# On the Semantic Properties of Interrogative Infinitives in English

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## I   Introduction

This paper aims to give a detailed and precise characterization of the semantic properties of interrogative infinitives in English and to put forward a unified analysis of the restrictions on the use of the target construction. Interrogative infinitives can be defined as the infinitival clause preceded by interrogative or conjunction words (i.e. *what, how, where, when, why* and *whether + to-*infinitives), which functions as a noun phrase (e.g. The sales staff show these new releases to retailers who decide *whether to place an order* (BNC: A6A 993)). This type of infinitival clause, one that has a function as a noun phrase, can be a grammatical object of predicate verbs. Some predicate verbs, however, do not take interrogative infinitives as their objects, while they can take interrogative finite clauses (e.g. *I doubt whether to accept/ I doubt whether I should accept). Several linguists have pointed out this linguistic fact (e.g. Huddleston and Pulum 2002; Bhatt 2006), but none of them elucidates the semantic mechanism by which interrogative infinitives cannot be governed by some predicate verbs. Therefore, the chief focus of this study is on clarifying the semantic properties of the interrogative infinitive and shed light on the semantic mechanism in which the target construction follows predicate verbs.

The organization of this study is as follows. In section 2, I provide a scrutinization of previous analyses of the semantic property of interrogative infinitives and restrictions on the use of this type of infinitival clause. Bhatt (2006) and Duffley and Enns (1996), for example, offer detailed analyses of the target infinitival clause, but their data sets are too small to endorse the validity of their research. Section 3 conducts a corpus-based approach to survey the target construction and places great emphasis on the fact that interrogative infinitives always presuppose the realization of the situation denoted by the infinitive and thus the preceding predicate verb necessarily has an implication of triggering the situation's realization. Section 4 concludes this paper with a brief summary.

## Ⅱ   Previous Analyses

Linguists have been examining the syntactic and semantic restrictions on the use of interrogative infinitives (e.g. Bhatt 2006; Duffley and Enns 1996; Huddleston and Pullum 2002), but in my view their data sets seem too small to bear out their empirical adequacies. Before embarking on the scrutinization of interrogative infinitives on the basis of corpus data, I will examine the validity of previous analyses of the target construction and point out their inadequacies.

Huddleston and Pullum (2002: 985) argue that most expressions which govern interrogatives allow both finite and infinitival constructions. Infinitivals are most often found with governors in the field of knowing, telling, deciding, and concerning. They give some examples where only the finite construction is permitted, as in:

（1） a.  I doubt whether I should accept/ *whether to accept.

 b.  It was amazing what they offered/ *what to offer.

 c.  It depends on how much I must pay/ *how much to pay.

 d.  I don't care whether I go or not/ *whether to go or not. (Huddleston and Pullum 2002: 985)

 e.  It doesn't matter what you say/ *what to say. (Huddleston and Pullum 2002: 1264)

Examples listed in (1a) – (1e) provide us an important clue to the semantic characterization of interrogative infinitives. Huddleston and Pullum, however, while presenting interesting examples, give us no account of the mechanism by which interrogative infinitives cannot be used in these examples.

Bhatt (2006) proposes more comprehensive analyses of the restrictions on the use of interrogative infinitives and puts forward several useful hypotheses. Bhatt coherently focuses on the modality denoted by interrogative infinitives and contends that the modality of the construction is interpreted as "deontic/ bouletic modality except in a limited set of environments where it can be circumstantial [modality]" (Bhatt 2006: 101).[1] He denies the possibility of epistemic modality denoted by the construction. This hypothesis could be promising, but Bhatt does not go on to explain the impossibility of interpretation of epistemic modality. It will not be difficult to give an account of the impossibility of epistemic reading on interrogative infinitives, however. Epistemic modality is concerned with making a judgement about the truth/falsehood of the proposition. Thus epistemic

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[1]   With respect to more detailed analyses of the modality denoted by infinitive constructions, see Akiyama (2008); Goldberg and van der Auwera (2012); Hackle and Nissenbaum (2003).

modality is "the modality of propositions, in the strict sense of the term, rather than of actions, states, events, etc." (Palmer 1990[2]: 50). This definition fully explicates the semantic incompatibility between epistemic modality and interrogative infinitives. Epistemic modality is always concerned with the truth/ falsehood of the proposition, which necessarily needs the grammatical tense (i.e. present/ past) (cf. Sawada 2006: 38). Without the grammatical tense, no situations could be examined regarding whether they are true or false. Interrogative infinitives are, however, non-finite clauses and thus necessarily do not have the grammatical tense (e.g. present/ past). In other words, the target construction cannot be treated as being a proposition and thus cannot denote epistemic modality. The following pair of examples will illustrate this explanation.

（2）a. She wondered **whether to say that she had missed him**. (BNC: A0R 1064)

    a'. She wondered **whether she should say that she had missed him.**

    b. I'm not sure that I know **how to explain it to you.** (BNC: A0F 2529)

    b'. I'm not sure that I know **how I can explain to you.**

The sentences (2a) and (2b) are paraphrased by the sentences (2a') and (2b'), respectively, in which the modal auxiliaries *should* and *can* have no meaning of epistemic modality. Rather, they denote "event modality", which is concerned with "events that have not taken place but are merely potential" (Palmer 2001[2]: 70). The event modality falls into two kinds, i.e. deontic modality (modality of obligation), which is typically illustrated by *should*, and dynamic modality (modality of future potential event), illustrated by *can*. In other words, interrogative infinitives in (2a) and (2b) never express epistemic modality. The auxiliaries *should* in (2a') and *can* in (2b') clearly express the deontic modality and the dynamic modality, respectively, which can also be applicable to the *whether to say* in (2a) and *how to explain* in (2b).

