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About 'about' *

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Abstract I provide a compositional account of *about*-PPs in combination with attitude predicates and content nouns, and as a predicate. The account requires that attitude predicates are properties of content-bearing eventualities, rather than relations that take propositions (or other clause denotations) as arguments. I argue further that the relevant notion of 'content' must be extremely general, allowing for question-like, proposition-like, and hybrid meanings.

Keywords: Semantics, pragmatics, questions, attitudes, clause embedding

1 Introduction

This paper examines attitude reports through the lens of the English preposition *about*, which is extremely productive. Three core uses are illustrated in (1–3):

(1) *Indirect reports:* John {asked / wondered / knows / dreamed / etc.} about {Mary / whether Mary dances}.

(2) *Content nouns:* John read a {book / article / story / blurb / etc.} about Mary.

(3) *Predication:* {The question / the claim} was about {Mary / why Mary left}.

The productivity of *about* suggests that we need a cross-categorial, compositional account. However, *about* is also what I term *over-productive*. By this I mean that, though its internal argument can always be either a DP or an interrogative, its external distribution does not match either of these categories. For example, there are verbs like *wonder* that don't take DPs without *about*, and verbs like *think* that take neither DPs nor interrogatives without *about*.

(4) John wondered {*Mary / ✓about Mary}.

(5) a. John thought {*Mary / *why Mary left / ✓that Mary left}.

b. John thought about {✓Mary / ✓why Mary left / *that Mary left}.

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The example of *think* is particularly interesting because when combined with *about*, it acts like a question-embedding predicate. An account of over-productivity requires not just a compositional account, but a detailed understanding of the lexical semantics of a range of indirect report predicates and how that might interact with a range of argument types. This leads to the third, and most basic puzzle: what theory of attitudes can account for the behavior and distribution of *about*?

I argue here that the best account involves not the classical Hintikkan relational treatment, but something more exotic. In particular, following Kratzer 2006; Moulton 2009; Anand & Hacquard 2009, 2013; Hacquard 2010 most directly, (see also Moltmann 1989, 2003, 2013; Ginzburg 1995a inter alia) I argue that attitude predicates are properties of eventualities that have *content*. 'Arguments' to attitude predicates tell us about that content intersectively, rather than relationally. Selectional restrictions are therefore necessarily decoupled from the structure of content; this builds on a long history of disentangling syntactic and semantic complement clause selection (Grimshaw 1979; Pesetsky 1982 and many others).

I further argue, based on the sheer variety of *about*-taking predicates, that this non-classical account of attitude predicates must be paired with a rich, general notion of content. Following much work in the questions literature, I use an alternative-structured notion of content, and in particular make use of *hybrid* alternative structures from Groenendijk & Roelofsen 2009; Ciardelli, Groenendijk & Roelofsen 2010. This allows for contents that are a mix of informative and what Groenendijk 1999 terms 'inquisitive,' i.e., having alternatives. The role of *about* is to connect up some alternative structure provided by its internal argument with the content of its external argument. It contributes that this internal alternative structure is *non-orthogonal* (Lewis 1988a) to the content of its external argument.

In the first part of this paper, §2, I go into detail about the range and types of predicates that *about*-PPs can combine with, building up a large sample of predicates via corpus work and expanding the arguments sketched above. I will examine both productivity and over-productivity in more detail, as well as lay out existing proposals in the literature. In the second part of the paper, §3, I turn to the analysis, setting out what is necessary to account for both the productivity and over-productivity of *about*. There I begin with content nouns, develop a general theory of 'content,' and provide several case studies of particular verbs that take *about*.

2 Assessing the productivity of *about*

I have claimed that *about* is productive, implying that a compositional analysis is necessary.[1] However, this alone doesn't determine what kind of compositional

1 Note that I set aside the approximation use of *about* (see Zaroukian 2013) as well as the spatial sense.

analysis is necessary. In the following sections I first lay out some of the previous strategies that have been tried for *about*, and then explore both productivity and over-productivity in detail in light of these strategies.

2.1 Analytical strategies for *about*

There are three strategies that have been taken for understanding *about* in prior work. The *formal strategy*, due to Pesetsky (1982), is to take this preposition to be one of the class of prepositions that appear for formal reasons, i.e., to mark case.[2] That is, some verbs cannot case-mark their internal argument on their own, and so require a preposition such as *of*, *on*, or perhaps *about* to do so. The *reduction strategy*, due to Boër 1978, reduces the effect of an *about*-phrase to an already-understood argument type; Boër's particular proposal (though somewhat more complicated than this) amounts to reducing *about*-PP arguments to (propositional) *that*-clause arguments.[3] However, the general strategy need not be implemented that way, and the reduction could be to interrogative complements. I will argue that both of these strategies are wrong, based on the distribution of *about*-phrases and their interaction with verb-specific selectional restrictions.

The third and more recent strategy, developed in Moulton 2009, is more subtle. Moulton proposes that *about*+DP provides a *res* argument for a *de re* attitude predication (Quine 1956; Lewis 1979; Cresswell & von Stechow 1982; Chierchia 1989 inter alia; Moulton uses in particular the analysis of *de re* ascriptions from Kratzer 1998, 2006). Moulton explicitly denies that an *about*-PP provides the 'content' of an ascription. That is, if John thought about Mary, he had a thought whose content we do not know, but that centered on Mary. This is intuitive, particularly given that the word *about* litters the paraphrases of papers about *de re* ascription. I will not suggest that this account is wrong. Rather, I will suggest that it is not complete, and raises a number of questions that must be answered. In the rest of this section, I visit evidence bearing on these strategies.

2.2 What predicates does it combine with?

The purest version of the formal strategy would lead us to expect that *about* is chosen idiosyncratically by predicates that it appears with. (In fact, this seems to be true for

2 (Pesetsky 1991: note 6), argues against this strategy, and implies that *about* serves a dual-role in both case-marking and interpretation.

