What's wrong with wonder that and believe whether?

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1 Introduction

- Some verbs take both declarative and interrogative complements, others take only declarative or only interrogative complements:

(1) a. Bill knows that Mary left.
    b. Bill knows whether Mary left / who left.

(2) a. *Bill wonders that Mary left.
    b. Bill wonders whether Mary left / who left.

(3) a. Bill believes that Mary left.
    b. *Bill believes whether Mary left / who left.

- Terminology (cf., Lahiri, 2002):
  - **Responsive verbs**: license both kinds of complements (e.g., know)
  - **Rogative verbs**: only license interrogative complements (e.g., wonder)
  - **Anti-rogative verbs**: only license declarative complements (e.g., believe)

- Questions to address:
  1. Why can (anti-)rogative verbs take only one kind of complement?
  2. Why can responsive verbs take both kinds of complement?

*This is an updated version of the handout that I presented, incorporating some of the thoughtful comments I received during and after the talk, in particular from Doris Penka, Regine Eckhardt, Gisela Grohne, and Yvonne Viesel. The ideas presented here are based on joint work with Nadine Theiler, Maria Aloni, and Ivano Ciardelli (Theiler, Roelofsen, and Aloni, 2016; Ciardelli and Roelofsen, 2015). Discussions with Jeroen Groenendijk and Wataru Uegaki have also been very valuable. Financial support from the Netherlands Organization for Scientific Research (NWO) and the European Research Council (ERC, grant agreement No 680220) is gratefully acknowledged.

- Two possible assumptions about complements:
  1. **Type distinction**
     Declarative and interrogative complements have **different semantic types**:
     - The selectional restrictions of (anti-)rogative verbs then seem unsurprising.
     - However, the flexibility of responsive verbs is puzzling.
  2. **Uniformity**
     Declarative and interrogative complements have the **same semantic type**:
     - In this case the selectional restrictions of (anti-)rogative verbs are puzzling.
     - But the flexibility of responsive verbs is unsurprising.

- Most previous work assumes a **type distinction**:

  Karttunen (1977); Heim (1994); Dayal (1996); Beck and Rullmann (1999); Lahiri (2002); George (2011); Spector and Egré (2015); Uegaki (2015), among others

- As far as I know, only Groenendijk and Stokhof (1984) favor **uniformity**.

- Plan for today:

  §2 Take a closer look at the prospects of accounting for the selectional restrictions of (anti-)rogative verbs in terms of a **type distinction**; point out some **challenges** for such an approach.

  §3 Lay out a **uniform** treatment of declarative and interrogative complements in **inquisitive semantics** (Ciardelli, Groenendijk, and Roelofsen, 2015).

  §4 Propose an account of the **selectional restrictions** of a range of (anti-)rogative verbs in this setting.

2 Prospects and challenges for a type-based account

- The **standard assumption** is that:
  - Declarative complements denote **propositions**: they are of **type** $\langle s,t\rangle$
  - Interrogative complements denote **sets of propositions**: they are of **type** $\langle\langle s,t\rangle,t\rangle$

- Under this assumption, it seems at first sight that we could easily account for the selectional restrictions of (anti-)rogative verbs by stipulating that:
  - **rogative** verbs like wonder only take complements of type $\langle\langle s,t\rangle,t\rangle$
  - **anti-rogative** verbs like believe only take complements of type $\langle s,t\rangle$

- However, as pointed out by Groenendijk and Stokhof (1984, p.93-94) in arguing for a uniform treatment of complements, different kinds of complements can be **conjoined**:

(4) a. John knows that Mary arrived and whether she brought the wine.
    b. John knows that Mary arrived and what she brought.

- To handle such conjunctions under the standard assumption, we need to assume a **type-shifting operation** that can shift the semantic type of one of the complements to that of the other.

- Indeed, such a type-shifting operation is explicitly assumed by Heim (1994), Dayal (1996), Beck and Rullmann (1999), and Uegaki (2015), among many others.