On the basis of Karttunen's (1977) analysis of predicates that take finite interrogative complements, Bhatt (2006: 103) puts forward eleven types of predicate verbs which are followed by finite interrogative complements. The eleven types of predicates are: (a) verbs of retaining knowledge (e.g. *know, be aware, recall, remember, forget*), (b) verbs of acquiring knowledge (e.g. *learn, notice, find out, discover*), (c) decision verbs (e.g. *decide, decide on, determine, specify, agree on, control*), (d) verbs of conjecture (e.g. *guess, predict, bet on, estimate*), (e) opinion verbs (e.g. *agree about, be certain (about), have an idea (about), be convinced (about)*), (f) verbs of relevance (e.g. *matter, be relevant, be important, care, be significant*), (g) verbs of dependency (e.g. *depend on, be related to, have an influence on, be a function of, make a difference to*), (h) verbs of one-way communication (e.g. *tell, show, indicate, inform, disclose*), (i) verbs of two-way communication (e.g.

*discuss, squabble over, talk about*), (j) verbs of cogitation (e.g. *address* (*the issue of*), *consider, debate, deliberate, fret about, study*), (k) inquisitive verbs (e.g. *ask, wonder, investigate, be interested in*). Out of these eleven types of predicates, according to Bhatt, three types do not take interrogative infinitives as their complement. Those three types are (d) verbs of conjecture (e.g. *guess, predicate, etc.*), (f) verbs of relevance (e.g. *be relevant, be important,* etc.), and (g) verbs of dependency (*depend on, have an influence on*). Bhatt (2006: 112) mentions that " [t]he meanings denoted by all finite modal questions cannot be rendered by infinitival questions. Consequently, it is possible for a predicate to take a finite question and not take an infinitival question but not vice-versa." However, he does not follow through and tackle an analysis of the mechanism by which the distinction of predicate verbs followed by interrogative finite clauses and interrogative infinitives is made. I will conduct a scrutinization of this problem in the next section.

In addition, Bhatt (2006: 105) indicates that emotive predicates like *be surprising*, *be amazing*, etc., also do not take interrogative infinitive complements, as in:

（3） a. *It is amazing what to do. (vs. It is amazing who Bill knows.)

　　 b. *It is surprising what to do. (vs. It is surprising how much Bill has accomplished.)[2]

Bhatt introduces a simple answer for the reason why these emotive predicates do not take interrogative infinitive complements, following Elliot (1971) and Grimshaw (1977). These two linguists argue that "the complements of these verbs form a distinct class which they call 'exclamatives'. From their perspective, the fact that emotive predicates do not take infinitival question complements follows from the fact that infinitive *wh*-clauses do not form good 'exclamatives'" (Bhatt 2006: 105). This explanation sounds rather too vague to account for how the interrogative infinitive proves to be unsuitable for 'exclamatives'. I will return to this problem in the next section.

Bhatt (2006: 106) contends that interrogative infinitives do not take pied-piping construction, as in[3]:

（4） a. Jan knows [which knife to cut the bread with].

　　 b. ?Jan knows [with which knife to cut the bread].

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[2]　Note that Huddleston and Pullum (2002) also indicate this linguistic fact as we have seen in (1b) above.

[3]　'Pied-piping' is a process by which a moved constituent (or set of features) drags one or more other constituents (or set of features) along with it when it moves (see Radford 1997: 276-282, 521).

A close look at the corpus data suggests that Bhatt's claim is false. The BNC contains 64 examples of the syntactic sequence（i.e. colligation）of "preposition + *which* + noun + *to*-infinitive", all of which are analyzed as examples of interrogative infinitives, as in:[4]

（5）a. But occasionally, the uncertainty remains **about which person to choose.**

　　b. We're unsure **in which direction to go next.**

　　c. Nor has the Department decided whether it is going to contribute towards the considerable capital cost of new computers, causing doctors to put off to the last minute a decision **on which system to choose.**

The examples of（5a-c）clearly illustrate that interrogative infinitives can take pied-piping construction.（5a）takes the interrogative infinitive（i.e. *about which person to choose*）as a complement of the predicate verb（i.e. *remains*）.（5b）and（5c）elucidate that pied-piped interrogative infinitives can appear as a complement of adjectives（i.e. *unsure*）and of nouns（i.e. *decision*）, respectively. The syntactic feature that pied-piped interrogative infinitives can be used as a complement of predicate verbs, adjectives and nouns is consistent with that of the other types of interrogative infinitives（e.g. *I have no idea of what to look for*）.

　For a final remark on Bhatt's analyses, I will direct attention to the syntactic possibility of "the interrogative pronoun *why* + interrogative infinitives". Bhatt（2006: 107）points out that the interrogative pronoun *why* cannot take interrogative infinitives, as in:

（6）a. *Michael wonders why to do that.

　　　（vs. Michael wonders why he should do that.）

　　b. *I don't know why to make such a fuss.

　　　（vs. I don't know why I should make such a fuss.）

Bhatt abandons analyzing the semantic restriction on the use of the interrogative pronoun *why* with interrogative infinitives.

　Duffley and Enns（1996）give a fine-grained analysis of the restrictions on the use of "*why* + *to*-infinitives". As a clue to the explication of the impossibility of "*why* + *to*-infinitives", they make a comparison between *to*-infinitives and bare-infinitives, as in:

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4)　In this paper, the linguistic term "colligation" refers to a syntactic association pattern involving at least one grammatical category, where this grammatical category co-occurs frequently with some lexical item(s).

（7） a. I helped them to carry the load by having my secretary get them a cart.

　　 b. *I helped them carry the load by having my secretary get them a cart.

（Duffley and Enns 1996: 223）

They argue that "the use of *to* has the effect of evoking the realization of the infinitive's event as being a consequence or result of the action of helping" (Duffley and Enns 1996: 223). This is because of "the meaning of the preposition *to*, which evokes the infinitive's event as the end-point of a movement" (Duffley and Enns 1996: 224). In other words, the situation denoted by the *to*-infinitive is basically understood to be realized in the future as the end-point of a movement in time. On the other hand, the bare infinitive construction, illustrated in (7b), "represents an event as an object of cooperation between the helper and the helpee, with the two agents conceived as being active at the same time" (Duffley and Enns 1996: 223).

