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Propositional *How* Questions and Negation

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1. Another kind of *how*-question

Typically, *how* questions are assumed to involve *wh*-movement of an adjunct denoting manner, method or instrument (1a)-(1b). However, English *how* questions can also have a very different, largely unnoticed interpretation: they can be used to express extreme surprise that the proposition under *how* holds at all (1c). I will refer to these 'propositional surprise' *how*-questions as PHQs, and to the more familiar manner/method/instrument *how*-questions collectively as MHQs.

(1)   How did John fix that chair?
  a.   Very slowly and carefully.   (manner, MHQ)
  b.   With a hammer.   (instrument, MHQ)
  c.   I know! I didn't think he could fix anything! (propositional surprise, PHQ)

While many *how*-questions, like (1), are ambiguous between MHQ and PHQ readings, MHQs and PHQs are distinguished by several properties. First, PHQs allow all kinds of stative and non-agentive predicates to head the proposition under *how*, while MHQs are more restricted in this regard. For example, while *fall asleep* in (2) denotes a change of state, *be asleep* in (3) denotes a simple state (reinforced by the adverb *still*). Correspondingly, the MHQ reading is available in (2) but not in (3).

(2)   How did Sarah fall asleep?
  a.   By counting sheep.   (MHQ)
  b.   I know—she was so wired at bedtime! (PHQ)

(3)   How is Sarah still asleep?
  a.   #By keeping her blinds closed.   (#MHQ)
  b.   I know—it's been ten hours now!   (PHQ)

The unavailability of (3)a is one manifestation of a general incompatibility between manner/instrument modifiers and non-eventive predicates (Smith 1991:ch3, Katz 2000). The fact that PHQs escape this restriction suggests that *how* is not associated with the clause-internal predicate in a PHQ. More examples of unambiguous PHQs with non-eventive predicates are given in (4).

(4)   a.   How is Chili's still open? (It's 2:00a.m.!)
  b.   How do you hate this song? (It's got such great lyrics!)
  c.   How has it already snowed six times? (It's only October!)
  d.   How does this book cost $80? (It's only 30 pages long!)
  e.   How is John still working on that paper? (It was assigned four months ago!)
  f.   How are you sweating so much? (It's freezing!)

There is also an intonational difference between PHQs and MHQs—while *how* can be de-accented in a MHQ, it must bear pitch-accent in a PHQ:

(5) a. { Hów / Hòw } did Sarah fall asleep?
    b. { Hów / ?*Hòw } is Sarah still asleep?

Additionally, PHQs are fully compatible with sentential negation, showing none of the weak-island effects induced by negation in MHQs (Abrusán 2008, Ross 1984, Kuno & Takami 1997, among others):

(6) How did John not fix that chair?
    a. #With a hammer. / #Carefully.   (#MHQ)
    b. I know! It looked like such a simple job!   (PHQ)

(7) a. How is Chili's not open yet?   (all PHQs)
    b. How do you not love this song?
    c. How has it not snowed at all this winter?
    d. How does this book not cost more?
    e. How is John not working on that paper anymore?
    f. How do three guys in their thirties not have $800 between them?

Oddly, however, while PHQs freely allow negation, they resist Neg-contraction to *n't*:

(8) a. ?* How isn't Chili's open yet?
    b. ?* How don't you love this song?
    c. ?* How hasn't it snowed at all this winter?
    d. ?* How doesn't this book cost more?
    e. ?* How isn't John working on that paper anymore?
    f. ?* How don't three guys in their thirties have $800 between them?

Some speakers that I have consulted reject sentences like (8) outright; others find them marginally acceptable. All have agreed, however, that there is a clear contrast in acceptability between the *how* questions in (8) and the *why* questions in (9), where Neg-contraction is fine, even preferred.

(9) a. Why isn't that restaurant open yet?
    b. Why don't you love this song?
    c. Why hasn't it snowed at all this winter?
    d. Why doesn't this book cost more?

