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EXPECTED CONTENT

JEFFREY HELZNER
Columbia University

Abstract. We propose an approach to assigning propositional content to deliberate acts of arbitrary type, as opposed to just speech acts. This approach, which is based on the idea that the content of an act is the decision maker's expectation concerning the change that would take place if the act were to be performed, is shown to be related to the concept of expected utility that has played a central role in various accounts of rationality.

§1. Smith runs a store that is open everyday until 7:00 PM. It is now 7:45 PM, and, though the store is closed for business, Smith has decided to stay after hours in order to check the store's inventory. Suddenly, the phone in the back office begins to ring just as a second man, Jones, enters the store. Smith, who has inadvertently forgotten to lock the door at closing time, sees Jones enter and says 'We close at 7:00' as he rushes to the back office in order to answer the ringing phone. Jones, after hearing what Smith has said, notices a clock next to a posting of the store's business hours and then leaves.

At the moment when the phone began to ring and Jones entered the store, Smith faced a predicament; he wanted to answer the phone before it stopped ringing, and he wanted Jones to leave the store. In order to make the tension between these goals explicit, let us assume that Smith, perhaps because of concerns about shoplifting, is uncomfortable with the possibility of letting Jones remain in the store while he, Smith, answers the phone in the back office. Continuing with this attempt at a rationalization of Smith's predicament, we can imagine that Smith is faced with a set of alternatives and that his utterance of 'We close at 7:00' is an admissible alternative within this set.

Various alternatives might have occurred to Smith. For example, he could have thrown something at Jones. Perhaps the selection of this alternative would have resulted in Jones exiting the store in time for Smith to answer the ringing phone, but it might also discourage Jones from ever shopping at the store again; even worse, Jones might counter with his own act of aggression. Smith could have uttered something more detailed such as 'The store that you are in closes at 7:00 PM and it is now past 7:00 PM' but this is more time-consuming than 'We close at 7:00 PM' and thus the advantages that are afforded by the extra detail must be weighed against the time constraints that are imposed by the ringing phone. If Smith is confident that Jones will not misinterpret 'We close at 7:00 PM', then the additional detail of 'The store you are in' is of little value; Jones might even be offended by this detail if he interprets it as Smith's attempt to address Jones as if he were a child. Similarly, if Smith notices that Jones is wearing a watch, then he might not see much of a point in mentioning that the current time is past 7:00 PM. On the other hand, 'We are closed' gets high marks for brevity, but it does not impart any information about the store's

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hours and thus might be deemed inadmissible if Smith believes that such an utterance is likely to be interpreted as an uninviting act that discourages Jones from ever returning to the store during business hours.

§2. The scenario that was presented in the previous section involves a situation where an agent might be considering various types of alternatives, from speech acts such as Smith uttering 'We are closed' to nonlinguistic acts such as Smith throwing a brick at Jones. Robert Stalnaker, in the introduction of Stalnaker (1999), writes as follows with respect to what he views as a need to situate the analysis of speech acts within a wider account of rational activity:

> My initial concern was with speech, and my approach was inspired and heavily influenced by the work of Paul Grice in which it was argued that that we should see speech and action to be explained, like any other action, in terms of the beliefs and purposes of the agent. Language is a device for achieving certain purposes, and we should separate, as best we can, questions about what language is used to do from questions about the means it provides for doing it. To put language and speech in context, we need a general account of rational activity, and of the cognitive and motivational states that explain it. (*Context and Content*, p. 2)

We agree with Stalnaker that work in this area ought to be informed by a general account of rational activity, but we are puzzled then by the fact that Stalnaker's own work in this area, like that of David Lewis (1980), focuses on language and takes its inspiration from logic, rather than from decision theory, which has at least as much of a claim to being a significant account of rational activity. Our concerns here recall earlier remarks by Leonard Savage who, in comparing traditional views in statistics to the decision theoretic outlook adopted by statisticians such as Wald (1950) and Savage (1972) himself, wrote as follows:

> In the verbalistic outlook, which still dominates most everyday statistical thought, the basic acts are supposed to be assertions; and schemes based on observation are sought that seldom lead to false, or at any rate grossly inaccurate, assertions.
>
> The verbalistic outlook in statistics seems to have its origin in the verbalistic outlook in probability criticized in §2.1, which in turn is traceable to the ancient tradition in epistemology that deductive and inductive inference are closely analogous processes.
>
> I, and I believe others sympathetic with Wald's work, would analyze the verbalistic outlook in statistics thus: Whatever an assertion may be, it is an act; and deciding what to assert is an instance of deciding how to act. (*The Foundations of Statistics*, pp. 159–160)