3 The particular puzzle that concerned Boër was that *tell that* is non-factive, *tell wh-* is factive, and *tell about wh-* is not factive. Hence, the function of *about* was to (effectively) convert an interrogative clause into a proposition, by existentially quantifying over a set of alternatives. Boër's (1978) puzzle, which he termed 'semantic cross-over,' is only one side of the coin. Also, not all verbs that take *about* work like this; *know about* seems just as factive as *know wh-*, an issue I deal with in §3.5.

a range of other prepositions, such as *of*.) In this section, I provide evidence to the contrary: *about* is extremely productive and cross-categorial. An *about*-PP occurs in three key contexts: as a sister to various nominals, as a sister to various attitudinal predicates, and most importantly for the argument, in a predicative use.

I begin with the use of *about*-PPs in predicative copular sentences, illustrated in (6). This use is extremely productive, and typically the subject DPs involve nominals that could alternatively be modified by an *about*-PP. This behavior contrasts with apparently similar prepositions such as *of*, and suggests both that a compositional (not purely formal) account is necessary, and that the type of an *about*-PP is that of a predicate of some sort.

(6) That book is about Joanna. (✓a book about Joanna)

(7) * That book is of songs. (✓a book of songs)

The nouns that an *about*-PP can appear as sister to subsume what Moltmann (1989) terms *content nominalizations* (see also Vendler 1972; Ginzburg 1995a,b; Moltmann 2003, 2007; Uegaki 2012 inter alia). To give a sense of the range of possibilities, in (8) I have provided a subjective classification based on 456 nouns that appeared with *about* in a corpus search in Davies 2008-.[4]

(8) a. John read a { book / article / story / blurb / letter / etc. } about Mary.
Media artifact

b. John heard a { rumor / story / anecdote / tale / lie / etc. } about Mary.
Communication

c. John raised a(n) { question / issue / inquiry / opinion / problem } about Mary. **Abstract entity/communication**

d. John knows a { conclusion / fact / thing / misconception / prediction / principle / etc. } about Mary. **Abstract entity**

e. John’s {ambivalence / anxiety / complex / despair / frustration / honesty / insight / naivete / sadness / etc. } about Mary surprised everyone.
Mental state

About-PPs show up similarly with a wide range of predicates (I return to the makeup of this class in more detail in §2.4). Two key cases are mental state and communication verbs, but many verbs don’t fit into this category.

(9) a. John { dreamed / figured out / fretted / panicked / realized / thought / understood / etc. } about Mary. **Mental state**

4 I recorded the first 1000 results for a search for N-*about* sequences, sorted by frequency; note that Davies 2008- results are unstemmed, and so with stemming for plurals, this would amount to nearly every hit providing a new result. Future work would involve analyzing these results quantitatively.

b. John { asked / babbled / bitched / chimed in / contacted me / hinted / gossiped / joked / lied / published / responded / talked / etc.} about Mary. **Communication**

c. John { hesitated / read / researched / smiled / etc. } about Mary. **Other**

To assess the range of verbs, I performed a similar search in Davies 2008- for V-*about* sequences. The first 1000 results (again unstemmed) led to 170 unique verbs after removing duplicates and false positives that take just an *about*-PP, as well as 228 additional verbs that take *about*-PPs only in combination with another clause or argument. For reasons of space I will largely ignore this latter class here, though they are obviously important to understand in the long run.[5] To assess the status of verbs that do take just *about*-PPs in the larger context of attitude predicates, I aggregated this sample with several other attitude verb classifications in the literature, most notably Hacquard & Wellwood 2012. The resulting database has 654 frames representing 554 unique verbs. I then annotated these with whether they are compatible with *about*-PPs, including annotations for uncertainty. (Future work involves multiple annotators, and crowd-sourcing of these judgments.) Of this sample, 213 take just *about*-PPs; excluding cases where the judgment is unclear, this is 35% of the sample. In this sample, this is comparable to the distribution of verbs that take *to*-infinitivals (30%), *for-to* infinitivals (39%), and gerundives (40%).

From this comparison I conclude that *about* is very productive, and therefore that a compositional account is desirable. While this method is too coarse for more quantitative analysis, future work will allow for metrics such as inter-annotator reliability. The productivity argument rules out a purely formal account of *about*.

2.3 Internal arguments to *about*

Existing strategies have tended to focus on just one use of *about*: either *about*+DP or *about*+interrogative. However, *about* is consistent in allowing both types of internal

5 The major factor seems to be whether the verb is obligatorily transitive, setting aside the *about*-PP. (Thanks to Paul Portner, p.c., for this suggestion.) This suggests both that *about*-PPs are pure modifiers of attitude verbs, and that selectional differences between pairs like *think* and *believe* that seem major at first glance, may be somewhat superficial. Example (iii) illustrates a case of *believe* taking both an *about* PP and its normal clausal argument.

(i) Alfonso thought about Joanna.

(ii) * Alfonso believed about Joanna.

(iii) Alfonso believed about Joanna that she was clever.

arguments. Across the contexts illustrated above, *about* can take as its internal argument a DP, or an interrogative CP.[6]

(10) a. John heard a tale about Rapunzel. **Referential**

b. John read a book about { cats / linguistics / French }.
Bare plural / subject matter

c. John read a story about every doctor at the practice. **Quantified**

d. Alfonso asked about { the price of milk / the capital of Italy }.
Individual concept-denoting

(11) a. Alfonso asked about {whether Joanna was going / why Joanna was going / who else was going}.

b. The email is about {whether Joanna was going / why Joanna was going / who else was going}.

c. I was surprised by the phone call about {whether Joanna was going / why Joanna was going / who else was going}.

This data suggests a systematic relationship between *about*+DP and *about*+interrogative in meaning. Moreover, it bears on both the formal strategy and the *de re* strategy. For the formal strategy, it raises the question of why the case-marking of DPs and interrogatives should be connected. This question in fact appears independently of *about*, and I will not attempt to provide an answer to it: in my sample, the distribution of DP-licensing and interrogative-licensing are in general highly correlated. To the *de re* strategy, it raises the question of what it means to be a *de re* ascription about a question; Moulton 2009 does not discuss interrogative data.