We found that 90% of negative *why* questions in the Corpus of Contemporary American English (Davies 2008) had contracted *n't* (2796/3119), compared to 3% of negative *how* questions (9/317).

The contrast between (7) and (8) (and between (8) and (9)) presents an interesting puzzle: Given that there is no problem with negation *per se* in PHQs, why should it matter if the Neg morpheme is reduced to *n't* or spelled out as *not*? I offer the following explanation:[1]

(10) **Proposal:** The problem arises when Neg raises to C. Raising allows Neg to undesirably scope over a covert operator in C (VERUM) that is responsible for the PHQ's semantics.

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[1] There is at least one other type of *how* question, distinct from both surprise PHQs and MHQs, which I will not be discussing here. Some examples:
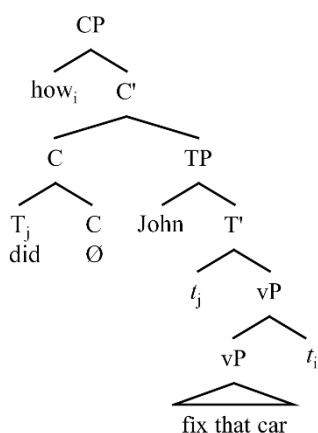
i. A: It's amazing how bad your idea is.   ii. A: All set; that'll be $800.
    B: How is that a bad idea?   B: Wait, how are you done? My car still won't start!

These questions are interpreted as challenges to someone else's use of an expression or proposition; I call them *echoic-mention* how *questions* (see Sperber & Wilson 1981). They are similar to PHQs in that they: (i) express surprise, and (ii) accept all kinds of stative predicates. However, they carry very different presuppositions from PHQs: While a PHQ presupposes the *p* that follows *how*, an echoic-mention *how* question presupposes 'Someone has said that *p*,' rather than *p* itself (in fact, it is used precisely when the speaker is *not* convinced that *p* is true).

2. Syntax and semantics of PHQs

Let's start by establishing a baseline syntax for MHQs. I assume that in a typical MHQ, *how* is initially merged as a vP adjunct and then moves to Spec,CP; i.e., it modifies a predicate rather than a proposition (Katz 2000; Thomason & Stalnaker 1973). Now compare the MHQ in (11)a to the PHQ in (11)b. Notice two key differences: (i) PHQ *how* is initially/externally merged in Spec,CP; and (ii) the PHQ has a covert semantic operator, VERUM, in C. I justify each of these proposals in §§2.1-2.2.

(11)   a. **Manner/instrument *how*-q** (MHQ)   b. **Propositional *how*-q** (PHQ)
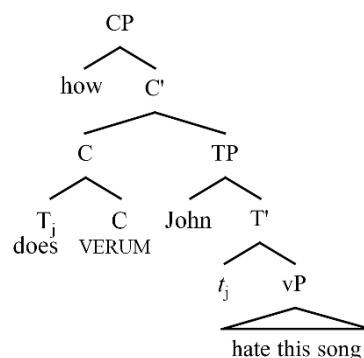
2.1 PHQ how starts off high

In the proposed PHQ structure in (11)b, *how* combines with a complete proposition, with no traces or gaps. Correspondingly, a PHQ of the form *how p* always presupposes *p*—the speaker who utters *How is Chili's still open?* (4)a, for example, acknowledges that Chili's *is* still open, while expressing great surprise at this state of affairs. Similarly, the negative PHQ in (12) acknowledges that Chili's is *not* open yet—i.e., the sentential negation is part of the presupposition.

(12)   PHQ: [$_{CP}$ **how** is [$_{TP}$ Chili's [$_{NegP}$ **not** [$_{vP}$ open yet]]]]   HOW > NEG

In a negative MHQ like (13), on the other hand, *how* is interpreted under the scope of negation and shows concomitant weak-island effects (see (6)). To the extent that (13) is interpretable, it is eliciting a method/instrument that John did *not* use to fix the car. Crucially, unlike in negative PHQs, the sentential negation is not part of the presupposition; i.e., (13) does not presuppose 'John did not fix the car.'