- However, as soon as we admit such an operation, we either **lose** the account of the selectional restrictions of rogative verbs, or that of anti-rogative verbs. After all:

  – If the operator adapts the type of interrogative complements to that of declarative complements (as in, e.g., Heim, 1994), then there is no reason anymore why anti-rogative verbs like believe would not accept interrogative complements.

  – Vice versa, if the assumed type-shifting operator adapts the type of declarative complements to that of interrogative complements (as in, e.g., Uegaki, 2015), then there is no reason anymore why rogative verbs like wonder would not accept declarative complements.[1]

- Moreover, as long as the assumed type distinction is not independently motivated, the account is merely a **reformulation** of the observed pattern in terms of semantic types; without independent justification, it has **no explanatory value**.

- So, a type-based account of the selectional restrictions of (anti-)rogative verbs needs to address the following **two challenges**:

  – It cannot directly capture the selectional restrictions of both verb classes at once; either rogative or anti-rogative verbs need to be dealt with separately.

  – To gain explanatory value, the assumed type distinction needs to be independently motivated.

[1] A possible objection to this argument is that sentences like those in (4) might not involve direct conjunction of the two complements at all. Rather, they might be elided versions of the following sentences, where each complement is embedded under a separate instance of the verb:

(i) a. John knows that Mary arrived and he knows whether she brought the wine.
    b. John knows that Mary arrived and he knows what she brought.

However, Roelofsen and Uegaki (2015) note that this objection does not apply to cases such as (ii).

(ii) What surprises John is which book Bill's sister is reading and that she is just nine.

Here, surprise can have a non-distributive interpretation: the sentence can be judged true in a situation in which John is not surprised by which book Bill's sister is reading per se, nor by the fact that she is just nine, but only by the *combination* of the fact that she is just nine and the fact that she is reading, say, *War and Peace*.

- The most sophisticated attempt to address these challenges is due to Uegaki (2015):
  - He accounts for the selectional restrictions of anti-rogative verbs like believe in terms of the assumed type distinction, and proposes a separate account of the selectional restrictions of rogative verbs like wonder.
  - He also constructs an explicit argument for the assumed type distinction, based on differences in the interpretation of responsive verbs like know and anti-rogative verbs like believe when taking **content nouns** (e.g., *the rumor that Mary left*) as their argument, rather than complement clauses.
- However, Theiler, Roelofsen, and Aloni (2016) discuss this proposal in detail and conclude that several issues remain to be addressed.
- It may of course be possible to do so in a satisfactory way, but it seems especially difficult to construe watertight independent justification for the assumed type distinction.
- An advantage of the **uniform** approach is that such justification is not needed.
- Let us try, then, to see how far such an approach could get.

3 A uniform treatment of complements

Sentence meanings in inquisitive semantics

- In $\mathsf{Inq_B}$, the meaning of a sentence φ, denoted $[\![\varphi]\!]$, is a **set of propositions** encoding both the **information** that is provided and the **issue** that is raised in uttering φ.
- Namely, in uttering φ a speaker is taken:
  - to provide the **information** that the actual world is contained in $\bigcup[\![\varphi]\!]$, and
  - to raise an **issue** whose resolution requires establishing a proposition in $[\![\varphi]\!]$.
- $\bigcup[\![\varphi]\!]$ is called the **informative content** of φ, and is denoted as $\textsc{info}(\varphi)$.
- The propositions in $[\![\varphi]\!]$ are called the **resolutions** of the issue expressed by φ.
- It is assumed that if a proposition p resolves an issue then any stronger proposition $q \subseteq p$ resolves that issue as well.
- Thus, a sentence meaning $[\![\varphi]\!]$ is always **downward closed**: if it contains a proposition p, then it also contains any $q \subseteq p$.