While DPs that appear as the argument to *about* often intuitively seem question-like, it is worth distinguishing them from 'concealed questions' (Baker 1968; Grimshaw 1979; Heim 1979 etc.). Concealed question DPs are ones like *the price of milk* that can appear as direct arguments to some question-embedding predicates. While these DPs can appear as arguments to *about*, we also find referential arguments such as proper names that cannot be concealed questions in the usual sense (see Romero 2005: §2.4.3 among others).

2.4 Over-productivity

To really assess the reduction strategy, we must examine the range of verbs that take *about*. Recall that the reduction strategy is to reduce the denotation of an *about*-PP to one of the better understood argument types, in the case of Boër 1978, a proposition-denoting argument. A basic prediction of this variety of account is that

6 Gerunds can also appear in this position, but I will not deal with them here.

Group	Count (+marginal)	Examples	finite reports?	int.s?	DPs?
1:	71 (+2)	ask, find out, tell, know	✓	✓	✓
2:	20 (+4)	inquire, notify X, wonder	✓	✓	x
2b:	4 (+2)	curse, moan, preach	✓	x	✓
3:	62 (+6)	argue, joke, persuade, think	✓	x	x
4:	31 (+3)	lie, talk, meet	x	x	x

Table 1 Selectional behavior of *About*-taking verbs

the distribution of *about*-PPs will track the distribution of the 'more basic' argument type; for Boër 1978 this should be *that*-clause arguments, but one could go the other way. What I show in this section is that the distribution of *about* cross-cuts all relevant selectional restrictions, and is therefore independent of such restrictions.

Using the sample of 170 verbs discussed above that take *about*, I analyzed the distribution of *about*-PP licensing in comparison with declarative, interrogative, and DP arguments. The results are shown in Table 1 (see the appendix for longer verb lists). If a verb licenses any kind of clausal complement at all, I have given it a check in the 'reports?' column. If it licenses interrogative clauses, I have given it a check in the 'int.s?' column, and similarly for DPs. The counts are given in the second column, with parenthetical indication of cases that marginally take *about*.

While more empirical work must be done before drawing strong conclusions from this data, several important patterns emerge. First, and this is what I will focus on in the present paper, the distribution of *about* clearly cross-cuts the distribution of both interrogatives and DPs as basic arguments. There are many verbs that take *about* but not interrogative clauses, and many verbs that take *about* but not DPs. Second, there is a non-trivial group of verbs (group 4) that otherwise would not be classified as attitude predicates, as they don't take other sorts of clausal complements, but nonetheless take *about*-PPs. These verbs, it should be highlighted, do not take *that*-clauses. Third, there are non-trivial asymmetries between interrogatives and DPs (e.g. group 2b is marginal at best). I will not deal with these asymmetries here beyond noting them, and in fact in the larger sample of verbs a similar relationship is present (in both cases highly significant on a Chi-Square). This pattern is a blow for the reduction strategy: one cannot easily reduce *about*-PPs to either question-like or proposition-like meanings.

Approached from another direction we get the same result: in pairs like (12) the *about*-PP seems to contribute something different: in (12a) it intuitively contributes a question-like meaning, and in (12b) a proposition-like meaning. It is the verb itself that determines this.

(12) a. Alfonso asked about why Joanna quit.
b. Alfonso told me about why Joanna quit.

Rather than reducing an *about*-PP denotation to a particular, more 'basic' kind of attitude ascription, data like this suggests that the account must generalize to handle a wide variety of predicates and attitudes.

I now return briefly to Moulton's (2009) proposal that *about*-PPs provide a *res* for an attitude report. Moulton's main argument for this view is that *about* can co-occur with *that*-clauses.

(13) John's belief about that idea is that it is wrong.

(14) John believed about that idea that it is wrong.

This is an important data point, and it is one that any account should handle, but I suggest it is orthogonal to the possibility of a *res* argument: it simply suggests that one or both of these are modifiers. Beyond this, the *de re* proposal leaves several important questions open. Most importantly, (i) if *about*-PPs do not determine the content of an attitude, it is nonetheless necessary to understand how a hearer recovers content given just an *about*-PP, something that they manifestly do. Several further issues remain: (ii) what explains the predicative use? (Higgins 1973; Kratzer 2006), and finally, (iii) what does it mean for the full range of content-bearing entities, e.g. a book or a poem to have a *res*? The idea behind Moulton's account is not obviously wrong, but any implementation must answer these questions.

2.5 Summary

The existing strategies for understanding *about* either fail entirely, or leave important questions unanswered. The formal strategy is eliminated on grounds of productivity, with predication as its worst case. The *de re* strategy, while not necessarily wrong, leaves too many questions unanswered, and also founders on predicative uses. The reduction strategy, which a priori might seem like the most plausible, fails on the sheer breadth of predicates that *about*-PPs can combine with: no single argument type is general enough to lead to a good reduction account.

In the next section I turn to a strategy that is successful: what might be termed the *generalization* strategy. That is, I argue that the right account of *about* has two components: a very general notion of the content of an attitude, and a decoupling of selectional restrictions per se from the ways in which an 'argument' to an attitude predicate interacts with the content of that attitude.

3 Analysis: a general notion of *content*

There are, at this point, three key desiderata for an analysis of *about*:

(15) Desiderata for an analysis of *about*

a. It is highly productive, both within particular categories, and across categories.

b. It is consistent in its internal argument types.

c. It cross-cuts other potentially relevant selectional restrictions for the predicates it combines with.

My proposal for resolving this situation has three parts. First, *about*-PPs denote properties of *content-bearing*, potentially abstract, entities, and tell us something about that content; I develop this idea in §3.1. Second (§3.2) we need a sufficiently general notion of content so as to cover the full range of verbs illustrated in Table 1. Finally, *about*-PPs don't directly determine content, but identify something that it is 'related to,' and I provide an implementation in §3.3. I then turn to DP arguments, arguing that they are derived via a coercion operation in §3.4. The analysis culminates with four case studies of important verbs that take *about*-PPs in §3.5.

