**ABSTRACTS PROGIC 2009**

*Invited talks*

**Merging Logical Dynamics and Probabilistic Update**
Johan van Benthem, University of Amsterdam

We discuss some current proposals for merging qualitative dynamic-epistemic logics of information update with probabilistic calculi. We address both technical issues and what can reasonably be expected from such systems.

**Conditionals as random variables?**
Richard Bradley, London School of Economics

This talk will explore the view that conditionals are proposition-valued random variables, building on earlier papers of Jeffrey and Stalnaker and McGee in which views of this kind are floated. This view, I argue, implies that there are two distinct kinds of uncertainty associated with a conditional: firstly, uncertainty about the world in which it is being evaluated and secondly uncertainty about its semantic value at that world. The dual uncertainties and the manner in which they articulate provide an explanation of both why and when Adams' Thesis holds.

**Judy Benjamin is a Sleeping Beauty, modulo Monty Hall**
Luc Bovens, London School of Economics

Van Fraassen's Judy Benjamin Problem (1981) has essentially the same structure as Elga's Sleeping Beauty Problem (2000). Solutions to problems of this nature are contingent on how the information is obtained by the informant, which makes them into cognates of the Monty Hall Problem.

**A New Resolution of the Judy Benjamin Problem**
Igor Douven, Leuven University (joint work with Jan-Willem Romeijn)

Van Fraassen's Judy Benjamin problem has generally been taken to show that not all rational changes of belief can be modelled in a probabilistic framework if the available update rules are restricted to Bayes's rule and Je□rey's generalization thereof. But alternative rules based on distance functions between probability assignments that allegedly can handle the problem seem to have counterintuitive consequences. Taking our cue from a recent proposal by Bradley, we argue that Je□rey's rule can solve the Judy Benjamin problem after all. Moreover, we show that the specific instance of Je□rey's rule that solves the Judy Benjamin problem can be underpinned by a particular distance function. Finally, we extend the set of distance functions to ones that take into account the varying degrees to which propositions may be epistemically entrenched.

**Ratifiability, Stability and the Role of Act Probabilities in Decision Theory**
James Joyce, University of Michigan at Ann Arbor

In a recent paper, Andy Egan has maintained that decision problems involving causally unratifiable acts provide outright counterexamples to causal decision theory. I argue that Egan has misapplied CDT by supposing that it requires agents to make binding decisions before they have taken all causally relevant information into account. I outline a version of CDT that is more explicit on this point, and show that Egan's counterexamples pose no difficulties for it. The account I develop has some similarities to a modification of CDT recently proposed by Frank Arntzenius, but the two differ in crucial respects. Indeed, I shall argue that Egan's examples show is that, contra Arntzenius, an agent can sometimes

rationally choose to perform an action she knows she will later regret.

**Expected Utility and Centered Chances**
Wlodek Rabinowicz, Lund University

The subjective expected utility of an option is the subjective expectation of its utility. As such, it might be seen as a weighted sum of the option's utilities in various possible worlds, with weights being the subjective probabilities of these worlds. But what about this notion of utility? The utility of an option in a world might depend not only on what would happen if the option were chosen, but also - if the option isn't chosen and the world's environment is chancy - to some extent on what could have happened if it had been chosen - on the objective chances of its possible outcomes. How to combine the would- with the could-considerations in the determination of utility is not obvious, but I have a suggestion as to how to do it: The two kinds of considerations can be combined using the notion of 'centered chance'.

**Some results about unbounded expected utilities**
Teddy Seidenfeld, Carnegie Mellon University (based on two recent papers with Mark Schervish and Jay Kadane of Carnegie Mellon University)

This talk engages several challenges for an Expected Utility theory of coherent preferences over random quantities when:

1. Utilities are (for random variables that are) unbounded.
2. Coherence – that is, avoidance of uniform dominance in the partition by states – is the liberal standard for rational preference afforded by de Finetti's (1974) theory.

The presentation has three parts. I offer a progress report – three positive results (in Part 3) – towards a de Finetti-style theory of Expected Utility for unbounded quantities. But first (Part 1), I review de Finetti's coherence criterion. And second (in Part 2) I present some fresh challenges that confront a theory of coherent preference for unbounded quantities.