(13)   #MHQ: [$_{CP}$ **how**$_i$ did [$_{TP}$ John [$_{NegP}$ **not** [$_{vP}$ fix that car ~~how~~$_i$]]]]   NEG > HOW

The same kind of contrast is observed in *how* questions with quantified subjects. On the PHQ reading, (14) presupposes (and expresses surprise) that nobody finished on time. On the MHQ reading, the question produces weak-island effects on par with (13); with *how* under the scope of *nobody*, it is interpreted as asking for a method/instrument that was not used by anybody to finish on time. Unlike its PHQ counterpart, (14)b does *not* presuppose 'Nobody finished on time.'

(14)   Q: How did nobody finish on time?
       a.   PHQ: **how** [nobody finish on time]   A: I know! It was such an easy test!
       b.   #MHQ: **how**$_i$ [nobody finish on time ~~how~~$_i$]   A: #By setting alerts on their watches.

(15) is also ambiguous. On the MHQ reading in (15)a, it is asking for the manner in which everyone behaved. Since *everyone* c-commands the trace of *how* here, a family-of-questions response is possible (Collins 1991). On the PHQ reading in (15)b, however, there is no trace or gap inside the TP; instead,

everyone behave(d) is interpreted as a complete proposition, with intransitive *behave* (='behave well'). Since *how* is never under the scope of *everyone* in (15)b, no family-of-questions reading is possible. And unlike (15)a, (15)b presupposes 'Everyone behaved (well).'

(15) Q: How did everyone behave?
    a. MHQ: **how**$_i$ [everyone behave ~~how~~$_i$]?
           A: Billy behaved very well; Mary behaved okay; Sam behaved terribly...
    b. PHQ: **how** [everyone behave]?
           A: I know! I thought at least one kid would have problems.

In (16) (a somewhat exceptional case), the material that follows *how* is not a complete proposition (**John did on the test*). As expected, (16) can only be interpreted as a MHQ, with a trace of *how* in vP.

(16) How did John do on the test?
    a. MHQ: **how** [John did ~~how~~$_i$ on the test]
    b. *PHQ: **how** [John did on the test]

So far we have seen evidence that PHQ *how* starts off above all overt clausal material, including the subject and NegP. But we have not yet ruled out the possibility that PHQ *how* undergoes some (short, string-vacuous) movement from a TP adjunct position to Spec,CP. In fact, this is exactly the kind of movement that Collins (1991) proposes for *why* questions, and that I assume for *why* questions as well (see (27)); notice that *why* questions, like PHQs, escape negative-island effects (9). Nevertheless, I maintain that PHQs are distinct from *why* questions (and MHQs) in having *how* initially merged in Spec,CP, for reasons presented in the next subsection.

2.2 VERUM and the semantics of a PHQ

We have seen that a PHQ *how p* simultaneously (i) acknowledges the truth of *p*; and (ii) expresses surprise at the truth of *p*. Essentially, a PHQ is used when the speaker previously believed that *p* was highly unlikely or impossible, but now must recognize its certainty. The implicit question seems to be:

(17) How *p*? (PHQ) = 'How do I reconcile *p* with the rest of my beliefs?'

Since this question refers to S's internal cognitive state (which H is not fully privy to), S likely utters it without expecting H to produce a 'correct' answer. This may be why PHQs are often used rhetorically.

Let's look more closely at the range of possible responses to a PHQ. As shown in (18)a and many of the earlier examples, H can respond to a PHQ by simply acknowledging the appropriateness of the S's surprise (*I know!*). Alternatively, H can respond by challenging the appropriateness of S's surprise (18)b, just as H can respond by challenging the truth of *p* itself (when appropriate) (18)c. Finally, it is possible to respond to a PHQ as an information-seeking question (18)d-(18)e.