3.1 Cross-categoriality: the dual life of entities and content

We have seen that *about*-PPs combine with a large and diverse range of both nominal and verbal predicates, and can serve as predicates themselves. My proposal is that this is best accounted for by adopting two ideas from recent work on attitude ascriptions (Kratzer 1998, 2006; Moulton 2009; Anand & Hacquard 2009, 2013; Hacquard 2010; see also Moltmann 1989, 2003, 2013). The first is that attitude verbs are neo-Davidsonian predicates. The second is that they are predicates of eventualities that have what has been termed *content* (Hacquard 2006, 2010). As Hacquard 2010 puts it, "if *John believes it rained*, the *object* of his belief is the proposition that it rained, while the *content* [of the belief eventuality] is the set of all propositions that John believes; the intersection of these is the set of worlds compatible with what he believes, his doxastic alternatives." Following Hacquard, I will assume a function CON that maps eventualities into their content, though the details will differ. (Moreover, it is far from clear that the content of a belief state consists of *all* one's beliefs; this certainly isn't true for a *thinking* event.) This function is defined only if its argument 'has content.' Hacquard and others who use this notion assume that content is propositional; below I will suggest that this must be elaborated. On Kratzer's view, the role of a complementizer such as *that* is to connect up its internal argument, a proposition, with the content of an eventuality. (I spell out the details for the verbal case in §3.5.)

Following Moltmann 2003 and Moulton 2009, this idea can be straightforwardly extended to content nouns. A noun like *belief* is a property of (potentially abstract)

entities that have content. I will be agnostic as to whether it is directly a property of eventualities in this case, or a property of some nominalized form of eventualities.

Finally, an *about*-PP is also a property of things that have content, and I suggest that it imposes no restrictions on its external argument beyond this. This in one blow accounts for its wide, cross-categorial distribution, as well as the predicative uses.

(16) Content nouns and *About*, preliminary sketch:

a. $[\![\textbf{book}]\!] = \lambda x_e \,.\, x$ is a book $\wedge\, x$ has content

b. $[\![\textbf{about}]\!] = \lambda c_? \,.\, \lambda x_e \,.\, x$ is a book $\wedge\, \textsc{Con}(x)$ is related to c
defined only if $x \in \text{Dom}(\textsc{Con})$

There are two main gaps in this denotation. The first is what c is and what is returned by the content function, and the second is what it means to *be related to*; I turn to these in the next two sections.

Before proceeding, I discuss two important predictions. First, we would expect on this account that the distribution of *about* with verbal predicates is independent of the distribution of clausal arguments, and this is in fact the over-productivity puzzle in a nutshell. A more specific prediction is that we would expect verbs that do not otherwise take clausal arguments (for lexical reasons) to license *about*-PPs. This prediction is borne out in the group 4 *about*-taking verbs identified in §2.4, verbs like *lie* and *talk*. Intuitively, these verbs *do* describe events that have some content, in this case, garden-variety speech events, but one cannot *lie that* or *talk that*. (It is somewhat unclear why not, but I will assume that this is a lexico-syntactic fact and not a necessary truth.)

A second and parallel prediction is that the variety of content nouns that take *about* should not be bound by which ones take clausal arguments – which turn out to be less than half the sample. The literature on content nouns has focused on rather abstract ones like *fact*, *claim*, *rumor*, and *thing*, but the distribution of *about* shows that this class is much wider than that, dominated by media-artifact nouns such as *book*, *movie*, communication nouns, and a wide variety of manner-ish mental state predicates such as *anxiety*. By understanding these nouns (or at least, the relevant NPs) as denoting properties of things that have a dual life as entities(/eventualities) and 'content,' we gain an understanding of the distribution of *about*-PPs as well as what content is.

3.2 Rich content

If an *about*-PP is a property of a content-bearing individual, what does it say about the content of that individual?[7] To get there, we first must establish what content is

7 This amounts to the question I raised for Moulton's (2009) proposal: what can one infer about content from just a *res* argument?

in the first place. The final proposal makes use of tools from Lewis 1988a,b, and in particular, the notion of *orthogonality*.

Previous work on content in attitude ascriptions has generally assumed propositional content. The wide variety of predicates that *about* can combine with makes it challenging to maintain this assumption. Here it is useful to focus on communication events. In both the nominal and verbal domain, predicates that take *ask* can describe events whose content is purely question-like (*ask*, *question*) and those whose content is purely assertion-like (*tell*, *claim*).

(17) Alfonso { asked / told me } about Joanna.

(18) The { question / claim } is about Joanna.

Thus, a notion of content minimally rich enough to handle questions is necessary.[8] To represent content, I will adopt Lewis's notion of *subject matters*. In (19) I provide a definition, modified from Lewis to handle partiality (discussed below).

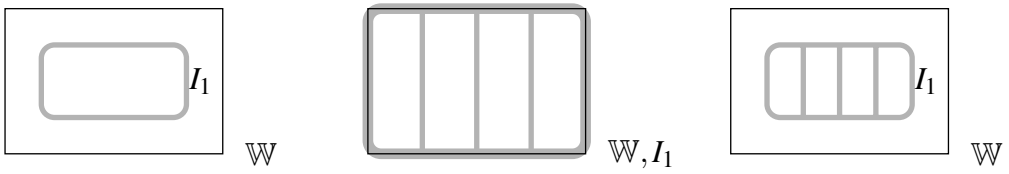
(19) Let a *subject matter a* be an equivalence relation (reflexive, symmetric, transitive) in some subset of $\mathbb{W}$.

Formally, a subject matter resembles question-meanings on a partition semantics for questions (Groenendijk & Stokhof 1984).[9] On this kind of account, an interrogative clause denotes a (curried) equivalence relation on worlds; an equivalence relation determines a set of alternatives that correspond to completely connected blocks of worlds, and these alternatives (intuitively) correspond to complete answers to the question. For example, *whether it is raining* would denote a function like $\lambda w_1 . \lambda w_2 . \text{raining}(w_1) = \text{raining}(w_2)$. Worlds are in a block if they resolve the 'raining' predicate in the same way, and so this relation determines two alternatives: one consisting of worlds where it is raining, and one consisting of worlds where it isn't.