**Connections between Decision-making and Probabilistic Logic**
Jon Williamson, University of Kent

While logic and decision-making are often viewed as quite separate, in this talk I will explore some ways in which the two constrain each other, focusing on Bayesian decision theory and a Bayesian semantics for probabilistic logic. The general picture is this. A decision will typically depend on the probabilities of several propositions. While one may have articulated the probabilities of some of these propositions, others will be unspecified and it is the job of a probabilistic logic to determine these from those that are specified. Hence probabilistic logic is crucial for decision-making. Under a Bayesian account, these probabilities are rational degrees of belief. Now caution often demands that one's degrees of belief should conform to a probability function that is compatible with one's evidence and otherwise minimises one's worst-case expected loss. So the appropriate belief function, and hence the probabilistic logic, depends on the loss function. We come full circle and find that logic and decision mutually constrain each other. In particular, logarithmic loss is a natural default loss function, in which case minimising worst-case expected loss corresponds to maximising entropy and thence to an objective Bayesian probabilistic logic. Such a logic can fruitfully be applied to decision-making. Since judgement is essentially a decision problem it can also be applied to thorny questions like judgement aggregation.

*Contributed papers*

**Perils of Probabilistic Support: Two surprising e□ects in confirmation theory**
David Atkinson and Jeanne Peijnenburg, University of Groningen

The theory of confirmation has consequences that appear strange or counterintuitive at first sight. We describe two of these consequences, the Disconfirmation E□ect and the Alan Author Effect, and we spell out the conditions under which they occur. We will present explicit models of both e□ects, and we explain their relevance to studies of epistemic chains of support, as well as their possible connection to certain cognitive illusions.

**Decision making outside the laboratory**
Marcel Boumans, University of Amsterdam

A model of a real-life decision problem encompasses assumptions that frame the problem as accurate as possible in three dimensions: demarcation of the probability space, definition of the target probability and construction of the information structure. A real-life decision problem can be modeled in different ways, due to assuming different interpretations of these dimensions. Each specific model imposes a specific rational decision. As a result, different models may impose different, even contradictory, rational decisions, creating choice 'anomalies' and 'paradoxes'. This aspect of decision making in real-life situations is different from decision making in a laboratory experiment. A laboratory is a designed setting according to an experimenter's model of the decision problem, while for a real-life situation it is not always obvious what the design is (solving the problem is tantamount to modeling the problem). This distinction between a real-life situation and a laboratory has also consequences for a laboratory experiment. A subject in an experiment may initially have a different model of the task than the experimenter and thus possibly make apparently irrational decisions from the experimenter's model perspective. As a consequence a choice anomaly can be eliminated by learning what the experiment's model is.

**Acceptance And Scoring Rules**
Jake Chandler, University of Leuven

After offering a number of general desiderata on the relation between (finite) probability models and sets of accepted formulae, it is noted that a number of these constraints will be satisfied iff accepted formulae are true under all valuations in a distinguished 'core'. Drawing inspiration from the closely-related issue of judgment aggregation, I then discuss various scoring-rule-based core-selection proposals.

**Ramsey's Test, Adams' Thesis, and Left-Nested Conditionals**
Richard Dietz, University of Leuven (joint work with Igor Douven)

Adams famously suggested that the acceptability of any indicative conditional whose antecedent and consequent are both factive sentences amounts to the subjective conditional probability of the consequent given the antecedent. The received view has it that this thesis offers an adequate partial explication of Ramsey's test, which characterizes graded acceptability for conditionals in terms of hypothetical updates on the antecedent. Some results in van Fraassen [1976] may raise hope that this explicatory approach to Ramsey's test is extendible to left-nested conditionals, that is, conditionals whose antecedent is itself conditional in form. We argue that this interpretation of van Fraassen's results is to be rejected. Specifically, we provide an argument from material inadequacy against a generalization of Adams' thesis for left-nested conditionals.