Informative and inquisitive sentences

- In some cases the informative content of φ is **trivial**, namely if $\textsc{info}(\varphi) = W$.
- φ is called **informative** just in case $\textsc{info}(\varphi) \neq W$.
- Similarly, the issue expressed by φ may also be **trivial**, namely if $\textsc{info}(\varphi) \in [\![\varphi]\!]$.
- In this case, the issue is already resolved by the information provided by φ itself.
- φ is called **inquisitive** just in case $\textsc{info}(\varphi) \notin [\![\varphi]\!]$.

Alternatives

- The **alternatives** associated with a sentence φ in $\mathsf{Inq_B}$ are those propositions that contain precisely enough information to resolve the issue expressed by φ.
- Technically, these are the **maximal elements** of $[\![\varphi]\!]$:

$$\textsc{alt}(\varphi) := \{p \in [\![\varphi]\!] \mid \text{there is no } q \in [\![\varphi]\!] \text{ such that } p \subseteq q\}$$

- If φ is **non-inquisitive**, it always generates a **unique alternative**, namely $\textsc{info}(\varphi)$.
- Vice versa, if φ generates **multiple alternatives**, then it must be **inquisitive**.

Declarative complements

- We assume that declarative complements and declarative matrix clauses are:
  - always **non-inquisitive**, and
  - usually **informative** (except when tautological)
- This means that a declarative complement φ always generates a **unique alternative**, namely $\textsc{info}(\varphi)$.
- For declaratives, $\textsc{info}(\varphi)$ is always the proposition that φ is standardly taken to express.
- For instance:

(5) $\textsc{alt}(\text{ that John left }) = \{\{w \mid \text{ John left in } w\}\}$

Interrogative complements

- We assume that interrogative complements and interrogative matrix clauses are:
  - always **non-informative**, and
  - usually **inquisitive** (except when tautological)
- This means that interrogative complements usually generate **multiple alternatives**, and that these alternatives always **completely cover** the set of all possible worlds.[2]
- For instance, if the domain of discourse consists of John, Mary, and Ann, we assume that:

(6) $$\textsc{alt}(\text{ whether John left }) = \left\{ \begin{array}{l} \{w \mid \text{ John left in } w\}, \\ \{w \mid \text{ John didn't leave in } w\} \end{array} \right\}$$

(7) $$\textsc{alt}(\text{ who left }) = \left\{ \begin{array}{l} \{w \mid \text{ John left in } w\}, \\ \{w \mid \text{ Mary left in } w\}, \\ \{w \mid \text{ Ann left in } w\}, \\ \{w \mid \text{ nobody left in } w\} \end{array} \right\}$$

- Side note:
  - The alternatives that we assume here for who left will only allow us to derive **non-exhaustive** (mention-some) readings;
  - The account can be refined so as to derive (strongly, intermediate, and weakly) **exhaustive** readings as well (see Theiler *et al.*, 2016).
  - This refinement does not affect:
    - the uniformity of the treatment of declarative and interrogative complements;
    - the account of the selectional restrictions of (anti-)rogative verbs given below.

4 Embedding verbs

4.1 Responsive verbs

- Before turning to rogative verbs like wonder and anti-rogative verbs like believe, we first give a baseline account of two closely related **responsive** verbs:
  - be certain (non-factive)
  - know (factive)
- Let σ_x^w denote the information state of x in w, i.e., the set of worlds compatible with the information that x has in w.

[2] For simplicity we leave the presuppositions that declarative and interrogative complements may have out of consideration here; the proposed account can be extended in a straightforward way to deal with such presuppositions.