Lewis's subject matters were relations in all of $\mathbb{W}$, but here I have allowed for subsets. This is to allow for what Groenendijk & Roelofsen (2009); Ciardelli et al. (2010) term 'hybrids.' A *hybrid* is an alternative structure that both provides informational and issue-like content. Following their terminology, I will refer to subject matters that are partial as *informative*, and subject matters that have more than one alternative as *inquisitive*. (See Hulstijn 1997; Groenendijk 1999; Isaacs & Rawlins 2008 for earlier instances of these notions.) Much of the generality of this notion of content follows from partiality. Figure 1 illustrates these notions visually. In (20) I have provided the formalization (see Groenendijk & Roelofsen 2009).

8 A similar point could be made about commands, with nouns like *order*, but I will not pursue this here.

9 This proposal could be completely translated into a Hamblin semantics for questions (Hamblin 1973; Kratzer & Shimoyama 2002 inter alia; see Rawlins 2013 for a treatment of orthogonality in a Hamblin semantics.) Here I stick to a partition semantics in order to be closer to Lewis's definitions.



(i) A purely informative subject matter $\mathbb{W} \supset Dom(I_1)$, $Alts(I_1) = \{Dom(I_1)\}$

(ii) A purely inquisitive subject matter $\mathbb{W} = Dom(I_1)$, $|Alts(I_1)| > 1$

(iii) A hybrid subject matter $\mathbb{W} \supset Dom(I_1)$, $|Alts(I_1)| > 1$

Figure 1 Informative, inquisitive, and hybrid subject matters

(20) a. $Dom(a) = \{w \mid \langle w, w\rangle \in a\}$
b. Inquisitivity: $Inq_D(a) = 1$ iff $\exists w_1, w_2 \in Dom(a) \cap D : \langle w_1, w_2\rangle \notin a$
c. Informativity: $Inf_D(a) = 1$ iff $\exists w \in D : w \notin Dom(a)$
d. a is purely inquisitive: $Inq_D(a) \wedge \neg Inf_D(a)$.
a is purely informative: $Inf_D(a) \wedge \neg Inq_D(a)$
a is hybrid otherwise.

These tools are sufficient to begin to understand a broad range of content nouns; several starting points are shown below. A question characterizes speech acts whose content is purely inquisitive, and a claim those which are purely informative. (One might want to place further restrictions on any of these.) A lie is also purely informative, but needn't be a potential speech act, and has to have false informative content. A book also has content, but the noun mainly places restrictions on the physical form of the book – allowing for rich, complicated hybrid content.[10]

(21) $[\![\textbf{question}]\!]^c = \lambda x_e\,.\, x$ is a speech act $\wedge\, Inq_{\mathbb{W}}(\textsc{Con}(x)) \wedge \neg Inf_{\mathbb{W}}(\textsc{Con}(x))$

(22) $[\![\textbf{claim}]\!]^c = \lambda x_e\,.\, x$ is a speech act $\wedge\, \neg Inq_{\mathbb{W}}(\textsc{Con}(x)) \wedge Inf_{\mathbb{W}}(\textsc{Con}(x))$

(23) $[\![\textbf{lie}]\!]^{w,c} = \lambda x_e\,.\, \neg Inq_{\mathbb{W}}(\textsc{Con}(x)) \wedge Inf_{\mathbb{W}}(\textsc{Con}(x)) \wedge w \notin Dom(\textsc{Con}(x))$

(24) $[\![\textbf{book}]\!]^c = \lambda x_e\,.\, x$ is a book $\wedge\, x$ has content

10 One prediction is that we might expect coercion to lead to content where there otherwise might not have been. A case where this prediction is borne out is certain interesting time interval nouns like *week*, *month*, *afternoon*. These don't generally entail the existence of content. However, they do take *about*-phrases, which force a reading where the interval contains some communicative content:

(iv) We had an afternoon about the project recently.

This coercion is unsurprising on the present account, and amounts to presupposition accommodation of the presupposition introduced by *about*.

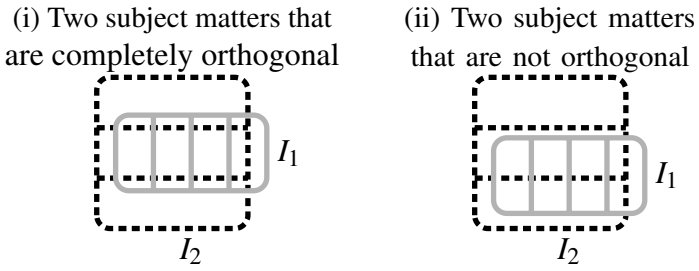


Figure 2 Orthogonality illustrated

I suggest that the combination of a question-like alternative structure with the notion of a hybrid provides a rich and general enough notion of content to cover the full range of uses of *about* under discussion in this paper. I now turn to what to actually do with this notion of content.

3.3 Orthogonality and rich content

In this section I develop a notion of what it might mean to *be related to* in terms of Lewis's (1988a,b) notion of *orthogonality*. I will propose that one subject matter is 'about' another just in case the two matters are not orthogonal. For Lewis, two subject matters are orthogonal if, roughly, the equivalence classes they determine (i.e., the alternatives) completely cross-cut each other. The intuition is illustrated in Figure 2. In (i), every cell in I_1, an equivalence class of worlds in the subject matter/equivalence relation, overlaps with every cell in I_2. Determining one of the issues either partially or completely would have no impact on the determination of the other. In contrast, in (ii) one of the cells in I_2 does not overlap any cell in I_2, and so the two are not orthogonal.