　While many linguists do not accept the colligation pattern "*why* + *to*-infinitive" (see (8a)), Duffley and Enns (1996: 228) present authentic examples to verify that this colligation is actually used in a specific context.

（8） a. *I don't know why to do it right now.

　　 b. *It doesn't matter why to meet him.

（9） a. Why to ban birthdays (*Time* 1992: 25)

　　 b. Radio: How, When and Why to Use it (Tolleris, 1946, book title)

　　 c. Why to vote Yes in the referendum (*The Globe and Mail*, 1992: A22)

（quoted from Duffley and Enns 1996: 228）

Duffley and Enns point out that the pragmatic implicational difference between (8a-b) and (9a-c) leads to the difference of the acceptability judgement of these two groups. Example (8a), for example, has a pragmatic implication that "I think I don't have to do it right now", in which the realization of the situation denoted by the *to*-infinitive (i.e. *to do it right now*) is not desirable and likely to happen. Examples (9a-c), on the other hand, have a strong pragmatic implication that the infinitive event is supposed to be desirable and likely to be realized. (9a) is "the title of an article explaining how many elderly people die shortly after their birthdays and suggesting that we should therefore stop celebrating these occasions" (Duffley and Enns 1996: 229). (9b) suggests that "the writer prepares his readers for the presentation of arguments in favour of using radio" (*ibid.*). In (9c) "the article introduced by this title presents reasons for voting "yes" in a Canadian referendum on the constitution" (*ibid.*). In (9a-c) the interrogative word *why* gives rise to the notion of positive

reasons calling for the realization of the infinitive's event. The following examples extracted from the BNC will endorse their argument.

(10) a. It means deciding where, when and *why to say Yes*. (BNC: A3T 239)

    b. I can't tell you who to love, or how to love: those school courses would be how-not-not-to as much as how-to classes (it's like creative writing — you can't teach them how to write or what to write, only usefully point out where they're going wrong and save them time). But I can tell you *why to love*. (BNC: G1X 1994-1995)

The BNC contains 16 examples of the syntactic pattern "*why + to*-infinitive", out of which 13 examples are identified as being interrogative infinitives.[5] In three BNC examples of *why to*-infinitives, some kinds of interrogative words (e.g. *where, when and why*) align in a row, as illustrated in (10a), which is similar to (9b) above. This aligning construction will make it easier to posit that the situation denoted by *why to say Yes* in (10a) is likely to be realized. In (10b), the semantic contrast between the first and the second sentences will enhance the likelihood of the realization of the situation denoted by *why to love*. In this context, the speaker takes a positive attitude for the realization of the situation denoted by the infinitive *to love*.

To summarize, interrogative infinitives seem to be used when the speaker wishes to question the identity of something which he supposes to exist (the object, place, time, reason or way to realize the event) (cf. Duffley and Enns 1996: 236).[6]

### Ⅲ　Collocation Patterns of Interrogative Infinitives

In this section, I will scrutinize the collocation patterns of predicate verbs + interrogative infinitives, using data from the BNC (*BNCweb*), and also describe the semantic properties of each pattern. My corpus investigation is conducted according to each interrogative word (e.g. *whether, how, what,* etc.).

### 1　*whether to*-infinitives
First of all, before embarking on the scrutinization of interrogative infinitives, I will conduct

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[5]　The other 3 examples are concerned with an idiomatic phrase "that/this is why" (e.g. *That is why* to know him is to trust him, and to trust him is to begin to know ourselves) (BNC: C8V 16) .

[6]　Swan (2004: 628) points out that the construction *why* + bare infinitives suggest that an action is unnecessary or pointless (e.g. Why argue with him?　He'll never change his mind) .

analysis of "interrogative words + finite clause". My BNC query of the predicate verbs governing "*whether* + subject + modal auxiliaries (e.g. *should, could*) + verb" returned 240 types of verb forms. The most frequently occurring predicate verbs (lemma) appearing in this syntactic pattern are *decide, know, determine, wonder, ask, consider, doubt,* many of which are classified into verbs of knowledge, verbs of decision, and inquisitive verbs. Table 1 is the list of the predicate verbs followed by the syntactic pattern "*whether* + subject (+ modal auxiliary) + verb" in the BNC.[7] Some examples are presented in (11a-c) below.

Table 1. The top 20 predicate verb forms having collocational value with "*whether* + subject + modal auxiliary + verb" in the BNC

| No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value | No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | decide | 6561 | 69 | 629.14 | 11 | deciding | 1853 | 21 | 194.41 |
| 2 | determine | 3887 | 53 | 510.67 | 12 | questioned | 1768 | 19 | 173.86 |
| 3 | doubt | 2047 | 47 | 502.11 | 13 | seen | 36316 | 37 | 166.70 |
| 4 | consider | 11565 | 45 | 320.89 | 14 | see | 114941 | 54 | 164.89 |
| 5 | wondered | 4411 | 33 | 278.16 | 15 | determining | 1262 | 17 | 163.25 |
| 6 | know | 118565 | 74 | 265.12 | 16 | ask | 18609 | 26 | 132.95 |
| 7 | asked | 31218 | 49 | 261.89 | 17 | predict | 1343 | 14 | 127.24 |
| 8 | wonder | 4388 | 30 | 247.46 | 18 | considering | 2723 | 16 | 127.10 |
| 9 | is | 990191 | 168 | 224.78 | 19 | establish | 5213 | 17 | 115.18 |
| 10 | wondering | 2299 | 24 | 218.24 | 20 | wonders | 391 | 9 | 96.12 |

(11) a. The commissioner had statutory jurisdiction to **decide** whether the road verges should be registered as common land. (BNC A4K 53)

b. Many Palestinians **doubt** whether anyone else would be able to do this. (BNC AJM 654)

c. But I **question** whether North-East fans would accept Cambridge's style of play. (BNC K4T 2224)

As I mentioned in (1a) above, Huddleston and Pullum (2002: 985) point out that the predicate verb *doubt* does not take *whether* + *to*-infinitive construction, while this verb can take *whether* + finite clauses. Out of 47 examples of the syntactic pattern "*doubt whether* + subject + modal auxiliary + V", 36 examples contain modal auxiliaries expressing epistemic modality (i.e. *will, would,*

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7) For the purpose of extracting examples of "*whether* + finite clause", I used a tag sequence of "*whether* ++** *_VM0 *_V**" for my query of this syntactic pattern. The grammatical tag *_VM0 stands for any modal auxiliaries and *_V** represents any verb. The symbol + is used to skip an arbitrary token, and * for an optional token. After retrieving the examples of "*whether* + finite clauses", I conducted a collocation inquiry of this syntactic pattern with predicate verbs. The selected range of the predicate verbs was -2 to -1.