- As is common in doxastic logic, we assume that:
  - σ_x^w is always **consistent** (non-empty),
  - subjects are always **introspective** ($\sigma_x^w = \sigma_x^v$ for all $v \in \sigma_x^w$),
  - but they may have **false information** (it may be that $w \notin \sigma_x^w$).
- For any sentence meaning P and any world w, we define:
  - $P^w := \{p \mid \exists q \in \textsc{alt}(P) : p \subseteq q \ \& \ w \in p\}$

  In words: the set of propositions that entail some alternative in P which is true in w.
- We call these propositions **truthful resolutions** of P in w.
- We assume the following entries for be certain and know:[3]
  (type $\langle\langle s, t\rangle, t\rangle$ is abbreviated as T; presuppositions are underlined)

(8) $[\![\text{be certain}]\!]^w = \lambda P_T.\lambda x.\, \sigma_x^w \in P$

(9) $[\![\text{know}]\!]^w = \lambda P_T.\lambda x : \underline{P^w \neq \emptyset}.\, \sigma_x^w \in P^w$

- Note that these entries apply uniformly to declarative and interrogative complements; both kinds of complement are of type T.
- There are **two differences** between know and be certain:
  - **Assertive**
    - be certain: σ_x^w coincides with a **resolution** of the complement;
    - know: σ_x^w coincides with a **truthful resolution** of the complement.
  - **Presuppositional**
    - know: the complement has **at least one truthful resolution**;
    - be certain: no such presupposition.
- When the complement of know is interrogative, its presupposition is trivially satisfied, because in this case $\bigcup P = W$ and therefore P^w is always non-empty.
- Some examples for know:

(10) Mary knows that John left.

$\rightsquigarrow$ **Defined** in w iff John left in w
$\rightsquigarrow$ **True** in w iff $\sigma_m^w \subseteq \{w \mid \text{John left in } w\}$

[3] For simplicity, we give truth-conditionals entries—these can easily be transformed into support-conditional entries which would be needed for a full-fledged compositional inquisitive semantics, see e.g. (Ciardelli *et al.*, 2016).

(11) Mary knows whether John left.

$\rightsquigarrow$ **Defined** in w iff $w \in W$ (always)

$$\rightsquigarrow \textbf{True} \text{ in } w \text{ iff } \exists p \in \left\{ \begin{array}{l|l} \{w & \text{John left in } w\}, \\ \{w & \text{John didn't leave in } w\} \end{array} \right\} \text{ s.t. } w \in p \text{ and } \sigma_x^w \subseteq p$$

(12) Mary knows who left.

$\rightsquigarrow$ **Defined** in w iff $w \in W$ (always)

$$\rightsquigarrow \textbf{True} \text{ in } w \text{ iff } \exists p \in \left\{ \begin{array}{l|l} \{w & \text{John left in } w\}, \\ \{w & \text{Mary left in } w\}, \\ \{w & \text{Ann left in } w\}, \\ \{w & \text{nobody left in } w\} \end{array} \right\} \text{ s.t. } w \in p \text{ and } \sigma_x^w \subseteq p$$

- Some examples for be certain:

(13) Mary is certain that John left.

$\rightsquigarrow$ **True** in w iff $\sigma_m^w \subseteq \{w \mid \text{John left in } w\}$

(14) Mary is certain whether John left.

$$\rightsquigarrow \textbf{True} \text{ in } w \text{ iff } \exists p \in \left\{ \begin{array}{l|l} \{w & \text{John left in } w\}, \\ \{w & \text{John didn't leave in } w\} \end{array} \right\} \text{ s.t. } \sigma_x^w \subseteq p$$

(15) Mary is certain who left.

$$\rightsquigarrow \textbf{True} \text{ in } w \text{ iff } \exists p \in \left\{ \begin{array}{l|l} \{w & \text{John left in } w\}, \\ \{w & \text{Mary left in } w\}, \\ \{w & \text{Ann left in } w\}, \\ \{w & \text{nobody left in } w\} \end{array} \right\} \text{ s.t. } \sigma_x^w \subseteq p$$

- So much for our baseline account of responsive verbs.
- Note that, in comparison to approaches that assume a type distinction between declarative and interrogative complements, the present approach yields a **more economical** treatment of responsive verbs: we don't need **multiple lexical entries** for such verbs, or **type shifting operators** to convert one kind of complement to the other.[4]
- We now turn to anti-rogative verbs (§4.2) and rogative verbs (§4.3).

