theory. Judgment aggregation studies how to aggregate individual judgments on logically interconnected propositions into a collective decision on the same propositions. When majority voting is applied to some propositions (the premises) it may however give a different outcome than majority voting applied to another set of propositions (the conclusion). Starting from this so-called doctrinal paradox, the paper surveys the literature on judgment aggregation (and its relation to preference aggregation), and shows that the application of a well known belief merging operator can dissolve the paradox. Finally, the use of distances is shown to establish a link between belief merging and preference aggregation in social choice theory.

From belief merging to Social Choice theory through distances

Ramon Pino-Pérez (Univ. de Los Andes - Merida, YV)

We compare Belief Merging with Social Choice Theory. In particular we study
some properties in Social Choice Theory inspired by similar ones in the setting of
Belief Merging. We also study some Social Choice Functions defined by distances.
We give some properties about the distances in order to have well behaved Social
Choice Functions.

Lifting preferences and manipulability

Ramon Pino-Pérez (Univ. de Los Andes - Merida, YV)

The aim of this work is to lift the Gibbard-Satterthwaite's manipulability theo-
rem settled for voting schemes to the framework of classical social choice func-
tions. This is done by means of lifting preferences over alternatives to preferences
overs subsets of alternatives.

Shifting priorities: Simple representations for twenty-four iterated theory change operators

Hans Rott (Univ. of Regensburg, D)

Prioritized bases, i.e., weakly ordered set of sentences, have been used for rep-
resenting an agent's 'basic' or 'explicit' beliefs, and alternatively for compactly
encoding an agent's belief state (without the claim that the elements of a base
are in any sense basic). This paper focusses on the second interpretation of pri-
oritized bases. I explain how the shifting of priorities in such bases can be used
for a simple, constructive and intuitive way of representing a large variety of
methods for the change of belief states – methods that have usually been char-
acterized semantically by a system-of-spheres modelling. Among the methods
represented are external, radical, conservative an moderate revision, revision by
comparison in its raising and lowering variants, as well as various constructions
for belief expansion and contraction.

Keywords: Priorities, belief bases, theory change, iteration

See also: J. Cantwell: 1997, 'On the logic of small changes in hypertheories', Theoria 63, 54-89; E. Fermé and H. Rott: 2004, 'Revision by comparison', Artificial Intelligence 157, 5-47; A.C. Nayak: 1994, 'Iterated belief change based on epistemic entrenchment', Erkenntnis 41, 353-390; H. Rott: 1991, 'A Non-monotonic Conditional Logic for Belief Revision I', in A. Fuhrmann and M. Morreau (eds.), The Logic of Theory Change, LNCS 465, Berlin: Springer, pp. 135–81; H. Rott: 2003, 'Coherence and conservatism in the dynamics of belief II: Iterated belief change without dispositional coherence', Journal of Logic and Computation 13, 111-145; M.-A. Williams: 1994, 'On the logic of theory base change', in C. MacNish, D. Pearce and L.M. Pereira (eds.), Logics in Artificial Intelligence, LNCS 838, Springer, Berlin, pp. 86-105.

Reasoning revision

Ken Satoh (NII - Tokyo, J)

Usually, belief revision and reasoning are separated; a new fact can arrive only in belief revision phase. However, for example, in a robot planning domain, new sensory information might come even during planning and influence reason for a plan and therefore, we need to revise reasoning. We show an implementation of such reasoning revision using a new form of abduction.

Keywords: Reasoning revision; abduction

A consistency-based framework for merging knowledge bases

Torsten Schaub (Universität Potsdam, D)

We present a framework for expressing various merging operators for belief sets. This framework generalises our earlier work on consistency-based belief revision and contraction. Two primary merging operators are identified: in the first approach, belief sources are consistently combined so that the result of merging knowledge bases $K_1, \ldots, K_n$ is a maximal consistent (if possible) set of formulas comprising the joint knowledge of the knowledge bases. This approach then accords with one's intuitions as to what a "merge" operator should do. The second approach is more akin to a generalised belief revision operator. Knowledge bases $K_1, \ldots, K_n$ are "projected" onto another (in the simplest case the knowledge base where only tautologies are known). Properties of these operators are investigated, primarily by comparing their properties with postulates that have been identified previously in the literature. Notably, the approach is independent of syntax, in that merging knowledge bases $K_1, \ldots, K_n$ is independent of

how each K_i is expressed. As well, we investigate the role of entailment-based and consistency-based integrity constraints, the interrelationships between these approaches and belief revision, and the expression of further merging operators.

Keywords: Merging, belief change

Joint work of: Delgrande, Jim; Schaub, Torsten

Pareto-minimal theory change, conditionals and contractions

Oliver Schulte (Simon Fraser University, CDN)

I survey a number of results concerning (1) axioms for conditionals (2) the Levi and Harper Identities for belief revision and contraction (3) my own approach for defining minimal theory change based on trading off retracting and adding beliefs using Pareto-optimality. I establish characterization results for each of these topics. The results show some surprising relationships; in particular, we arrive at the AGM axiom $K \star 3$ from a variety of approaches.

Keywords: $K \star 3$, Ramsey test, belief revision, belief contraction, Levi Identity, Harper Identity, Pareto-optimality

Full Paper: http://www.sfu.ca/philosophy/schulte/mamoru.pdf

See also: Minimal belief change, Pareto-optimality and logical consequence. Oliver Schulte (2002). Economic Theory 19(1): 105-144.