*may* and *could*）（see（11b）above）. It is reasonable to state that the finite clauses expressing epistemic modality cannot be replaced by the infinitival clause as I have explained in the previous section. The other 11 examples are concerned with dynamic modality, as in:

（12）a. At the same time I **doubt** whether the state alone *can* solve it.（BNC A69 317）

    b. Some of Mr Gandhi's advisers **doubt** whether the party *can* win an election in the near future.（BNC ABE 1186）

As examples（12a）and（12b）illustrate, the modal auxiliary *can* expresses the neutral possibility, a kind of dynamic modality, being dependent on the circumstance in which the event in question occurs. Interrogative infinitives basically denote dynamic（event）modality, as pointed out in the previous section, and thus it is expected that the verb *doubt* should also take *whether* + *to*-infinitive. Furthermore, dictionaries explain the meaning of the interrogative word *whether* as "used to express a doubt or choice between alternatives"（*OALD* 9th ）or "you use *whether* when you are talking about a choice or doubt between two or more alternatives"（*Cobuild*）. These dictionary definitions should guarantee the compatibility between the verbs of *doubt* and *whether*-clauses. However, this is a wrong expectation. My corpus query of the predicate verbs governing "*whether* + *to*-infinitives" returned 443 types of verb forms, but no examples of this colligation pattern follow the verb *doubt*. Table 2 demonstrates the top 20 predicate verbs having collocational value with "*whether* + *to*-infinitive" in the BNC.

Table 2. The top 20 predicate verbs having collocational value with "*whether* + *to*-infinitive" in the BNC

| No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value | No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | decide | 6561 | 263 | 3348.21 | 11 | debating | 288 | 8 | 95.19 |
| 2 | deciding | 1853 | 116 | 1576.99 | 12 | decides | 877 | 8 | 77.25 |
| 3 | wondering | 2299 | 47 | 530.71 | 13 | determine | 3887 | 10 | 71.34 |
| 4 | know | 118565 | 102 | 511.27 | 14 | knowing | 4498 | 8 | 51.23 |
| 5 | considering | 2723 | 40 | 424.94 | 15 | determining | 1262 | 5 | 39.95 |
| 6 | choose | 6704 | 39 | 341.93 | 16 | split | 2467 | 5 | 33.30 |
| 7 | wondered | 4411 | 26 | 228.52 | 17 | pondering | 161 | 3 | 33.27 |
| 8 | consider | 11565 | 27 | 187.59 | 18 | divided | 3925 | 5 | 28.74 |
| 9 | debated | 657 | 16 | 186.16 | 19 | wonder | 4388 | 5 | 27.64 |
| 10 | decided | 14485 | 26 | 167.13 | 20 | balloted | 34 | 2 | 26.85 |

　　Facing the contradiction between the meaning of *whether* and the linguistic fact that the predicate verb *doubt* never does take interrogative infinitives (e.g. *whether to do it*), it will be reasonable to suppose that interrogative infinitives have some extra meaning in addition to dynamic modality, which prevents the infinitive clause from emerging as a grammatical object of the verb *doubt*. Here let us take a look at dictionary definitions of the verb *doubt*.

(13)　a.　to think that something may not be true or that it is unlikely (*LDOCE* 5th)

　　　b.　If you doubt whether something is true or possible, you believe that it is probably not true or possible. (*Cobuild*)

　　　c.　to feel uncertain about something; to feel that something is not true, will probably not happen, etc. (*OALD* 9th)

As these dictionary definitions demonstrate, the verb *doubt* has a clear implication that the situation is unlikely to be realized. Here let us reconsider the acceptability judgement of *why* + *to*-infinitives in English. As we examined in the previous section, *why* + *to*-infinitive is used when the speaker sees the reasons evoked by *why* "as valid for any prospective actualizer of the infinitive's event and calling for this event to be actualized" (Duffley and Enns 1996: 229). This amounts to saying that the prospect for the realization of the situation denoted by the *to*-infinitive is obligatory for the use of *why* + *to*-infinitive. This semantic property of *why* + *to*-infinitive seems to be applied to other types of interrogative infinitives. Here I put forward a comprehensive semantic property of interrogative infinitives on the basis of Duffley and Enns's analysis of *why* + *to*-infinitives.

(14)　The interrogative infinitive can be used when the situation denoted by the infinitive is presupposed to be realized in the context.

The lexical meaning of the verb *doubt* (i.e. "the situation is unlikely to be realized") comes into semantic conflict with the semantic property of interrogative infinitives (i.e. (14)).

　　One might claim that "the noun *doubt*" will be easily followed by *whether* + *to*-infinites, as in:

(15)　"One is in *doubt whether to laugh or to weep*," proclaimed the London Daily Telegraph. (COCA)

Example (15) does not falsify the validity of the hypothesis (14). The relationship between the noun *doubt* and the interrogative infinitive *whether to laugh or to weep* in (15) is the noun and its complement. The noun *doubt* in (15) refers to the feeling of being not sure whether the speaker

should either laugh or weep.[8] *Doubt* in（15）never lowers the likelihood itself of realization of the situation denoted by the *to*-infinitives（i.e. *to laugh or to weep*）. In other words, either *to laugh* or *to weep* should be actualized. Therefore, example（15）does not contravene the hypothesis in（14）, and thus is acceptable.