[4]Besides a gain in parsimony, this has other advantages as well: some thorny problems for mainstream reductive theories, discussed in George (2011) and Elliott *et al.* (2016), do not arise on the present approach, exactly because the interrogative-embedding use of responsive verbs is not reduced here to their declarative-embedding use (see Theiler *et al.*, 2016, for detailed discussion). It should be noted, though, that these problems do not arise either on the approach of Uegaki (2015), which assumes reduction in the other direction.

4.2 Anti-rogative verbs

- Within the class of anti-rogative verbs, it is possible to distinguish at least four subclasses:
  1. Attitude verbs: e.g., believe, think, feel, expect, want, desire.
  2. Likelihood verbs: e.g., seem, be likely.
  3. Speech act verbs: e.g., claim, suggest.
  4. Truth-assessing verbs: e.g., be true, and be false.
- Why would such verbs not license interrogative complements?
- Do they perhaps have another property in common from which this may be derived?
- As observed by Zuber (1982) there is indeed a property that many of these verbs (though not all of them) have in common.
- Namely, verbs like believe, think, feel, expect, want, seem, and be likely are all **neg-raising** verbs:

(16) John doesn't believe that Mary left.
$\therefore$ John believes that Mary did not leave.

(17) John doesn't think that Mary left.
$\therefore$ John thinks that Mary did not leave.

(18) John doesn't expect that Mary will leave.
$\therefore$ John expects that Mary will not leave.

(19) It doesn't seem that Mary will leave.
$\therefore$ It seems that Mary will not leave.

(20) It isn't likely that Mary will leave.
$\therefore$ It's likely that Mary will not leave.

- Zuber (1982) claims that all neg-raising verbs are anti-rogative.
- We will show that anti-rogativity indeed follows straightforwardly from a standard account of neg-raising, when this account is recast in our present framework.[5]
- We will first focus on believe, and then indicate how the account can be extended to other neg-raising verbs.
- We start with a preliminary entry for believe, which is identical to the one for be certain. This entry will be refined immediately below.

[5] For an account of the anti-rogativity of be true and be false, see Theiler *et al.* (2016).

(21) $[\![\textsf{believe}]\!]^w = \lambda P_T.\lambda x.\, \sigma_x^w \in P$ (preliminary entry)

- Now let us consider how this preliminary entry should be refined in order to account for neg-raising effects.

- One prominent proposal in the literature is that neg-raising verbs come with a so-called **excluded middle presupposition** (Bartsch, 1973; Gajewski, 2007).[6]

- That is, John believes that Mary left presupposes that:

  John believes that Mary left or he believes that she didn't leave

- Since presuppositions survive under negation, John doesn't believe that Mary left has the same presupposition.

- In the case of John believes that Mary left, the asserted content is stronger than the presupposed content, so the presupposed content easily goes unnoticed.

- But in the case of John doesn't believe that Mary left, the asserted content and the presupposed content are logically independent, and together they imply that John believes that Mary didn't leave. This accounts for the neg-raising effect.

- Incorporating an excluded middle presupposition in our setting yields the following refined entry for believe:

(22) $[\![\textsf{believe}]\!]^w = \lambda P_T.\lambda x : \underline{\sigma_x^w \in P \vee \sigma_x^w \in \neg P}.\ \sigma_x^w \in P$

- Here, $\neg$ is the standard **inquisitive negation** operator, which when applied to a sentence meaning P returns the set of those propositions that are inconsistent with every member of P:[7]

(23) $\neg P \quad := \quad \{p \mid \forall q \in P : p \cap q = \emptyset\}$

- The refined entry for believe only differs from our preliminary entry in that it involves a definedness restriction capturing the excluded middle presupposition.

- Namely, it says that $[\![\textsf{believe}]\!]^w(P)(x)$ is only defined if:
  - σ_x^w resolves P, or
  - σ_x^w is inconsistent with all resolutions of P.