Belief change with noisy sensing and introspection

Steven Shapiro (Universität Leipzig, D)

In this paper, we generalize the framework of Shapiro et al. [2000], where belief change due to sensing was combined with belief introspection in the situation calculus. In that framework, sensing was assumed to be infallible and the plausibilities of alternate situations (i.e., possible worlds) were fixed in the initial state, never to be updated. Here, we relax both assumptions. That is, we model noisy sensors whose readings may stray from reality and may return different values in subsequent readings. We also allow the plausibilities of situations to change over time, bringing the framework more in line with traditional models of belief change. We give some properties of our axiomatization and show that it does not suffer from the problems with combining sensing, introspection, and plausibility update described in Shapiro et al. [2000].

Keywords: Belief change, noisy sensing, theories of action, situation calculus

Actions and belief Revision I: Axiomatic foundation

Michael Thielscher (TU Dresden, D)

The fluent calculus has been developed to endow logic-based agents with the ability to reason about their actions and plan. In this talk we show how the fluent calculus can be combined with a method for belief revision, which allows agents to accommodate new evidence that is possibly inconsistent with existing beliefs. We justify the resulting formalism by showing that it satisfies the standard postulates for iterated belief revision, plus a new postulate of Independence. We argue for the necessity of the latter as a general property of belief revision operators.

Keywords: Reasoning about actions and change, iterated belief revision

Belief change and dynamic logic

Hans van Ditmarsch (University of Otago, NZ)

The established AGM-way to model belief revision is as revision of a theory - a deductively closed set of formulas. A theory T is revised with a formula ϕ resulting in a revised theory $T \star \phi$. Typically, $\neg\phi$ is in T and ϕ is in $T \star \phi$. We can also envisage 'belief revision with ϕ' as an 'epistemic program' with a corresponding dynamic modal operator $[\star\phi]$. An epistemic program is an epistemic state transformer, just like a 'standard' numerical program is a (numerical) state transformer - where a state consists of a set of numerical variables. Epistemic states are pointed Kripke models (M, w). They explicitly encode knowledge and/or belief. The analogue of "ϕ is in T" is "$B\phi$ is true in world w of model M"; B is an epistemic modal operator. We can now express that $\neg\phi$ is in T and ϕ is in $T \star \phi$, by the truth of $B\neg\phi \wedge [\star\phi]B\phi$ in an epistemic state modelling T. Epistemic state transformations may delete worlds, add worlds, change the point of the model, change the access between worlds, and change valuations of worlds (i.e., change facts). Using those structural operations, we then can express changed beliefs in the way outlined above. Such belief revision by way of dynamic modal operators allows for multi-agent belief change, higher-order belief change, and iterated belief revision. It can model both expansion and revision, both knowledge and belief, and both revision and update. As far as we know, there is no integrated approach that combines all these features at the same time: but various differing proposals, not necessarily compatible, address one or more of these issues. We will try to outline some of those. A feature of such dynamic logics for belief revision is that the AGM postulates cannot be required to hold universally. A typical example is that revision with $p \wedge \neg Bp$ - fact p is true and you don't know that - can only be successful at the price of inconsistency: $B(p \wedge \neg Bp)$ cannot be consistently believed. We will address the problems encountered, and focus on this issue of 'success'. The direction to address this issue is to restrict

revision to logical fragments of successful formulas, and/or to try to characterize
such fragments. The matters addressed in this overview overlap with conditional
modal logics for belief revision, with recent proposals to model more complex -
in a multi-agent setting - epistemic actions than public revision with a formula,
and with temporal epistemic logics modelling runs in interpreted systems.

Keywords: Belief change, dynamic logic, success

Full Paper: http://drops.dagstuhl.de/opus/volltexte/2005/337

To know or not to know: information value in semantic games

Bernhard Walliser (ENPC - Paris, F)

A syntactical and a semantical framework are proposed for the modeling of a
multiplayer belief revision rule that allows to study the impact of a message on the
initial belief within a game structure. For that purpose, we introduce first some
accuracy relations expressing that one knows more in one belief hirarchy than
in another. Then, we define the status of a message (especially secret, private or
public) and we design a belief revision rule such that the accuracy property can
be shown to be carried from the message to the final belief. Finally, we define
a semantic game and we prove in this context that the information value of a
message is positive (i) for the receiver of a secret message (ii) for the receiver
of a private message in a zero-sum game (iii) for all players receiving a public
message in a coordination game

Keywords: Belief structure, belief revision, accuracy order, status of a message

Joint work of: Billot, Antoine; Vergnaud, Jean-Christophe; Walliser, Bernard

Revision by conditionals

Emil Weydert (University of Luxemburg, L)

We discuss JLZ revision, an approach to iterated conditional revision where the
epistemic states are quasi-probabilistic ranking measures and the epistemic in-
puts are finite sets of plausibility conditionals. The revision strategy is based on
minimal ranking construction techniques known from default reasoning, namely
System JLZ. It may be seen as a kind of ranking counterpart to cross-entropy
minimization in probabilistic dynamics. JLZ revision supersedes an earlier ac-
count haunted by non-intuitive reversibility properties.

Keywords: Revision, rankings, plausibility, conditionals, defaults, cross-entropy

Dynamic epistemic logic

Wiebe van der Hoek (University of Liverpool, GB)

When giving an analysis of knowledge in multiagent systems, one needs a framework in which higher-order information and its dynamics can both be represented. Our work contributes to such a framework. It also fits in approaches that not only dynamize the epistemics, but also epistemize the dynamics: the actions that (groups of) agents perform are epistemic actions. Different agents may have different information about which action is taking place, including higher-order information. We demonstrate that such information changes require subtle descriptions. Our contribution is to provide a complete axiomatization for an action language, in which an action is interpreted as a relation between epistemic states (pointed models) and sets of epistemic states. The applicability of the framework is found in every context where multiagent strategic decision making is at stake, and already demonstrated in game-like scenarios such as Cluedo and card games.