Here we need to examine another syntactic pattern involving *whether* + *to*-infinitive, as in:

（16）I don't care whether I go or not／ \*whether to go or not.（=（1d））

Huddleston and Pullum（2002: 985）present the example（16）and claim that the verb *care* does not take *whether* + *to*-infinitives. We should remind ourselves here that the verb *care* belongs to the category "verb of relevance"（e.g. *matter, be relevant, be important, care, be significant*）, which was suggested by Bhatt（2006）. My corpus survey finds that Huddleston and Pullum's and Bhatt's judgment is right on the track. There are no examples of interrogative infinitives which co-occur with verbs of relevance. My investigation, however, found that verbs of relevance can take a *whether* + finite clause which does *not* contain any modal auxiliary.

（17）a. He didn't even **care** *whether Jahsaxa was watching him or not.*（BNC: BMM 426）
　　 b. It doesn't **matter** *whether people are 'on the front-line' or not.*（BNC: A7K 661）

Out of 42 examples of the verb *care* + *whether* + finite clauses and out of 135 examples of *it* + *matter* + *whether* + finite clauses, no finite clauses contain modal auxiliaries. All the finite clauses have the present or past tense. The meaning of the verb *care* is "to think that something is important, so that you are interested in it, worried about it etc"（*LDOCE* 5th）. Also the meaning of the verb *matter* is "to be important, especially to be important to you, or to have an effect on what happens"（*LDOCE* 5th）. These two verbs seem to be concerned with the judgment of importance. On the basis of my corpus investigation, it follows that the judgment of importance denoted by the verbs *care* and *matter* is only made for "factual situations" which have been actualized. Non-factual situations cannot be a grammatical object（or subject）of the verb *care* and *matter*. On the other hand, the interrogative infinitives, as we have seen, always denote event modality, i.e. the speaker's attitude for the potential future event. This construction necessarily cannot express factual situations, and thus the verbs *care* and *matter* cannot co-occur with the target construction（see（1d）and（1e）above）.

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8) The noun *doubt* means "a feeling of being not sure whether something is true or right（*LDOCE* 5th）" or "a feeling of being uncertain about something or not believing something（*OALD* 9th）".

## 2　*what to*-infinitives

Attention here is directed to examining the relationship between predicate verbs and *what* + *to*-infinitives. Before investigating this syntactic pattern, let us observe predicate verbs which precede *what* + subject + modal auxiliary + verb construction. Table 3 presents the list of the predicate verbs followed by the syntactic pattern "*what* + subject + modal auxiliary + verb" in the BNC. My BNC query of the predicate verbs governing "*what* + subject + modal auxiliaries + verb" returned 651 types of verb forms. Some examples from the list are presented in (18a-b) below.[9]

Table 3. The top 20 predicate verbs having collocational value with "*what* + subject + modal auxiliary + verb" in the BNC

| No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value | No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | know | 118565 | 358 | 1677.78 | 11 | imagine | 5846 | 38 | 234.08 |
| 2 | see | 114941 | 231 | 900.57 | 12 | predict | 1343 | 21 | 165.97 |
| 3 | tell | 28801 | 148 | 844.50 | 13 | think | 88395 | 69 | 149.70 |
| 4 | knows | 8044 | 79 | 551.44 | 14 | say | 66463 | 60 | 145.27 |
| 5 | wondered | 4411 | 55 | 409.95 | 15 | consider | 11565 | 30 | 131.10 |
| 6 | wonder | 4388 | 50 | 363.68 | 16 | asked | 31218 | 41 | 126.80 |
| 7 | decide | 6561 | 53 | 349.30 | 17 | knowing | 4498 | 21 | 115.68 |
| 8 | knew | 23935 | 69 | 315.73 | 18 | ask | 18609 | 32 | 114.92 |
| 9 | wondering | 2299 | 38 | 304.60 | 19 | guess | 2285 | 17 | 109.22 |
| 10 | 's | 337484 | 171 | 250.49 | 20 | understand | 14914 | 27 | 99.55 |

(18)　a.　Battle is joined again, and surely after this we **know** *what the result will be.* (BNC: ACG 1740)

　　　b.　We'll just have to **see** *what a course of ECT will do for him.* (BNC: A7J 570)

　　　c.　The problem is to **decide** *what such an influence might be.* (BNC: A75 264)

As Table 3 demonstrates, verbs of knowledge (e.g. *know*, *understand*) and verbs of conjecture (e.g. *see*, *wonder*, *imagine*, *predict*, *guess*, *think*) frequently occur in this syntactic pattern. Among the verbs of conjecture, the verbs *imagine*, *predict*, and *guess* take the finite clauses which contain modal auxiliaries expressing epistemic modality (e.g. *would*, *might*), as in:

(19)　a.　Can you **imagine** *what a scandal that would be*? (BNC: CH6 6812)

　　　b.　Who can **predict** *what Brazilian carnival queen might not cross his path*? (BNC: EDJ 1562)

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9)　Unfortunately, this syntactic query also involves "relative pronoun *what* + subject + modal auxiliaries + verb".

    c.　I think I can **guess** *what that question might be.*（BNC: CN3 3879）

It is easily expected that these three verbs are less likely to take interrogative infinitives, which never do express epistemic modality. Indeed, there are no examples in the BNC where the predicate verbs *imagine*, *predict* and *guess* take interrogative infinitives. My corpus query of the predicate verbs governing "*what + to*-infinitives" returned 203 types of verb forms. Table 4 shows the top 20 most frequently occurring predicate verbs followed by *what + to*-infinitives in the BNC.