**Towards an algebraic framework for many-valued conditional probability**
Tommaso Flaminio, University of Siena
Hykel Hosni, Scuola Normale Superiore Pisa

We investigate probability functions defined over many valued conditional events. During the last decade or so considerable research e□ort has been directed towards the understanding of what (subjective) conditional probability might look like in the context of many-valued logics. The main idea of our work consists in treating conditional probability as a simple (i.e. unconditional) probability on a conditional algebra.

**A Logic-Based Approach To Admissibility**
Jeffrey Helzner, Columbia University

Many, perhaps most, accounts of rationality are based on the concept of preference. By taking admissibility rather than preference as the fundamental notion of rational choice, accounts that relax ordering can be investigated in a neutral setting. Despite the number of formal studies examining choice in the absence of a complete preference ranking, we are not aware of any attempts to provide a logical analysis of admissibility (i.e. attempts to provide truth conditions for statements of the form 'x is admissible from the menu consisting of $y_1$ ,...,$y_n$'). The purpose of the present work is to o□er such an analysis.

**Confidence and beliefs**
Brian Hill, University of Paris

In the talk we shall present two decision rules involving confidence in beliefs and two (decision theory-style) representation theorems for the model of beliefs. One is based on the idea that one can have preferences over the (binary) choices which one is offered: one prefers to have to make a choice where one is more confident in the probabilistic beliefs underlying the decision than to have to make one in which one is less confident. The other is based on the idea that the greater the stakes involved in a choice, the more confident one has to be in the probability judgements underlying the decision. We also relate the two representation theorems to each other, by stating a coherence assumption on the agent's preferences which is necessary and sufficient for the implausibility order and the utility functions obtained from the two representation theorems to be identical (up to positive affine transformation, in the latter case). Time-permitting, we will discuss the relationships between the model and results here and other pertinent notions and developments in logic, decision theory and statistics (such as sets of probability functions and associated decision rules, second-order probability, Dempster-Shafer theory, confidence-intervals).

**Nonparametric Predictive Utility Inference**
B. Houlding, Trinity College Dublin
F.P.A. Coolen, Durham University

This work considers the combination of two strands of recent statistical research: that of decision making with uncertain utility and that of nonparametric predictive inference. In doing so we discuss the use of Nonparametric Predictive Utility Inference (NPUI) within a sequential decision selection problem for the situation of a Decision Maker (DM) who is confronted with a choice set that includes novel or unfamiliar outcomes.

**On a connection between arbitrary choice functions and solving decision trees**
Nathan Huntley, Durham University
Matthias C. M. Troffaes, Durham University

Many approaches to solve decision trees exist. A simple and attractive one is to specify in advance one's actions in all eventualities, i.e., to specify a normal form decision. We investigate situations where one may not be able to elect a single best normal form decision.

In particular, we consider a setting where each normal form decision yields an uncertain reward, that is, a gamble. We do not make the assumption that it is expressed in utilities, and we do not assume any probabilities over these rewards: instead, we assume that whatever information we have is expressed through a choice function on sets of gambles. Via such choice function, we can define a corresponding normal form solution for any decision tree. We then study the connection between certain desirable properties of such solution, and properties of choice functions.

**Objective Bayesianism and Unfair Coins**
Bert Leuridan, Ghent University

There exist many interpretations of probability. In recent years, Objective Bayesianism, which regards probability as mental (i.e. degrees of belief) yet objective (not arbitrary), has become very influential in philosophy of science. In the first part of my presentation I will argue that Objective Bayesianism leads to inconsistent results when faced with unfair coins. In the second part of my presentation I will illustrate this inconsistency by means of a Dutch book (where bets are placed on the outcome, i.e. the relative frequency of heads, in finite sequences of tosses). I will conclude by discussing some possible ways to escape or to solve this problem.

**Worries about Backward Induction**
Edward F. McClennen, Syracuse University

A standard argument against violations of Independence of Irrelevant Alternatives, and also against violations of The Independence (or Sure Thing) Axiom for gambles involves invoking the Backward Induction Argument (BIA). It also plays a role in an argument against the concept of Resolute Choice that I developed some years ago. I shall review the history of this principle (which is a direct descendent of what was originally known as Bellman¹s Principle), and then proceed to criticize its application in a number of situations to which it has been applied. I shall argue that insisting on the validity of BIA in many of these cases makes no sense whatsoever.