In what follows we will attempt to outline an account that takes much of its inspiration from decision theory rather than logic. Under this account, an act of arbitrary type is assigned a proposition in an interpreted boolean algebra of sets, although the underlying elements of such sets are not state descriptions in the usual sense. Rather, the points that underly this algebra of sets are dynamic objects that are constructed over a collection of what are essentially experiments. The propositions in this algebra are used to encode a notion of content that is based on the agent's expectation of what change would result from a selection of the act to which the content is assigned. These expectations are themselves

explicated in terms of the agent's judgements as to what would be the outcome of various 'experiments'.

§3. With respect to the scenario that has been presented, there could be information that Smith does not have but which he would like to have for the purpose of evaluating the alternatives that are available to him. Perhaps Smith would like to have information concerning Jones' sobriety as this might factor into Smith's evaluation of the risk that Jones will become violent. But the request for such information is vague. There are several proposals that might be offered as a means for gauging Jones' sobriety. Some of these proposals might be regarded as credible by Smith while others might not.

Suppose that Smith is impressed by what he has read about a type of device that is capable of measuring a person's 'blood-alcohol level' and believes that this thing which the device measures is well correlated with sobriety. In this case Smith might like to know what blood-alcohol level such a device would record if it were applied to Jones at some time t during which Smith is evaluating his alternatives. We can specify such an application by giving an initial location for each of the items that are required for the application (e.g. the device, Jones, the operator of the device), a program that provides unambiguous instructions for what steps to take from the initial configuration (e.g. place the tube that is attached to the device in the mouth of Jones) and a set of mutually exclusive and exhaustive outcomes that are observable within some specified interval of time after the program terminates (e.g. the set of all possible configurations of the device's output following a successful run).

More generally, every *feature of the world* may be presented as a unique tuple that consists of the following: a set of objects along with the initial position of each of these objects, a program that provides unambiguous instructions on what steps to take from the initial configuration, a set of mutually exclusive and exhaustive outcomes along with a nontrivial interval of time during which such outcomes can be observed after a successful run of the indicated program. We use the term 'feature of the world' to emphasize the objective character of those things that are specified in the manner that has been described. Were it not for the fact that the present notion does not require anything that might count as a proper hypothesis, we might have used a term like 'protocol for an experiment' rather than the terminology that has been adopted. Nonetheless, regardless of terminological matters, it should be clear that the concern here is essentially that of the scientific method.

§4. For each time t at which Smith exists let F_t be the set of those features of the world that count as relevant for Smith at time t. As discussed, it would not be unreasonable if the Jones' blood-alcohol feature considered above were to count as relevant for Smith during at least some of those times t at which he is evaluating his alternatives. On the other hand it is difficult to see a reason why certain features would count as relevant for Smith at such times. For example, consider the feature of the world that consists of placing a particular type of mercury-in-glass thermometer at a given location that lies 10,000 miles away from a fixed location in Smith's store, letting some fixed amount of time pass, and then recording the 'temperature' value displayed in the thermometer's glass tube.

At each time t, F_t determines a set of points, P_t, that will play an important role in what follows. We may represent P_t as the product set $\prod_{f \in F_t}[O_f \cup \{\Delta_f\}]$, where, for each f in F_t, O_f is the set of possible outcomes that is part of the specification of f and Δ_f is something that is disjoint from O_f which is to be interpreted as representing an instance

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where the program given in the specification of f cannot complete a successful run (e.g. an instance where Jones is unavailable to satisfy the required initial position in the Jones' blood-alcohol feature).

Let p be an element of P_t. If f is a feature of the world that counts as relevant for Smith at t, then p_f denotes the value of p at f. Each such p can be interpreted as a set of answers to a set of questions that are indexed by F_t. Think of p_f as an answer to the question that asks what would happen if a run of the underlying program of f were initiated at a given time. P_t may be partitioned into the collection of those p that represent answers that Smith judges to be reasonable at t and the collection of those p that do not. Clearly the above 'answers-to-questions' interpretation does not depend on the fact that P_t is constructed over the features that count as relevant for Smith at t. In the development that follows we will make use of this sort of interpretation in connection with other constructions that, like P_t, are determined by a set of features.