(18) How is John still working on that paper?
    a. I know! It was assigned four months ago!
    b. What are you talking about? Of course he's still working on it; it just got assigned today.
    c. What are you talking about? He finished it last week.
    d. I don't know.
    e. Well, he got really sick, and then he had four other papers he had to write…

The responses in (18)d-(18)e are noteworthy because they suggest that, even though PHQs are used primarily to express surprise, they retain the semantics of questions. In this respect, they are different from true *wh* exclamatives like (19), which are never interpreted as information-seeking questions:

(19) A: How we danced! How the wine flowed!
    B: I know! / *I don't know.

I believe that PHQs are a type of *how-possibly* question (Dray 1957, Hempel 1965, Jaworski 2009, Salmon 2006). A *how-possibly* question is a request for cognitive resolution (Jaworski 2009)—we ask it when 'we cannot reconcile what we know, or think we know,' with *p* (Dray 1957:161). Consider these *how-possibly* questions from earlier work:

(20) a. How could this possibly have happened? (Hempel 1965:428)
      b. How could a DC-9 jet airplane have flipped over onto its back? (Salmon 2006:137)
      c. How could the fielder have caught the ball at the 20-foot mark, with absolutely nothing to stand on? (Dray 1957:160)
      d. How did you manage to notice her (a toddler) in all the commotion? (Jaworski 2009)

The examples in (20) bear two important points of resemblance to our PHQs:

i)   An informative response to *how(-possibly) p* is a proposition *q* that makes *p* more compatible with S's existing beliefs—e.g. by supplying new information that might 'render the occurrence of [*p*] less improbable' (Hempel 1965:429). Notice that the informative responses to PHQs in (18)e and (21) are appropriately characterized in this way—they provide new information that might help S view *p* as less surprising or unlikely than s/he had previously thought.
ii) Unlike *why*-questions, *how-possibly* questions do not require that the response be an actual explanation; 'any *potential* explanation not ruled out by known facts' is satisfactory (Salmon 2006:137; emphasis mine). Consistent with this generalization, the informative PHQ responses in (18)e, (21) have the flavor of suggestions than complete answers.

(21) a. Q: How is Chili's still open?
          A: Well, I've noticed that a lot of restaurants have started staying open later these days.
      b. Q: How has it already snowed six times?
          A: Actually, I heard that snowfalls in October used to be really common here.

The main difference between our PHQs and the (other) *how-possibly* questions in (20) is that PHQs need not contain an overt modal or change-of-state predicate (*possibly, could, manage to*) for *how* to associate with. I propose that in the PHQ, *how* associates with a covert operator in C—namely VERUM.

VERUM, according to Romero & Han (2004), is a conversational epistemic operator that asserts the speaker's certainty that a proposition should be added to the common ground (CG) (similar to *really* in *Sarah really is still asleep*).

(22) [[VERUM]] = [[FOR-SURE-CG]] = λp. It is for-sure that *p* should be added to CG.

Suppose that the purpose of VERUM in the PHQ is to rule out the possibility that there is some mistake about the truth of *p*. This could be the source of the surprise expressed by a PHQ: The addition of VERUM to *p* yields an implicature that *p* is particularly unlikely or hard to believe (otherwise VERUM would be unnecessary information, per Grice's (1975) Quantity-2).

The addition of *how* above VERUM then produces:

(23) [[how FOR-SURE-CG *p*]] = 'By what means should we for-sure add this (unlikely) *p* to CG?'

Informally speaking, (23) is asking for something that will make the addition of *p* to CG easier. Following Jaworski (2009), I assume that this 'something' is a proposition *q* that bears a falsification relation to at least one proposition in the set of S's beliefs (other than *p* and *q*)—thus making *p* more compatible with the rest of S's beliefs.

Under this analysis, *how* still means *how*; i.e., it is used to query instrument/method/manner as usual. But in the PHQ, *how* is merged so high that it associates with the conversational operator VERUM ('we should add *p* to CG') rather than with an event or predicate internal to *p*. The 'instrument' that *how* elicits is therefore a piece of new information (a proposition *q*) that S can use to resolve their cognitive conflict and more easily add *p* to CG.

We can now see why PHQ *how* needs to be intially merged in Spec,CP (11)b—in short, because the analysis depends on *how* taking obligatory scope over VERUM in C.