**An Axiomatic Approach to the Value of Information**
Sheila Miller, United States Military Academy at West Point

Every rational decision making agent must answer the questions of what informa- tion to solicit, which assets to exchange for it, and how to integrate the information into its knowledge structure. Classical theories of information, such as Shannon's entropy and Kähre's Mathematical Theory of Information, presuppose the existence of an ideal receiver. We propose an axiomatic definition for information in decision making that avoids this assumption and permits reasoning systems to distinguish between potential and actualized information, allowing metrics to assign the same content distinct values in each context.

**Deontic probabilities and obligations that vary in degrees**
Martin Peterson, Technical University Eindhoven

In deontic logic it is generally taken for granted that every act is either obligatory or not. We question this assumption by hypothesizing that obligations sometimes come in degrees. Some acts (or propositions) may be obligatory to some degree and forbidden to some other degree. But how should this notion of degree be accounted for? We point out that the axioms of Standard Deontic Logic (SDL) can be derived from the axioms of the probability calculus, given that the latter are extended with a new axiom addressing the relationship between obligatory and permissible propositions. However, the probabilistic approach is not without its problems; we articulate two reasons for thinking that the probability calculus cannot be used for introducing degrees into deontic logic. We thereafter present our main result, viz. a generalization of SDL based on a set of semantic intuitions. The new proposal is axiomatized

and shown to be sound and complete. We also show that the new axiomatization avoids the problems faced by the probabilistic approach.

**The Logic of Explanatory Power**
Jonah N. Schupbach, University of Pittsburgh
Jan Sprenger, University of Tilburg

In this paper, we defend Bayesian Explanationism by offering an account of an hypothesis's explanatory power relative to some evidence. We begin with a critical discussion of McGrew's (2003) previous attempt at providing a Bayesian measure of explanatory power. Subsequently, we apply our insights in order to show that a set of deeply plausible conditions of adequacy for any acceptable measure of explanatory power determine a unique probabilistic measure. By highlighting several theorems of our measure, we defend it as an accurate account of an hypothesis's explanatoriness, relative to some evidence. Lastly, we spell out the implications of our measure for Bayesian Explanationism, and the relationship between explanations and reasons.

***Most* and *Probably* – Quantifiers and Statistical Reasoning**
Corina Strößner, University of Saarland

*Every men is mortal. Socrates is a man. Therefore: Socrates is mortal*. This well-known inference is logically valid. The word "every" in the first premise makes it necessary that the conclusion is true. The word "every" gives information for any individual. *Most women work. Mary is a woman. Therefore: Probably Mary works.* Such reasoning is plausible as well. The determiner "most" gives no ultimate information about a single woman like Mary but it is not useless: it justifies a subjective probability. The aim of my talk is to analyze inferences of the second kind by combining study of natural language determiners and the theory of probabilities.

**Decision Theory And Rational Choice**
John R. Welch, Saint Louis University

The principal difficulty in applying decision theory is the exceptionally heavy information load it imposes on users. Strict Bayesian decision theorists take the probability and utility functions that underlie expected utilities to determine sharp numeric values. Real-life decisions, however, must usually be made without nearly as much information. Hence, the objection goes, decision theory is just inapplicable to the messy business of real-world decision making. Considerations like these have spurred repeated bids for a more realistic theory of decision. Some have tried to retrench by dropping back from point-valued to interval-valued functions. This paper also angles for a more realistic decision theory. It does so as a cousin to the interval-based approach, but it carries interval's retrenchment strategy to its outer limit. Just as point values require more precision than interval values, interval values require more precision than comparative values. The paper incorporates comparative plausibilities and utilities in a novel form of decision theory. It illustrates the potential of comparative decision theory by addressing the problem of rational choice among theories. It proposes that choice among scientific theories should be based on the comparative plausibilities of states posited by rival theories and the comparative desirabilities of their information outcomes.