- If P is the meaning of a **declarative** complement, it contains only **one alternative** p.

[6] See also **??** for a proposal that is very similar in spirit.

[7] There is both empirical and conceptual independent support for the inquisitive negation operator. Conceptually, the operator is determined by exactly the same algebraic properties as the standard truth-conditional negation operator (Roelofsen, 2013). Empirical support comes, for instance, from the behavior of negation in sluicing constructions (AnderBois, 2014).

- Then, the first disjunct in the presupposition amounts to x being certain that p is true, while the second disjunct amounts to x being certain that p is false.
- This is the inquisitive rendering of the excluded middle presupposition, which accounts for the fact that believe exhibits **neg-raising** effects when taking a declarative complement.

- Without any further stipulations, the entry also accounts for the fact that believe is **anti-rogative**:
  - Suppose that P is the meaning of an **interrogative** complement.
  - Then $\neg P = \emptyset$, because the propositions in P completely cover W.
  - This means we can be sure that $\sigma_x^w \notin \neg P$.

    Intuitively: it is impossible to believe the negation of an interrogative complement.
  - So the second disjunct in the definedness restriction of believe can never hold.
  - Thus, if believe takes an interrogative complement, its semantics reduces to the following:

    (24) $[\![\textsf{believe}]\!]^w = \lambda P_T.\lambda x : \underline{\sigma_x^w \in P}.\ \sigma_x^w \in P$
  - But this means that whenever $[\![\textsf{believe}]\!]^w(P)(x)$ is defined, it is true.
  - In other words, when the verb takes an interrogative complement, its **assertive component is trivial**, given its presupposition.
  - We take it that this systematic triviality explains why combining believe with interrogative complements results in ungrammaticality.[8]

- An analogous explanation can be given for other neg-raising anti-rogative verbs.
  - think and feel are essentially synonymous with believe (when embedding a clause).
  - Other predicates can be given a semantics that is structurally very similar to that of believe. For example, instead of demanding that the subject's information state is in P, we might require that:
    * the set of worlds compatible with the subject's expectations is in P (expect),
    * the set of worlds compatible with the subject's desires is in P (want), or
    * the set of worlds compatible with the contextual information is in P (seem).
  - The key to deriving the anti-rogativity of all these verbs is their **excluded-middle** presupposition, which, just as for believe, systematically trivializes their assertive component when taking an interrogative complement.

- So, at least for a large range of anti-rogative verbs, their selectional restrictions can be explained based on independently motivated features of their lexical semantics.

[8]See Gajewski (2002) and Chierchia (2013) for a general discussion of explaining ungrammaticality in terms of systematic contradictoriness or triviality.

- Assuming a **type distinction** between declarative and interrogative complements is **not necessary** to account for the selectional restrictions of these verbs.

- In fact, for our account it is crucial that declarative and interrogative constructions are treated **uniformly**.

  – This makes it possible to uniformly define logical operations like **negation**;

  – And thus, crucially, to generalize the usual formulation of the **excluded-middle** presupposition of neg-raising verbs.

4.3 Rogative verbs

- Within the class of rogative verbs, it is possible to distinguish at least three subclasses (cf., Karttunen, 1977):

  1. Attitude verbs: e.g., wonder, be curious, investigate
  2. Speech act verbs: e.g., ask, inquire
  3. Verbs of dependency: e.g., depend on, be determined by

- We focus here on attitude verbs, in particular wonder (Ciardelli and Roelofsen, 2015).

- For rogative speech act verbs and verbs of dependency, see Theiler *et al.* (2016).

- In order to formally capture what it means for an individual to wonder about something, it is not enough to have a model of her **information state**, i.e., the things she currently takes herself to know.

- We also need a representation of the **issues** she is entertaining, i.e., the things that she **would like to know**.

- We will model this as the individual's **inquisitive state**.

- The inquisitive state of an individual x in a world w, which we will write as Σ_x^w, is a downward closed set of consistent information states which together cover σ_x^w.