§5. Suppose that Smith wants to assess the merits of some particular alternative, say α. It seems to us that Smith ought to ask himself what he expects would result from selecting α. This proposal requires that α is equipped with, or at least assessed with respect to, an evaluation time, which we will denote as t_α. In general, without the specification of an evaluation time the suggested line of questioning fails to be well-defined since *when* the result is projected to manifest is often important in the assessment of the alternative under consideration. For example, Smith might expect that selecting α will result in Jones leaving the store, but whether Jones' exit will take an hour or a day or a week could very well matter in Smith's assessment of α.

If Smith restricts his attention to results that he believes have empirical content, then his expectations can be represented as a set of points based on a particular collection of features. More precisely, let $F_t[\alpha]$ be the collection consisting of those features of the world that Smith currently (i.e. at t) believes could be relevant in assessing the result of selecting α with the assumption that this assessment would take place at t_α. Analogous to the determination of P_t from the set of features of the world that count as relevant for Smith at t, let $P_t[\alpha]$ denote the product set $\prod_{f \in F_t[\alpha]}[O_f \cup \{\Delta_f\}]$. As in the discussion of P_t, for each f in $F_t[\alpha]$, O_f is the set of possible outcomes that is part of the specification of f and Δ_f is something that is disjoint from O_f which is to be interpreted as representing an instance where the program given in the specification of f cannot complete a successful run. Each p in $P_t[\alpha]$ can be interpreted as a set of answers to a set of questions that are indexed by $F_t[\alpha]$. As before, think of p_f as an answer to the question that asks what would happen if a run of the underlying program of f were initiated at a given time. $P_t[\alpha]$ may be divided into the collection of those p that represent answers that Smith currently, i.e. at t, expects that he would judge to be reasonable at t_α if α were selected and the collection of those p that do not satisfy this expectation.

§6. Thus far we have discussed several concepts that emerge from an analysis of choice problems of the sort that Smith faces in the opening scenario. We now apply these concepts in order to derive a general notion of content that is applicable to all sorts of acts and is easily related to a standard account of how a rational agent ought to choose among acts. The motivating idea behind this notion of content is roughly that *the content of an act is the decision maker's expectation concerning the change that would take place if the act were to be performed.*

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Let us now attempt a more precise rendering of this idea in terms of that which was developed in the previous sections. Let α be an alternative that Smith is deliberating upon at time *t*. Recall the following from the discussion above: There is a set of points, P_t, that is determined by those features of the world that count as relevant for Smith at t. P_t contains a subset, S_t, that consists of those points in P_t that represent answers that Smith judges to be reasonable at *t*. Think of S_t as a representation of Smith's 'serious possibilities' at t.[1] There is a set of points, $P_t[\alpha]$, that is determined by those features of the world that Smith, at t, believes could be relevant in assessing the result of selecting α given that this assessment would take place at t_α. For each nonempty subset X of $P_t[\alpha]$, let $E_t[\alpha \mid X]$ consist of those points in $P_t[\alpha]$ that Smith, at t, expects that he would judge to be reasonable at t_α if α were selected at t and X were the set of points in P_t that represent answers that Smith judges to be reasonable at t. The basic idea is that $E_t[\alpha \mid X]$ encodes Smith's t-expectations for α, conditional on X.

Suppose that π is a partition of S_t. For each $s \in S_t$, let π_s be the equivalence class of s under π. In what follows we will assume the existence of a canonical partition π such that, if π_s and $\pi_{s'}$ are disjoint, then so are $E_t[\alpha \mid \pi_s]$ and $E_t[\alpha \mid \pi_{s'}]$. Nothing in what follows will hinge on the details of this canonical partition. However, it is perhaps worth pausing here to consider what might be the most obvious way to specify such a thing. It seems reasonable to assume that there is at least one partition π for which $E_t[\alpha \mid -]$ is partition preserving, since there is the trivial partition where all the elements of S_t belong to the same equivalence class. We can partially order the collection $\mathcal{P}$ of such partitions in the obvious way, i.e. $\pi \sqsubseteq \pi'$ iff $\pi_s \subseteq \pi'_s$ for all s in S_t. The trivial partition is the top element. What about the bottom element of the partial order? Consider the partition $\perp$ having equivalence classes $\perp_s = \bigcap_{\pi \in \mathcal{P}} \pi_s$. If we assume that $E_t[\alpha \mid -]$ is monotone with respect to subset inclusion, then it is easy to show that $\perp$ is the bottom element of this partial order.[2] Moreover, $\perp$ seems like a reasonable candidate for the canonical partition if we want to have the most refined encoding of Smith's conditional expectations as represented by $E_t[\alpha \mid -]$.