Table 4. The top 20 predicate verbs having collocational value with "*what + to*-infinitive" in the BNC

| No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value | No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | decide | 6561 | 263 | 3348.21 | 11 | debating | 288 | 8 | 95.19 |
| 2 | deciding | 1853 | 116 | 1576.99 | 12 | decides | 877 | 8 | 77.25 |
| 3 | wondering | 2299 | 47 | 530.71 | 13 | determine | 3887 | 10 | 71.34 |
| 4 | know | 118565 | 102 | 511.27 | 14 | knowing | 4498 | 8 | 51.23 |
| 5 | considering | 2723 | 40 | 424.94 | 15 | determining | 1262 | 5 | 39.95 |
| 6 | choose | 6704 | 39 | 341.93 | 16 | split | 2467 | 5 | 33.30 |
| 7 | wondered | 4411 | 26 | 228.52 | 17 | pondering | 161 | 3 | 33.27 |
| 8 | consider | 11565 | 27 | 187.59 | 18 | divided | 3925 | 5 | 28.74 |
| 9 | debated | 657 | 16 | 186.16 | 19 | wonder | 4388 | 5 | 27.64 |
| 10 | decided | 14485 | 26 | 167.13 | 20 | balloted | 34 | 2 | 26.85 |

In addition to *imagine*, *predict* and *guess*, verbs such as *matter*, *anticipate*, *specify*, *ask*, *hear*, *dictate*, *realize* do not appear in examples of predicate verbs + *what + to*-infinitives.

　Here a special syntactic pattern needs to be examined. As we have seen in（1b）,（3a）and（3b） above, the adjectives *amazing* and *surprising* never precede interrogative infinitives as in:

（20）　a.　It was amazing what they offered/ *what to offer.（=（1b））

      b.　*It is amazing what to do.（vs. It is amazing who Bill knows.）（=（3a））

      c.　*It is surprising what to do.（vs. It is surprising how much Bill has accomplished.）（=（3b））

　The adjectives *amazing* and *surprising* refer to the state of our feeling that we have when something unexpected happens（c.f. *LDOCE* 5th）. Let us categorize these two words into "adjectives of surprising". It is easily expected that other members of adjectives of surprising cannot also take interrogative infinitives. My corpus survey endorses this expectation. Other adjectives meaning "surprise", such as *astonishing*, *astounding*, *startling*, and *stunning*, also do not co-occur with

interrogative infinitives（e.g. *It is astonishing what to offer）.

　The BNC contains 51 examples of "*amazing* + *what* + finite clause", in which 22 examples do not have a modal auxiliary in their finite clause and refer to factual situations, as in:

　(21)　a.　"It's amazing *what a change of government does*," she stated.（BNC: K5C 2125)
　　　　b.　It's amazing *what they're doing with them*.[10]（BNC: KBD 8416)

It should be noticed that the situations denoted by *what* + finite clauses in（21a-b) are not potential but actualized at the moment of speech.（21a) and（21b) describe that the speaker was amazed to see（or hear）the situations in question. The adjective *amazing* refers to a state of a particular feeling and thus the situation which triggers this feeling（i.e. *amazing*) must have been noticed. Otherwise, the feeling of *amazing* never emerges. The other 29 examples, however, contain modal auxiliaries and thus the finite clause might not seem to express actualized situations.

　(22)　a.　It was amazing *what modern technology **could** accomplish*.（BNC: CHO 2549)
　　　　b.　It's amazing *what some men **will** do for a meal ticket*.（BNC: ABW 207)
　　　　c.　It is amazing *what damage a few of these **can** do to your plants*.（BNC: ACX 2386)

The modal auxiliaries *could*, *will* and *can* in（22a-c) express dynamic modality and fall into the categories of "subject-oriented modality" and "neutral/ circumstantial modality". The modal auxiliary *could* in（22a) expresses the subject's ability and implies actualization of the situation and thus denotes subject-oriented modality, a type of dynamic modality, which is concerned with the ability or volition of the subject of the sentence and is also "applied to inanimate objects, to indicate how such objects will characteristically behave"（Palmer 1990: 136)（e.g. The stout plant *will* grow up to 12 inches in slow-flowing rivers in their natural habitat). Thus the situation expressed by *what modern technology could accomplish* has an implication of actualization, and this actualized situation triggers for speaker's amazedness. The modal auxiliary *will* in（22b) does not express a pure futurity but denotes subject-oriented modality. The finite clause *what some men will do for a meal ticket* in（22b) refers to "some men's" characteristic behaviors, which is described through the speaker's experiences. Thus, even though this finite clause contains the auxiliary *will*, which denotes subject-oriented modality, the speaker can express the situation denoted by the finite clause（i.e. the men's characteristic behaviors）"on the basis of his/her past experience". As we have seen, the adjective

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　10)　In（20a-b) the word *what* can be parsed either as an interrogative pronoun or as a relative pronoun.

*amazing* refers to a state of a particular feeling and thus the situation which triggers this feeling（i.e. *amazing*）must necessarily have been noticed before this feeling emerges. As the men's characteristic behaviors expressed by "what some men will do for a meal ticket" have been observed （noticed）through the speaker's experience, this situation is regarded as having been realized before and thus can be a trigger for the feeling *amazing* to emerge. Example（22c）is concerned with the problem that weevil grubs deteriorate the plants. The finite clause *what damage a few of these can do to your plants* refers to the characteristic of grubs which cause damage to plants. This characteristic is expressed on the basis of the speaker's experience. Thus the situation expressed by the finite clause is regarded as being actualized before and can be a trigger for the feeling of amazing to emerge.

