

Epistemics, Embedding, and Sentience: A Case for Information States

Introduction. Following Hintikka (1969), propositional attitude verbs have been analyzed as relations between a proposition and a sentient attitude-holder: reference to the attitude-holder's beliefs produces a doxastic attitude, while reference to the attitude-holder's desires produces a bouletic attitude. This paper argues for the recognition of a new class of "attitude" verbs, VERBS OF ARGUMENTATION, or VOAs (e.g., *assume*, *claim*, *demonstrate*, *imply*), which refer to the informational content expressed by or contained in the "attitude-holder." VOAs and doxastics pattern together in licensing embedded epistemic modals, in contrast to bouletics (1):

- (1) a. * John {hopes, wishes, commanded} that the Earth might be flat.
 b. John {believes, claims, implies} that the Earth might be flat.

However, they differ in their ability to obviate von Fintel and Iatridou's (2003) ECP (2) or take a non-sentient attitude-holder (8). We argue that (1) and (8) are derivable assuming that both epistemics (4) and VOAs (7) are dependent on events with propositional content, while doxastics are dependent on events with content based on a belief state (5) and bouletics lack propositional content entirely (Villalta 2000). We further argue that (2) is derivable assuming that ECP obviation is a diagnostic of objective epistemic modality (Tancredi 2007).

Objective and subjective epistemics. Although the attitude verbs in (1b) all admit embedded epistemics, they treat them non-uniformly. To wit, while an epistemic underneath *believe* obeys von Fintel and Iatridou's (2003) Epistemic Containment Principle (ECP), whereby a quantifier like *every* cannot take scope over an epistemic, epistemics underneath *assume* or *imply* do not:

- (2) a. # Holmes believed that every partygoer might be the murderer.
intended: H. believed each partygoer had the possibility of being the murderer.
 b. Holmes {assumed, implied} that every partygoer might be the murderer.

The contrast in (2) mirrors the observation of Tancredi (2007) that the tag *objectively speaking* may obviate the ECP in matrix contexts:

- (3) #(Objectively speaking), every partygoer might be the murderer.

Tancredi argues that the contrast in (3) indicates that the ECP is obeyed by subjective but not objective epistemics (in the sense of Lyons, 1977). Following Tancredi, we take subjective epistemics to involve doxastic alternatives and objectives to involve reasoning from accepted premises. Given this, the contrast in (2) may be derived assuming that what VOAs access in (2b) is not Holmes' doxastic state (as (2a) would do), but the set of premises associated with Holmes' particular act of assumption or implication. Crucially, this set of premises is itself an objective *information state*, abstracted from the particular doxastic state of the attitude-holder.

Analysis. Following Hacquard (2006), this set of premises is determined by the attitude verb eventuality via the function CONTENT, which returns the propositions associated with an eventuality. Hacquard assumes that accessibility relations are relative not to worlds but to events, which include speech events and attitude events. Epistemic relations (versus, e.g., deontics) require the event to have associated content:

- (4) $MB_{\text{epis}}(e) = \lambda w. w$ is compatible with CONTENT(e)

Attitude states such as *believe*, which quantify over doxastic alternatives, have content in the form of the attitude-holder's beliefs, allowing embedded epistemics, whose event argument must be bound by the nearest eventuality quantifier (in matrix contexts, the utterance event):

- (5) John believes that it might be raining.
 $\exists s [\text{believe}(s) \ \& \ \text{Exp}(s, J.) \ \& \ \forall w'' \in \text{DOX}(s): \exists w''' \in \text{MB}(s): \text{it is raining in } w''']$

The acceptability of VOAs in (1b) indicates that while epistemics may quantify over doxastic

alternatives, they may also quantify over the worlds in the intersection of an information state. Thus, while they may use doxastic alternatives, they need only make use of a consistent set of propositions, like those given by a theory or body of knowledge:

(6) According to {my book, Relativity, A. Friedmann}, the universe might be hyperbolic.

(7) John assumes that the Earth might be flat.

$\exists e[\text{assume}(e) \ \& \ \text{Ag}(e, J.) \ \& \ \forall w' \in \cap \text{CONTENT}(e): \exists w'' \in \text{MB}(e): \text{the Earth is flat in } w'']]$

We take the contrast in (1) to highlight a fundamental difference in the event structure of bouletics and commands on the one hand and doxastics/VOAs on the other: only the latter possess associated propositional content (see Villalta 2000 for a proposal that makes such a fundamental distinction and gives the former a semantics in terms of contextual alternatives).

Evidence for a split: Non-sentient subjects. While doxastics conform to the expectation that their attitude-holder's are sentient (7a), VOAs allow for the additional possibility of an information-bearing attitude-holder, e.g., books, theories, etc. (7b):

(8) a. # The book {thinks, believes, suspects} that the Earth is flat.

b. The book {claims, implies, argues, assumes} that the Earth is flat.

The contrast in (8) is fully in line with expectations following from the distinction in (2) – while only sentient entities may have doxastic alternatives, non-sentient entities may possess propositional content in virtue of the information state they record.

Interestingly, verbs like *imply*, which show VOA behavior with information-bearing subjects (8b), can sometimes admit non-information-bearing subjects. When they do so, they still allow epistemic modals, perhaps suggesting that epistemics need not target the propositional content of the attitude verb event:

(9) His actions implied (to me) that John might be a hero, #although I disagree.

It is compatible with my doxastic alternatives, in view of his actions, that John is a hero.

However, the infelicitous continuation indicates that (9) entails that the embedded proposition is compatible with the experiencer's doxastic state. Correspondingly, we argue that it is this state that serves as the propositional content the epistemic is sensitive to. Following Tancredi, doxastic propositional content induces subjective epistemic modality, and hence we predict no ECP obviation in cases such as (9). This prediction appears to be correct:

(10) #The shattered wineglass implied (to Holmes) that every partygoer might be the murderer.

Thus, while verbs of argumentation need not have a sentient attitude-holder, if the attitude-holder is non-contentful, a doxastic perspective is required to provide propositional content.

Conclusion. We have argued for the existence of a class of attitude verbs that require not sentience but an associated information state, whose perspective-neutrality is registered by diagnostics for objective epistemic modality. We have further argued that epistemic modals themselves obey a similar requirement, and thus cannot appear within bouletics or commands. Thus, we may account for the notorious difficulty of embedding epistemic modals without retreating into non-truth-conditional treatments of them (e.g., Halliday 1970, Palmer 1986, Drubig 2001). In addition, the tight connection between the embedding attitude and the flavor of epistemic modality in its complement supports a view of modality such as Hacquard (2006), where the type of modal base available to a modal is constrained by its grammatical environment and not simply contextually determined.

Selected references: von Stechow & Iatridou (2003) "Epistemic Containment" *Linguistic Inquiry* 34; Hacquard (2006) *Aspects of Modality*. PhD. Thesis; Lyons, J. (1977) *Semantics*, Cambridge University Press; Tancredi, C. (2007) 'A Multi-Modal Theory of I-Semantics.', *ms*; Villalta, E. (2000) 'Spanish subjunctive clauses require ordered alternatives', *SALT X*.