Let π be the canonical partition of S_t. The intended interpretation outlined above suggests that $\pi_s \times E_t[\alpha \mid \pi_s]$ can be taken as a representation of Smith's current expectation, conditional on π_s, concerning the change that would take place if α were to be performed. As in expected utility theory, we are interested in combining these conditional expectations into a single unconditional expectation. One seemingly reasonable way of doing this is to take the unconditional expectation, $E_t[\alpha]$, to be the union of all the conditional expectations as follows:

$$E_t[\alpha] = \bigcup_{\pi_s \in \pi} (\pi_s \times E_t[\alpha \mid \pi_s]). \tag{1}$$

[1] Our use of the term 'serious possibilities' is inspired by, but differs from, the use of this term in Levi (1980).

[2] $s \in \perp_s$ for all $s \in S_t$. If $\perp_s \neq \perp_{s'}$, then there is some $\pi \in \mathcal{P}$ such that $\pi_s \neq \pi_{s'}$. Since π is a partition, it follows that π_s and $\pi_{s'}$ are disjoint. Since $\perp_s \subseteq \pi_s$ and $\perp_{s'} \subseteq \pi_{s'}$, it follows that $\perp_s$ and $\perp_{s'}$ are disjoint. Hence, $\perp$ is a partition of S_t. Suppose that $\perp_s$ and $\perp_{s'}$ are disjoint. It follows that there is some π such that $\pi_s \neq \pi_{s'}$. By assumption, $E_t[\alpha \mid -]$ is partition preserving on $\mathcal{P}$. Hence, $E_t[\alpha \mid \pi_s]$ and $E_t[\alpha \mid \pi_{s'}]$ are disjoint. Since $\perp_s \subseteq \pi_s$ and $\perp_{s'} \subseteq \pi_{s'}$, the assumption that $E_t[\alpha \mid -]$ is monotone with respect to subset inclusion guarantees that $E_t[\alpha \mid \perp_s]$ is a subset of $E_t[\alpha \mid \pi_s]$ and $E_t[\alpha \mid \perp_{s'}]$ is a subset of $E_t[\alpha \mid \pi_{s'}]$. Thus, $E_t[\alpha \mid \perp_s]$ and $E_t[\alpha \mid \perp_{s'}]$ are disjoint and we have shown that $\perp \in \mathcal{P}$. It is clear that $\perp$ is the bottom element of the indicated partial order.

We may relate (1) to expected utility by interpreting the equivalence classes of π as the states to which probabilities are assigned and by interpreting $\{E_t[\alpha \mid \pi_s] \mid \pi_s \in \pi\}$ as the set of outcomes to which utilities are assigned. Thus, under this interpretation, $E_t[\alpha \mid \pi_s]$ is the outcome of α in state π_s. If p is a probability function on this set of states and u is a utility function on this set of outcomes, then the expected utility of α is given as follows:

$$\mathbf{E}_t[\alpha] = \sum_{\pi_s \in \pi} (p(\pi_s) * u(E_t[\alpha \mid \pi_s])). \tag{2}$$

By assigning probabilities and utilities, the additive and multiplicative operations from the category of sets, as employed in (1), are replaced by the additive and multiplicative operations from the field of real numbers, as employed in (2), to pass from expected content to expected utility.[3]

§7. While the approach that is outlined in the previous section is close to what we will ultimately offer as a more precise rendering of the informal proposal that was suggested at the beginning of that section, it does, at least in its current state, suffer from at least one problem. This problem can be seen as follows. Suppose we wish to compare the content of an act, α', that is under consideration at t' by an agent, say Williams, to the content of α, which, as discussed, is under Smith's consideration. Let $F'_{t'}$ be the set of those features of the world that count as relevant for Williams at t'. Let $F'_{t'}[\alpha']$ be the set of those features of the world that Williams, at t', believes could be relevant in assessing the result of selecting α' given that this assessment would take place at the evaluation time, $t'_{\alpha'}$, that is part of the specification of α'. Let $P'_{t'}$ and $P'_{t'}[\alpha']$ be the sets of points that are determined by $F'_{t'}$ and $F'_{t'}[\alpha']$, respectively, as P_t and $P_t[\alpha]$ are determined by F_t and $F_t[\alpha]$, respectively and as discussed above in detail. Following the approach of the previous section, the content of Smith's α at t is represented by $E_t[\alpha]$, a subset of $P_t \times P_t[\alpha]$, while the content of Williams' α' at t' is represented by $E'_{t'}[\alpha']$, a subset of $P'_{t'} \times P'_{t'}[\alpha']$. Hence, the content of the first act is a proposition in the boolean algebra that consists of the subsets of $P_t \times P_t[\alpha]$ while the content of the second act is a proposition in the boolean algebra that consists of the subsets of $P'_{t'} \times P'_{t'}[\alpha']$. If either F_t fails to be equal to $F'_{t'}$ or $F_t[\alpha]$ fails to be equal to $F'_{t'}[\alpha']$, then the indicated algebras are distinct. In a case where these algebras are distinct it is not clear how to compare the content of the first act to that of the second.