At a technical level something more must be said; as introduced above, Lewis dealt only with total relations in $\mathbb{W}$, but I allow partial relations. (The above picture can be made sensible on Lewis's original formulation by assuming that the inverse space for each subject matter constitutes an alternative as well.) What I will do here is provide an operation for converting a partial matter into a total one, and use Lewis's original formula. The $\mathbb{W}$-*closure* of a subject matter a is a with any extra worlds added into one further alternative. Effectively, it takes the negation of the informative content of a and builds the union of that with a. For a purely inquisitive matter, it will have no impact. For a purely informative matter, it will build what is intuitively the 'polar question' version of that subject matter. The most general hybrid case is illustrated in Figure 3. The resulting definition of orthogonality is given in (26).

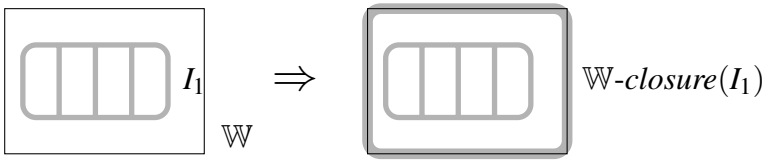


Figure 3 $\mathbb{W}$-*closure*: converting partial subject matters to total subject matters

(25) $\mathbb{W}\text{-}closure(a) = a \cup \{\langle w_1, w_2\rangle \in \mathbb{W} \times \mathbb{W} \mid w_1 \notin Dom(a) \wedge w_2 \notin Dom(a)\}$

(26) **Orthogonality**
a_1 and a_2 are orthogonal iff $\forall w, v \in \mathbb{W} : \exists u \in \mathbb{W} : \langle u, w\rangle \in \mathbb{W}\text{-}closure(a_1) \wedge \langle u, v\rangle \in \mathbb{W}\text{-}closure(a_2)$

Put intuitively, a question q_1 is about a question q_2 if at least some resolutions of q_1 move us towards resolving q_2. A proposition is about a question if its truth or falsity moves us towards answering that question. In fact, this notion closely resembles and generalizes the definition of ‘relevance’ introduced into the question literature by Roberts 1996 (see especially Beaver, Roberts, Simons & Tonhauser 2011: def. 13).[11]

Building on this, in (27) I give a revised entry for *about*. For convenience, I have curried the c argument. This entry takes an argument c that is type-wise a (Groenendijk & Stokhof-style) question denotation, an x that must have content, and returns true just in case that content is non-orthogonal to the subject matter provided by c.

(27) $[\![\textbf{about}]\!] = \lambda c_{\langle s\langle st\rangle\rangle} . \lambda x_e . \textsc{Con}(x)$ is not orthogonal to $\{\langle w_1, w_2\rangle \mid c(w_1)(w_2)\}$
defined only if $x \in Dom(\textsc{Con})$

To illustrate this, consider the example in (28). *The book* denotes an entity with (rich, potentially hybrid) content. *About how Rasputin died* as a predicate conveys that that content is not orthogonal to the resolution of the question of how he died, which provides a set of alternatives each determining completely a manner of death.

(28) The book was about how Rasputin died.

I return to the interaction with attitude verbs in §3.5; at this point I have presented a complete account of the interaction of interrogative *about*-PPs and content nouns. Both are properties of content-bearing individuals. As a predicate, an *about*-PP takes that individual as an argument, and in post-nominal position, the *about* PP would act as an intersective modifier (i.e., combine via a rule like Predicate Modification).

11 Some important sanity checks: a proposition (purely informative subject matter) is not orthogonal to itself, its negation, or anything it entails. Because this notion is symmetric, it is also not orthogonal to anything that entails it. Two strictly consistent propositions are, in contrast, necessarily orthogonal.

3.4 DP arguments via coercion

In §2.3, I showed that *about* systematically takes both interrogative and DP arguments no matter its external distribution, suggesting that the two argument types should be treated uniformly at some level. Just about any DP appears in this position, and when in this position can be coerced into a question-like meaning. This stands in contrast to so-called 'concealed question' DPs, which are much more restricted (e.g. disallow referring expressions). This coercion is highly context-sensitive. For example, if Joanna was supposed to be at a restaurant but wasn't there yet, (29) could mean that Alfonso wondered if she was coming, or if she was just late. In a different context, it might involve wondering whether she was happy, or how she was going to get to the party if her car was in the shop, or any number of other things. Similarly, the example in (30) involves knowing something intuitively more propositional, but the exact content could vary: Alfonso could know that Joanna wasn't going to dinner, or that she was so unhappy she had moved away, or that she was getting a ride with Henry, or any number of other things. Clearly, the coercion process must allow quite a bit of room for context sensitivity.

(29) Alfonso wondered about Joanna.

(30) Alfonso knew about Joanna.

Accordingly, I will give an extremely flexible coercion operation. The proposal is that the DP is coerced into a 2-alternative subject matter constructed from some salient property of the referent.

(31) $[\![\textbf{about } \alpha_{\textbf{DP}}]\!] = \lambda x_e \,.\, \exists P \in D_{\langle e\langle st\rangle\rangle} \,.\, P \text{ is salient} \wedge$
$[\![\textbf{about}]\!]\,(\lambda w_1 \,.\, \lambda w_2 \,.\, P([\![\alpha_{\textbf{DP}}]\!])(w_1) = P([\![\alpha_{\textbf{DP}}]\!])(w_2))(x)$

It is important to note that without the salience criterion this would be too weak: unrestricted existential quantification over properties in this kind of operation can easily lead to triviality (Thomason forthcoming).[12,13]

12 There are several potential alternatives that I will leave for future research. One idea, building on Moulton's (2009) *de re* proposal, would be to try to construct a subject matter around the set of situations whose minimal elements contain the referent. This is suggested by borderline cases that do not so intuitively involve 'propositional' subject matters:

(v) Alfonso cares about Joanna.

(vi) Alfonso dreamed about Joanna.

In (ii), for example, it may be that Joanna simply needed to be present in Alfonso's dream. While this kind of meaning *can* be represented propositionally, it is unclear whether it should be. See also Yablo forthcoming for an extended discussion of 'aboutness' from a philosophical perspective.