This approach also sheds light on the (sometimes subtle) difference between PHQs and *why* and *how come* questions:

(24)　Q:　a.　Why are these plants wilting?
　　　　　b.　How come these plants are wilting?
　　　　　c.　How are these plants wilting? (PHQ)
　　　A:　They got infested by bugs.

(24)a-(24)c could all be answered with (24)A. But this convergence does not mean that the questions have the same semantics. *Why* and *how come* questions are similar to each other in that they typically seek an explanation (or rationale or reason) for *p*—S's ordinary assumption being that H probably knows this explanation.[2] The PHQ, if I am correct in treating it as a kind of *how-possibly* question, seeks *any* kind of information that might help S resolve their cognitive conflict. An explanation like (24)A could serve this purpose, but so could a range of other propositions, e.g. (25). Furthermore, in a PHQ like (24)c there is no assumption that H knows the 'real' explanation for *p*.

(25)　a.　We haven't been watering them *that* much.
　　　b.　Plants sometimes wilt even when you water them a lot.

3. Now, why no Neg-contraction?

We can now propose an answer to our question from §1: Given that sentential negation is freely permitted in PHQs, why does it matter if Neg is contracted to *n't* or spelled out as *not*?

(26)　a.　How does John not love this song?
　　　b.　?* How doesn't John love this song?
　　　c.　*cf.* Why doesn't John love this song?

I assume that there are two basic steps to deriving a *why-n't* question like (26)c:

(27)　a.　**Step 1 (Syntax)**: Neg raises to T and then to C by cyclic head movement.
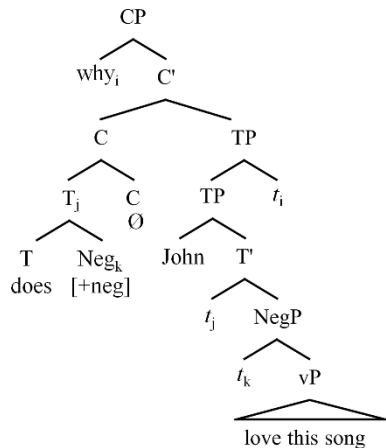
　　　b.　**Step 2 (PF)**: Allomorphy rule for [+NEG] applies:

　　　　　[+NEG] ↔　**n't** / X+__
　　　　　　　　　　not (elsewhere)
　　　　　(where 'X+Y' means 'X is left-adjacent to Y within the same (M-)word' (Embick 2010))

Now why can't these same two steps successfully derive a negative PHQ? Interestingly, if a PHQ is used in an embedded clause—a context where T does not raise to C in English—then Neg contraction

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[2] I am not claiming that *why* and *how come* questions have the same semantics, only that they are similar in the ways noted above. See Collins (1991), Conroy (2006), Fitzpatrick (2005), Tsai (2008) for more on the differences between *why* and *how come* questions.

is fine (28). This suggests that the problem with (26)b is not the spellout of Neg as *n't* (Step 2), but rather has to do with Step 1, the raising of Neg to C—where VERUM is.[3]

(28) I want to know [CP **how** [C VERUM] [TP John [T **does [n't**i]] [NegP t_i [vP love this song]]]]

     Romero & Han (2004) argue that VERUM is present in English *yes/no* questions with *n't* (e.g. (29)), and that VERUM is responsible for the well-known bias in these questions. Specifically, incorporating Neg into C enables Neg to scope over VERUM:

(29) Isn't there a vegetarian restaurant here?   (Ladd 1981, Romero & Han 2004)
     [CP [C [T is$_i$ [Neg n't$_j$]] VERUM] [TP there t_i [NegP t_j [vP a vegetarian restaurant here]]]]
     Q > NEG > VERUM > *p* 'It's not for-sure that we should add to CG that there's a vegetarian restaurant here; it is for-sure that we should add to CG that there's a vegetarian restaurant here.'