The above difficulty may be overcome by normalizing all content to a common set of points. Analogous to the manner in which F_t determines P_t, F – the set of all features of the world – determines its own set of points. This set of points, P, may be represented as the product set $\prod_{f \in F}[O_f \cup \{\Delta_f\}]$ where, for each f in F, O_f and Δ_f are interpreted as they are in the analogous constructions that have already been discussed. The product set $P \times P$ will serve as our common set of points. Suppose that U is a subset of the product $P_t \times P_t[\alpha]$. Let $\overline{U}$ be the subset of $P \times P$ that consists of all points (x, y) in $P \times P$ for which there exists a point (r, s) in U such that $x_f = r_f$ for all f in F_t and $y_f = s_f$ for all f in $F_t[\alpha]$. Clearly there is a completely analogous map that takes subsets of $P'_{t'} \times P'_{t'}[\alpha']$ to subsets of $P \times P$.

By using the canonical mappings that have just been described we may represent the *normalized* expected content of α for Smith at t as $\overline{E_t[\alpha]}$. Likewise, the normalized

[3] See Mac Lane (1971) for a discussion of *coproducts* and *products* in various categories including the category of sets.

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expected content of α' for Williams at t' is represented as $\overline{E'_{t'}[\alpha']}$. By employing the indicated canonical mappings the normalized expected content of every act is represented in the propositional algebra on $P \times P$.

§8. It is clear that the present account depends on several parameters that vary as a function of those decision contexts in which an act may be realized by the selection of an alternative. Recall that such parameters include the set of features of the world that count as relevant for the decision maker and the decision maker's judgment concerning what constitutes a reasonable set of answers to the questions that are indexed by these relevant features. Furthermore, recall that additional parameters enter into the evaluation of particular alternatives. Such parameters include the evaluation time for the alternative, the set of features of the world that the decision maker currently believes would be relevant in assessing the result of selecting the alternative, and the decision maker's current expectation for a performance of the alternative.

There are other contextual matters, rather different from those afforded by the above parametric considerations, that are of interest for the role that they play in the pragmatics of language. To discuss these other contextual matters within the present account we need recourse to a type of thing that may have several instances, each of which takes the form of an alternative in a decision problem. With such a thing in hand we may discuss the manner in which the proposition that is assigned to each of these instances, under the present account by virtue of their status as an alternative, varies. Perhaps the most familiar example of such a thing is that of a sentence in a language. A given sentence may be uttered deliberately in several different instances. According to the present account, each of these instances is – like every other deliberate act – assigned a proposition in the canonical algebra. Thus the present account allows one to consider the manner in which the expected content of a sentence can change from one utterance to another.

According to the application of expected content that has just been suggested, the meaning of a sentence in a context where an utterance of that sentence is being considered is what the considering agent expects would be accomplished by this utterance. It seems to us that this suggestion is natural enough that it warrants further investigation. There are at least two ways that such an account can run into problems. One way is by being too sensitive to context. This happens when there are distinct utterances of a sentence that ought to have the same meaning, but do not according to the given account. This could certainly be the case if some of the parameters reviewed at the beginning of this section are sufficiently sensitive. Another way that such an account can run into problems is by not being sensitive enough to context. Imagine two different agents, perhaps at very different times and places, such that each is considering an utterance of the sentence "I prefer beauty to progress" as an alternative. Nothing in the account that has been offered excludes the possibility that these distinct utterances have the same expected content. Such a case merely requires that these two different agents are identical with respect to the parameters that were reviewed at the beginning of this section. However, whether or not this counts as defect of the present account of content depends on desiderata that have yet to be articulated. What are these desiderata? It seems to us that, at least minimally, knowledge of the content of an act ought to inform the selection of a response to that act; knowledge of what an agent expects to happen as a result of performing a certain act strikes us as an intuitively plausible candidate to satisfy this minimal requirement. If the selection of a response can be understood as a function of the content of the initial act, where other parameters (e.g. the responder's beliefs and values apart from knowledge concerning the content of the initial act) are fixed