13 There are a number of further issues raised by DP arguments that I will not fully resolve here. While non-concealed-questions have been my focus, concealed question DPs (e.g. *the price of milk*) can

3.5 Four verbal case studies

When *about*-PPs combine with attitude predicates, the proposal is that it has the same entry, and that x is a content-bearing eventuality. This directly follows Kratzer's (2006) proposal for *that*-PPs. I will follow Kratzer also in assuming that composition occurs via Chung & Ladusaw's (2004) *Restrict* operation: it modifies but does not saturate the outermost argument of a function. A formulation of this operation is given in (32). An extension of Kratzer-style regular complementizers is given in (33) and (34), assuming that v is the type of an eventuality, and that α, β are types.

(32) Where $\beta = \langle \beta_1 \langle ... \langle \beta_n t \rangle \rangle \rangle$ s.t. $n \geq 0$: $\mathit{Restrict}(A_{\langle \alpha\beta \rangle}, B_{\langle \alpha t \rangle}) =$
$\lambda x \in D_\alpha \,.\, \lambda y_1 \in D_{\beta_1} ... \lambda y_n \in D_{\beta_n} \,.\, A(x)(y_1)...(y_n) \wedge B(x)$

(33) $[\![\textbf{that}]\!] = \lambda p_{\langle st \rangle} \,.\, \lambda e_v \,.\, \textsc{Con}(e) = \{\langle w_1, w_2 \rangle \mid p(w_1) = p(w_2) = 1\}$

(34) $[\![\mathbf{C}_Q]\!] = \lambda p_{\langle s\langle st \rangle \rangle} \,.\, \lambda e_v \,.\, \textsc{Con}(e) = \{\langle w_1, w_2 \rangle \mid p(w_1) = p(w_2)\}$

A *that*-clause equates a propositional argument packaged as a purely informative subject matter with a content. An interrogative clause simply equates its question-denotation (which will be inquisitive) to the content of e. Believing that p involves having a belief whose content is the purely informative matter of p.

As a starting point for *about*, let us consider the verb *ask*. This verb describes speech events whose content is purely inquisitive. (There might be further restrictions, such as requiring them to be cross-speaker.)

(35) $[\![\textbf{ask}]\!] = \lambda e_v \,.\, \lambda w_s \,.\, e$ is a speech event in $w \wedge \mathit{Inq}(\textsc{Con}(e)) \wedge \neg \mathit{Inf}(\textsc{Con}(e))$

An *about*-PP, when it combines with *ask* via *Restrict*, will simply conjoin its aboutness condition to the internal formula in (35). For example, if someone asks about Joanna, they are the agent of a speech event whose content is purely inquisitive, and whose content is not orthogonal to some subject matter constructed from a salient property of Joanna. The resulting formula is shown in (36).

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appear as the argument to *about*, and more may need to be said about this case. A second, related issue, concerns scope. (Thanks to a SALT reviewer for raising this point.) DP arguments can be interpreted *de dicto*, and the coercion above does not obviously lead one to expect this.

(vii) Alfonso read a story about a unicorn. ($\not\rightsquigarrow$ a unicorn exists.)

More generally, quantified DPs can appear in this position. What I suggest is that the analysis presented here can be integrated with 'off-the-shelf' solutions to these problems: the scope of a quantified DP in *about* PPs in DPs amounts to the problem of inverse linking (May & Bale 2007), and the concealed-question problem may amount to how to deal with individual concepts in this position (Heim 1979; Romero 2005; Frana 2010).

(36) $[\![\textbf{ask about Joanna}]\!] = \mathit{Restrict}([\![\textbf{ask}]\!], [\![\textbf{about Joanna}]\!]) =$
$\lambda e_s . \lambda w_s . e$ is a speech event in $w \wedge \mathit{Inq}(\textsc{Con}(e)) \wedge \neg \mathit{Inf}(\textsc{Con}(e)) \wedge$
$\exists P_{\langle e\langle st\rangle\rangle} . P$ is salient $\wedge$
$\textsc{Con}(e)$ is not orthogonal to $\{\langle w_1, w_2\rangle \, P(\text{J.})(w_1) = P(\text{J.})(w_2))\}$

It is important to consider a case that is less question-oriented, and a factive verb is an ideal test case. Here I consider *know*. There is obviously far more to say about this verb than I will do here, and the goal is simply to ensure that the account makes the correct predictions for *know about*. The entry in (38), setting aside many issues, covers the *about* case (as well as *that*-clauses and interrogative clauses). Basically, the holder of the knowledge state believes an alternative in the content of the state if that alternative is true at the evaluation world. Moreover, it is presupposed that their doxastic alternatives fully contain the subject matter. When content is purely informative, the presupposition leads to factivity, and in the case of inquisitive content, it forces there to be some true alternative. When this verb is handed an *about*-PP, the holder must believe the true resolution of the subject matter. (The function *Alts* here converts from a partition semantics into a Hamblin-style set of alternative propositions, for convenience.)

(37) $\mathit{Alts}(a) = \{p_{\langle st\rangle} \mid \exists u \in \mathit{Dom}(a) : \forall v \in \mathit{Dom}(a) : \langle u, v\rangle \in a \leftrightarrow p(v) = 1\}$

(38) $[\![\textbf{know}]\!] =$
$\lambda s_v . \lambda w_s . \mathit{state}(s) \wedge \forall p \in \mathit{Alts}(\textsc{Con}(s)) : (p \supseteq \mathit{Dox}_w(\mathit{Holder}(s))) \leftrightarrow p(w)$
defined for w, s only if $\mathit{Dom}(\textsc{Con}(s)) \supseteq \mathit{Dox}_w(\mathit{Holder}(s))$

To conclude, I give two more brief case studies, of the verbs *think* and *talk*. *Think* is a prototypical group 3 verb (see §2.4), i.e., it does not take interrogative clauses, but does take *that*-clauses and *about*. Similarly, *talk* is a prototypical group 4 verb, and otherwise does not take embedded clauses.