The partition in (29) is unbalanced—FOR-SURE versus all other degrees of certainty—so the question is used in contexts when the speaker is biased towards believing that there *is* a vegetarian restaurant nearby.
     If Romero & Han are correct that Neg and VERUM interact in this way when Neg raises to C, then we have a plausible explanation for why Neg-to-C is inhibited in PHQs:[4]

(30) **Neg-to-C is dispreferred in PHQs because it enables NEG to scope over VERUM.**
     a. *Intended:* VERUM > NEG 'By what means should we for-sure add ~*p* to CG?'
     b. *Unintended:* NEG > VERUM 'By what means is it not for-sure that we should add *p* to CG?'

If Neg is left *in situ* below C[VERUM], this ambiguity is avoided.

(31) [CP how [C [T does$_i$] **VERUM**] [TP John t_i [NegP **not** [vP love this song]]]]   VERUM > NEG

     Further support for this proposal comes from negative MHQs. Recall that negative MHQs (contracted and uncontracted) are degraded for independent reasons—because of the weak-island effects that arise when *how* is interpreted under negation (32). But as noted by Kroch (1989), these weak-island effects can be removed by contextual conditions (33):

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[3] The fact that PHQs allow embedding at all is noteworthy, since this behavior suggests that they are 'regular' questions even though they are often used rhetorically (see Caponigro & Sprouse 2007, Cheung 2008 for more discussion). On the other hand, PHQs do not seem to be possible across *all* embedded contexts; e.g., changing the subject and tense of the main clause, or raising *how* across a clause boundary for a long-distance construal, makes the PHQ reading difficult if not impossible (? *Sarah asked how John was still working on that paper*; ? *How do you think John is still working on that paper?*). This could be because VERUM, as a conversational operator, is semantically best-suited for root contexts (but still possible in embedded contexts if the semantics of the main clause are compatible with the conversational operator, e.g. *I'm wondering, I want to know*).

[4] Romero & Han (2004) actually claim (following Ladd 1981) that (29) is ambiguous between a NEG > VERUM reading and a VERUM > NEG reading (i), the latter being available in a context where the speaker is biased towards believing that there is *not* a vegetarian restaurant nearby (ii):

    i.   Q > VERUM > NEG > *p* 'It is for-sure that we should add to CG that there's not a vegetarian restaurant here; it is not for-sure that we should add to CG that there's not a vegetarian restaurant here.'

    ii. A: I know you don't eat meat, so we'll have to take a taxi to dinner.
        B: Oh really, isn't there a vegetarian restaurant around here?

Sailor (2013), however, shows that the VERUM > NEG reading is unavailable for many American English speakers. If VERUM > NEG *is* possible for some speakers after Neg-to-C, then we would expect this to be the case in their PHQs as well. The degraded status of e.g. *?*How hasn't it snowed yet?!* would then be attributed to a desire to avoid ambiguity, rather than true ungrammaticality—which could square with the fact that some speakers find PHQs with *n't* marginally acceptable. This question awaits further investigation.

(32) A: How did John not fix that chair?
      B: # With a hammer.

(33) A: How did John fix that chair?
      B: He used so many different tools, you'd be better off asking: how *didn't* he fix it?

Notice that Neg-contraction is fine in (33)B. This is just what we expect under the current analysis, since there is no VERUM to inhibit Neg-to-C raising in MHQs.

4. Conclusion

This paper presented a syntactic and semantic analysis of the PHQ (propositional surprise *how* question, e.g. *How is Sarah still asleep?*). I argued that unlike manner/instrument *how* questions, PHQs have (i) a VERUM operator in C, and (ii) *how* initially merged in Spec,CP (rather than moving from vP). This analysis enabled us to:

- account for the absence of negative-island effects and family-of-questions readings in PHQs;
- provide a compositional analysis of the PHQ as a request for cognitive resolution—i.e., for some new information that might make *p* less surprising and therefore easier to add to CG;
- treat PHQs as regular information-seeking questions (rather than e.g. exclamatives);
- treat *how* as having essentially the same semantics in PHQs as in other *how* questions; and
- explain the degraded status of Neg-contraction in PHQs.

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