with respect to the responder's situation, then it seems that evidence of a given account's failure to satisfy these desiderata would take the form of an improper response. We are not aware of an example that would furnish such evidence with respect to the present account of content, but these remarks ought to at least suggest a way to pursue negative results concerning such an account.

§9. Expected content is our attempt at a more precise rendering of the informal suggestion that the content of an act is the decision maker's expectation concerning the change that would take place if the act were to be performed. With this relatively precise formulation in hand let us now consider some basic properties of the view that has been advanced. Perhaps the first thing to note is that the expected content of an act is a proposition in the sense that the expected content is represented as an element of a particular algebra of sets. However, despite being familiar in this respect, it is important to note that the interpretation of the set of points on which this algebra is based is quite different from the 'state-description' interpretations that inform various other propositional accounts of content.

In suggesting that the points of $P \times P$ are not easily construed as state descriptions, we are assuming that there is an intended interpretation that distinguishes a state description from an abstract point in the sense of pure mathematics. Rather than being state descriptions, the points of $P \times P$ are used in representing an agent's expectation for the change that would result from the selection of a given alternative. It seems to us that the points of the set underlying the relevant algebra of propositions are inherently dynamic in a way that state descriptions are not.

It might be suggested that the elements of P itself can be viewed as possible worlds along the following lines: x in P is the world where, for each feature f, if the underlying program of f were run, then the result would be x_f. However, this suggestion requires an assignment of truth-values to such conditionals, a thing that some philosophers are reluctant to do (Levi, 1996). Additionally, even regarding the elements of P as state descriptions seems awkward once we recall the empirical status that features of the world are assumed to enjoy in the account that has been offered; such an attempt to identify each point of P with a particular state description will fail if state descriptions are not determined by the values that are assigned to their features according to the suggested identification.

Of course one could argue that the empirical requirements concerning the points of P mark a place where we have gone astray, that there are times when a rational decision maker ought to be concerned with a more fine-grained analysis than what is afforded by features of the world. Yet it is easy to underestimate the resources that are available even within the requirements that are imposed by our empirical interpretation. For example, an instantiation of a program for computing a function can be accommodated within our empirical interpretation as long as the instantiation is observable. Indeed the idea of considering the action of a program on observables was a central motivation behind the present concept of a feature of the world. Furthermore, it seems to us that the empirical requirements of our intended interpretation allow for a more plausible view of how a decision maker might learn from past expectations. For example, according to the present account, $E_t[\alpha]$ represents Smith's expectations at t of what would happen if he were to select α. Assuming that Smith selects α, the empirical requirements of our intended interpretation suggests that Smith could, in principle, determine whether or not his expectations were fulfilled.

Finally, even if the points of $P \times P$, or P, are not readily identified with state descriptions, it might be possible to find a mapping from the propositional algebra on $P \times P$ to the

propositional algebra on the set of state descriptions, thereby providing a translation of expected content into something more familiar. Imagine that such a mapping has been proposed so that when this mapping is applied to the normalized expected content of a speech act it yields a representation of the content of this act as a set of state descriptions. Will this mapping preserve the propositional algebra structure? It seems not. For example, consider a completely clueless agent who has vacuous expectations for what would happen if a particular sentence were uttered. All possible changes are consistent with this clueless agent's expectations, and so the (normalized) expected content of this act is the set of all elements in $P \times P$, which is the top element of the propositional algebra on $P \times P$. Should the proposed mapping preserve this aspect of the propositional algebra structure? If so, then the proposed mapping would suggest interpreting the content of the speech act in question as the set of all state descriptions. According to the usual interpretation, the set of all state descriptions is a representation of those propositions that are tautologies. This does not strike us as a very promising translation of expected content. More generally, similar remarks can be made with respect to the possibility of having a translation that preserves other aspects of propositional algebra structure, e.g. the algebra's partial ordering of its propositions.

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DEPARTMENT OF PHILOSOPHY
COLUMBIA UNIVERSITY
E-mail: jh2239@columbia.edu