- That is:

$$\bigcup \Sigma_x^w = \sigma_x^w$$

- The information states in Σ_x^w are exactly those information states where the issues that x is entertaining would be resolved.

- Informally, x **wonders** about a question, e.g., about who called, just in case:

  1. x isn't certain yet who called, but
  2. x wants to find out who did.

- In somewhat more formal terms:

1. x's current information state does not resolve the question;
2. every information state in x's inquisitive state is one that does resolve the question.

- Thus we define:

(25) $[\![\textsf{wonder}]\!]^w := \lambda P_T.\lambda x.\quad \underbrace{\sigma_x^w \notin P}_{x\text{ isn't certain yet...}} \quad\wedge\quad \underbrace{\forall \sigma \in \Sigma_x^w : \sigma \in P}_{\text{but wants to find out}}$

- This entry yields desirable results when the verb takes an interrogative complement.[9]
- Now let us consider what happens when it takes a **declarative complement**:

(26) *John wonders that Mary called.

- In this case, the two conjuncts in the entry for the verb always become **contradictory**.
  - If P is the meaning of a declarative complement it always contains a **single alternative** p.
  - Since complement meanings are downward closed, this means that P amounts to the powerset of p, $\wp(p)$.
  - Now suppose that the first conjunct in the entry for wonder holds: $\sigma_x^w \notin P$.
  - Then it must be that $\sigma_x^w \not\subseteq p$.
  - But then, since $\bigcup \Sigma_x^w = \sigma_x^w$, it must also be that $\bigcup \Sigma_x^w \not\subseteq p$.
  - It follows that there is at least one $\sigma \in \Sigma_x^w$ such that $\sigma \not\subseteq p$.
  - But if $\sigma \not\subseteq p$, then since p is the unique alternative in P, we have that $\sigma \notin P$.
  - So the second conjunct in the entry for wonder must be false.
- Hence, whenever wonder takes a declarative complement, we get a contradiction, no matter what the specific content of the complement is.
- This systematic contradictoriness explains why wonder does not license declarative complements.[10]
- A similar explanation can be given for other rogative attitude verbs.
  - For instance, the lexical semantics of investigate may be taken to have the same two components as that of wonder:

[9] Although see Roelofsen and Uegaki (2016) for a refinement of the entry which captures the ignorance implication of the verb in a more precise way. This refinement does not affect the prediction, discussed right below, that wonder is incompatible with declarative complements.

[10] Again, see Gajewski (2002) and Chierchia (2013) for a general discussion of explaining ungrammaticality in terms of systematic contradictoriness or triviality.

  * one conveying that the subject's information state does not resolve the issue expressed by the complement yet,
  * and the other conveying that the subject would like to get to a state which does resolve this issue.
- In the case of investigate, unlike in the case of wonder, the verb also conveys that the subject is taking specific actions to reach such a more informed state.
- But in both cases alike the two components will yield a contradiction when applied to a declarative complement.

5 Conclusion

- We set out to address the following two questions:
  1. Why can rogative and anti-rogative verbs only take one kind of complement?
  2. Why can responsive verbs take both kinds of complement?
- Declarative and interrogative complements are usually taken to differ in semantic type.
- This type distinction can be taken to form the basis for an account of the selectional restrictions of (anti-)rogative verbs, but we have seen that:
  - Such an account can only deal with one of the two verb classes, not with both;
  - If the type distinction is not motivated independently, it has no explanatory value;
  - To explain the fact that responsive verbs license both kinds of complement one needs to assume lexical ambiguity or special type shifting / LF operations.
- Departing from this standard picture, we have laid out a **uniform** treatment of declarative and interrogative complements. On such an approach:
  - The fact that response verbs license both kinds of complement is accounted for immediately, without any special stipulations.
  - The selectional restrictions of (anti-)rogative verbs, or at least a large range of them, can be derived in a straightforward way from independently motivated features of the lexical semantics of these verbs.

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