As we have seen in section 2, interrogative infinitives denote the event modality. Palmer（2001: 22; 1990）formulates a system of event modality as follows:

Figure 1. The classification of event modality suggested by Palmer（2001）
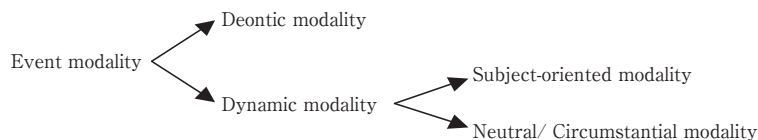


If a sentence containing interrogative infinitives co-occurred with adjectives of surprising（e.g. *amazing*）, the interrogative infinitive should express the actualized situation. Otherwise the interrogative infinitive can never be a trigger for the feeling of surprising to emerge. Therefore, the infinitive must denote subject-oriented modality, which expresses the subject's characteristics（i.e. subject's ability, volition, characteristic behavior）on the basis of the speaker's experience. Deontic modality（i.e. modality of obligation）and neutral/ circumstantial modality（i.e. modality of possibility）are not concerned with the characteristics of the subject of the sentence and these types of modality are not expressed based on the speaker's experience. So these modalities do not imply that the situation in question has been actualized before. However, interrogative infinitives（e.g. *what to do*）can never express subject-oriented modality. This is simply because the subject of the *to*-infinitive is not explicit but implicit（e.g. *It is amazing what to offer）. Moreover, the sentence subject（i.e. *It*）refers to the interrogative infinitive itself. The situation denoted by interrogative infinitive is not observable, and thus it is not a trigger for the feeling of *amazing* to emerge. That is why interrogative infinitives cannot co-occur with adjectives of surprising.

Some might argue against this explanation in that expressions meaning *surprise* can occur even if

the triggering situation is expressed by *if*-clause, which has the implication that the situation in question has not been realized yet. Here are two examples which might seem to endorse this argument.

(23) a. It will be **surprising** *if its conference next week sees a sudden change of tone.* (BNC: A3J 18)

　　b. And indeed the logic of their oppositeness is so variable and opaque, it would surely be **amazing** *if these particular pairs were inborn.* (BNC: CGF 912)

However, the examples (23a-b) do not refute my explanation. (23a) and (23b) are sentences with a conditional clause (i.e. *if its conference next week sees a sudden change of tone*) and a subjunctive clause (i.e. *if these particular pairs were inborn*), respectively. The main clauses (i.e. [*i*]*t will be surprising* in (23a) and *it would surely be amazing* in (23b)) describe that the feelings of *surprising* and *amazing* will emerge on condition that the situation expressed by the *if*-clause is actualized. Thus, the triggering situation for the feeling of surprising/amazing to emerge does not need to be actualized before the speech time.

## 3　*how to*-infinitives

　My corpus query of the predicate verbs governing "*how* + subject + modal auxiliary + verb" returned 529 types of verb forms.[11)] Table 5 is the list of the predicate verbs followed by the syntactic pattern "*how* + subject + modal auxiliary + verb" in the BNC. Most of the verbs in the list are concerned with verbs of knowledge (e.g. *know*, *understand*) and verbs of conjecture (e.g. *wonder*, *imagine*, *realise*). Some examples are presented in (24a-c) below.

Table 5. The top 20 predicate verbs having collocational value with "*how* + subject + modal auxiliary + verb" in the BNC

| No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value | No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | see | 114941 | 370 | 1832.65 | 11 | understand | 14914 | 55 | 285.55 |
| 2 | know | 118565 | 297 | 1325.47 | 12 | knows | 8044 | 46 | 278.32 |
| 3 | wondered | 4411 | 96 | 836.84 | 13 | explain | 7672 | 44 | 266.46 |
| 4 | show | 17560 | 105 | 645.03 | 14 | determine | 3887 | 37 | 261.15 |
| 5 | shows | 9774 | 86 | 593.91 | 15 | consider | 11565 | 46 | 245.57 |
| 6 | wonder | 4388 | 62 | 486.55 | 16 | tell | 28801 | 56 | 221.79 |

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11)　I used a tag sequence of "*how* ++** *_VM0 *_V**" for my enquiry into this syntactic pattern. The grammatical tag *_V** stands for "any verb (form)". The symbol + is used to skip an arbitrary token, and * for an optional token. The selected range of the predicate verbs was -2 to -1.

| 7 | decide | 6561 | 58 | 400.94 | 17 | knew | 23935 | 51 | 210.83 |
| 8 | imagine | 5846 | 53 | 369.01 | 18 | Knowing | 4498 | 28 | 174.05 |
| 9 | wondering | 2299 | 42 | 351.15 | 19 | showing | 6132 | 27 | 149.46 |
| 10 | predict | 1343 | 36 | 328.75 | 20 | realise | 3799 | 23 | 141.70 |

（24） a. We took it in turns to **see** *how close we could get.*（BNC: A0H 1633）

b. I used to **wonder** *how these people could resist talking about her.*（BNC: FAT 317）

c. I cannot **imagine** *how this discussion would go,* can you?（BNC: CAJ 1166）

Intriguingly, the verbs of conjecture, a frequently occurring type of verbs in Table 5, are less likely to occur with *how* + *to*-infinitive construction. Table 6 shows the top 20 most frequently occurring predicate verbs followed by *what* + *to*-infinitives in the BNC. My corpus query of the predicate verbs governing "*how* + *to*-infinitives" returned 431 types of verb forms.

Table 6. The top 20 predicate verbs having collocational value with "*how* + *to*-infinitive" in the BNC

| No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value | No. | Predicate verbs | Total Num. in the BNC | Observed collocate freq. | Log-likelihood value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | know | 118565 | 1270 | 8391.92 | 11 | decide | 6561 | 88 | 614.75 |
| 2 | learn | 8119 | 405 | 3909.04 | 12 | tell | 28801 | 127 | 609.65 |
| 3 | knew | 23935 | 290 | 1970.60 | 13 | learnt | 2144 | 63 | 539.07 |
| 4 | learning | 3735 | 153 | 1413.01 | 14 | explains | 2449 | 49 | 381.35 |
| 5 | taught | 3713 | 145 | 1324.96 | 15 | deciding | 1853 | 46 | 377.93 |
| 6 | show | 17560 | 166 | 1045.15 | 16 | teaching | 3310 | 49 | 351.83 |
| 7 | knows | 8044 | 138 | 1032.21 | 17 | showed | 10400 | 61 | 326.45 |
| 8 | learned | 4405 | 114 | 946.60 | 18 | showing | 6132 | 48 | 284.02 |
| 9 | teach | 2740 | 94 | 833.95 | 19 | shows | 9774 | 48 | 240.24 |
| 10 | knowing | 4498 | 91 | 710.46 | 20 | forgotten | 3550 | 35 | 223.01 |

As this table suggests, *how* + *to*-infinitives tend to follow the verbs of retaining knowledge (e.g. *know*), the verbs of acquiring knowledge (e.g. *learn*), and the verbs of one-way communication (e.g. *teach, show, describe*).