The proposal for group 3 verbs is that some (though not all) of these verbs involve meanings that interact non-trivially with inquisitive subject matters, and that this is masked by selectional preferences; *think* is an example of this complicated situation. The proposal for this verb in particular is that *think*ing involves contemplating possibilities that are compatible with an agent's doxastic alternatives. *Thinking that* involves a purely informative subject matter, so the agent only considers one such alternative. However, *thinking about* can involve contemplating multiple alternatives.

(39) $[\![\textbf{think}]\!] = \lambda e_v . \lambda w_s . \mathit{Dom}(\textsc{Con}(e)) \supseteq \mathit{Dox}_w(\text{Agent}(e)) \wedge$
$\forall p_{\langle st\rangle} \in \mathit{Alts}(\textsc{Con}(e)) : \text{Agent}(e)$ contemplates p

(40) $[\![\textbf{think about whether to go to the party}]\!] =$
$\lambda e_v . \lambda w_s . \mathit{Dom}(\textsc{Con}(e)) \supseteq \mathit{Dox}_w(\text{Agent}(e))$
$\wedge \forall p_{\langle st\rangle} \in \mathit{Alts}(\textsc{Con}(e)) : \text{Agent}(e)$ contemplates p
$\wedge \textsc{Con}(e) = \{\langle w_1, w_2\rangle \mid \text{Agent}(e)$ goes in $w_1 = \text{Agent}(e)$ goes in $w_2\}$

This is illustrated in (40). Thinking about whether to go to the party involves an event whose content consists of two possible alternatives: the agent goes in one, doesn't in the other. These truth-conditions are satisfied if they contemplate each of these alternatives.

Finally, the account of group 4 verbs like *talk* is extremely straightforward. Such verbs describe a speech event, and a speech event will have content, so it is entirely unsurprising that *about* can combine with them. Some verbs like *meet* describe an event that can have content, and *about* forces this.

(41) $[\![\textbf{talk about Joanna}]\!] =$
$\lambda e_v \,.\, \lambda w_s \,.\, \text{talking}(e) \wedge \exists P \in D_{\langle e\langle st\rangle\rangle} \,.\, P$ is salient $\wedge$
$\textsc{Con}(e)$ is not orthogonal to $\{\langle w_1, w_2\rangle \,|\, P(J.)(w_1) = P(J.)(w_2)\}$

These case studies have illustrated the contribution of a general notion of content, to flexibly disassociating complex content restrictions from argument selection.

4 Conclusions

I have argued, based on the productivity and 'over-productivity' of *about*-PPs, that they are properties of potentially abstract entities or eventualities that have 'content.' They contribute some information about that content, namely that it is orthogonal (in the sense of Lewis 1988a to a matter contributed by the content of the PP. A book about Alfonso, therefore, is a book whose content, though being presumably quite complex, is not orthogonal to the resolution of some property with respect to Alfonso. The view of attitudes that this requires is distinctly non-classical. Following most directly Kratzer 2006; Moulton 2009, attitude predicates are neo-Davidsonian properties of eventualities that have content, and clausal complements as well as *about*-PPs are also properties of such eventualities.

This work opens up a range of questions and future projects. First, I have started to build a large, quantitatively analyzable sample of attitude predicates. However, more work is required to firm up this data set, including the use of multiple annotators. Despite its preliminary nature, however, this data set provided a wealth of information on *about*. Second, I have left open many issues about *about*. Two important questions are: (i) the behavior of modifiers of *about*-PPs (e.g. *partly about*, *all about*), and (ii) the relationship between *about*-PPs and so-called *res* arguments (Moulton 2009). I have argued that it is not sufficiently explanatory to simply equate them, but this is hardly the end of the story. A final issue is the class of verbs that don't take *about*. The prediction is that if a verb does not characterize content-denoting events, then *about* will not be licensed at all. This prediction seems correct for purely 'non-representational' verbs such as *want* (Bolinger 1968; Anand & Hacquard 2009, 2013), but I leave a full exploration to the future.

Appendix: more examples of the verb types

All verbs take *about*-PPs. The criteria for taking a DP is conservative, including anything (except cognate objects, which are too widely acceptable.) In particular, the type 2B verbs except for 'preach' are all good only with concealed question DPs.

(42) Type 1 verbs (take interrogative and DP).
advertise, advise, agree, anticipate, **ask,** babble, blog, boast, chatter, check, clarify, communicate, confess, crow, daydream, debate, decide, explain, extrapolate, figure out, **find out,** forecast, foresee, forget, gossip, guess, hear, howl, inform X, **know,** learn, mumble, murmur, mutter, overhear, point out, probe, project, protest, read, realize, reason, recollect, regulate, remember, remind, report, scream, scribble, share, shout, sign, signal, study, suspect, **tell X,** tweet, understand, whisper, write, yell

(43) Type 2 verbs: take interrogative but not DP.
advise X, agree, boast, care, consult X, educate X, enlighten X, inform X, **inquire**, **notify X**, question X, **wonder**, worry

(44) (Type 2b, converse case is marginal. Some possibilities: cry, gush, moan, preach.)

(45) Type 3 verbs: take neither argument type. (Communication predominates.)
apologize, **argue**, bitch, brag, brood, carp, caution (X), chime in, comment, complain, concur, conjecture, counsel X, fret, fume, gripe, grouse, grumble, hint, insist, **joke**, kid (X), marvel, mislead, obsess, panic, **persuade X**, petition, **pray**, pretend, quibble, quip, rant, rave, reassure X, reflect, remark, reminisce, reply, respond, scoff, speculate, stew, swear, tease (X), **think**, theorize

(46) Type 4 verbs: not otherwise used in (finite) indirect reports.
bicker, call (X), confuse X, contact X, differ X, discipline X, discourage X, encourage X, fuss, impress X, laugh, **lie**, listen, press X, speak, **talk**, deliberate, relax, **meet**, fight, hesitate, consult X, grill X

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