In this instance we have a special colligation pattern to examine. As Bhatt（2006: 12）and Huddleston and Pullum（2002: 985）point out, the verbs of dependency (e.g. *depend on, be related to, have an influence on*) cannot govern *how* + *to*-infinitives, as in:

（25） It depends on how much I must pay／ *how much to pay.（=（1c））

In my corpus investigation, the predicate verb *depend on* governing the *how* + subject + modal auxiliary + verb construction takes 54th place in the form of *depends on* and 96th place in the form of *depend on* of all the predicate verb forms governing this construction. There are no examples of *depend on* governing interrogative infinitives in my corpus survey.  Another corpus examination also reveals that there are 72 examples in which the verb phrase *depend on* governs the *how* + subject + verb construction. Two examples are:

（26）a.　Much would **depend on** how the oil revenue is split.（BNC: AHT 631）
　　　 b.　The starting point for this will **depend on** how familiar the school is with the procedures. （BNC: B23 557）

Out of the 72 examples, only six examples contain modal auxiliaries. Intriguingly, all the six modal auxiliaries have a form of *can*, as in:

（27）a.　The dishwasher you choose will **depend on** *how much you **can** afford to spend*, the features you want and the space available. （BNC: C9X 1408）
　　　 b.　I think a lot will **depend on** *how quickly we **can** all encourage North American tourists to come to Britain.* （BNC: KRL 4083）

As the examples （26a-b） illustrate, the modal auxiliary *can* in all the six examples expresses the subject-oriented modality, which can be denoted by interrogative infinitives. Therefore it follows that incompatibility between the predicate verb *depend on* and interrogative infinitives is less likely to be caused by the modality. We need to consider another clue to the explication of this incompatibility problem. Let us take a look at dictionary definitions of the verb *depend*.

（28）The definitions of the verb *depend*:
　　　 a.　if something depends on something else, it is directly affected or decided by that thing. （*LDOCE* 5th）
　　　 b.　If you say that one thing depends on another, you mean that the first thing will be affected or determined by the second. （*Cobuild*）
　　　 c.　to be affected or decided by something. （*OALD* 9th）

As these definitions imply, the verb phrase *depend on* relates two situations as "a condition and its result". I put forward a semantic structure of this verb phrase as follows:

（29） The semantic structure of *depend on*

The realization of Situation A (i.e. THE RESULT) depends on Situation B (i.e. A CONDITION)

This semantic structure basically seems to be applied to any example involving the verb phrase *depend on*. Situation B（the grammatical object of the verb phrase）functions as a condition for the realization of Situation A. Thus Situation B necessarily has to be described as true. This hypothesis is consistent with the linguistic tendency that the finite clauses governed by the verb *depend on* contain non-modal expressions, in particular non-epistemic expression. In addition, Situation B may be expressed in as much detail as possible. Interrogative infinitives consist of an interrogative word （e.g. *how*）and *to*-infinitives, and thus there is no overt subject expressed, though finite clauses necessarily have their explicit subject expressed（see（25）above）. The lack of overt subject of the interrogative infinitive may lead to the impossibility as a condition for Situation A. Needless to say, this explanation needs more empirical validity, however.

## Ⅳ  Conclusion

The purpose of this paper was to explore the semantic properties of interrogative infinitives and scrutinize the semantic mechanism by which this construction is collocated with predicate verbs on the basis of the linguistic data retrieved from the BNC. The present study has pointed out that interrogative infinitives are confined to express event modality rather than epistemic modality. Epistemic modality is always concerned with the truth/ falsehood of the proposition, which necessarily contains the grammatical tense (i.e. present/ past). Without the grammatical tense, no situations could be examined regarding whether they are true or false. My argument is that interrogative infinitives are non-finite clauses and thus necessarily do not have the grammatical tense, and, therefore, the construction in question cannot be treated as being a proposition and thus cannot denote epistemic modality. My corpus survey certainly endorsed this hypothesis; there are no examples in which interrogative infinitives denote epistemic modality. On the other side, event modality, which the target construction can express, can be classified into two types, i.e. deontic modality（modality of obligation）and dynamic modalilty（modality of potential future event）. The event modality can also be expressed by modal auxiliaries（e.g. *should/ can*）, but I argued that the same modality denoted by interrogative infinitives has an additional semantic property that the interrogative infinitive can be used when the situation denoted by the infinitive is presupposed to be realized in the context（see（14））.

In addition to semantic properties of the interrogative infinitive, my examination of the BNC data

falsified Bhatt's analysis that interrogative infinitives do not take pied-piping construction. The present study proved that the syntactic feature that pied-piped interrogative infinitives can be used as a complement of predicate verbs, adjectives and nouns is consistent with that of the other types of interrogative infinitives.

The restrictions on the use of interrogative infinitives are contingent on the compatibility between the semantic property of the predicate verbs and that of the infinitive clause. My corpus data endorsed that the predicate verb *doubt*, for example, cannot govern interrogative infinitives. This verb has a clear implication that the situation is unlikely to be realized. This implication comes into semantic conflict with the semantic property of the interrogative infinitive I put forward in (14). Another incompatibility I analyzed was concerned with the syntactic pattern "adjectives of surprising + interrogative infinitives". Adjectives of surprising refers to a state of a particular feeling and thus the situation which triggers this feeling must necessarily have been noticed before this feeling emerges. However, the interrogative infinitives cannot express the situation which has been actualized before the speech time. This semantic property of the target construction prevents it from co-occurring with adjectives of surprising. The present paper has mainly focused on three patterns of interrogative infinitives (i.e. *whether/what/how* + *to*-infinitives). Examination of the other patterns (e.g. *where* + *to*-infinitives) will be conducted in future research.

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