

A slightly different version will appear in *Linguistic Inquiry*.

The nominal nature of *where*, *when*, and *how*: Evidence from free relatives*

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In this squib, we argue that the wh-words *where*, *when*, and *how* are inherently nominal, rather than prepositional, though they are NPs with a peculiar property: they are always base-generated as the complement of a preposition (P), which is often silent. Our main evidence comes from the behavior of embedded non-interrogative wh-clauses known as *free relatives* (FRs). We show that this behavior can be easily accounted for if *where*, *when*, and *how* are inherently nominal. We bring further empirical support to our proposal by extending it to wh-interrogatives and by discussing the similarities between FRs and the NPs that have been called *bare-NP adverbs* or *adverbial NPs* (Emonds 1976, 1987; Larson 1985; McCawley 1988). We also show that potential alternative accounts which make different assumptions about the nature of *where*, *when*, and *how* are unable to account for the data.

1. Two puzzles

FRs exhibit two puzzling syntactic/semantic properties when introduced by wh-words like *where*, *when*, or *how* (henceforth, w/w/h FRs). First, they have the same distribution and interpretation as either PPs or NPs (first noticed by Bresnan & Grimshaw 1978: §5).¹ What looks like the very same w/w/h FR can be replaced and paraphrased with a PP or an NP, depending on the matrix clause. Examples of w/w/h FRs are given in (1) - (3). Example a. of each pair shows a bracketed w/w/h FR occurring as the complement of the matrix predicate, as well as its NP paraphrase. Example b. shows the same w/w/h FR occurring as an adjunct of the matrix clause, as well as its PP paraphrase.

- (1) a. Lily adores $\left\{ \begin{array}{l} [\text{FR } \textit{where} \text{ this very tree grows } [\text{PP } __]]. \\ [\text{NP } \textit{the place} \text{ in which this very tree grows } [\text{PP } __]]. \end{array} \right.$
- b. Lily napped $\left\{ \begin{array}{l} [\text{FR } \textit{where} \text{ this very tree grows } [\text{PP } __]]. \\ [\text{PP } \textit{in the place} \text{ in which this very tree grows } [\text{PP } __]]. \end{array} \right.$
- (2) a. Lily dreaded $\left\{ \begin{array}{l} [\text{FR } \textit{when} \text{ Jack had to go } [\text{PP } __]]. \\ [\text{NP } \textit{the time/moment} \text{ that Jack had to go } [\text{PP } __]]. \end{array} \right.$
- b. Lily cried $\left\{ \begin{array}{l} [\text{FR } \textit{when} \text{ Jack had to go } [\text{PP } __]]. \\ [\text{PP } \textit{at the time} \text{ that Jack had to go } [\text{PP } __]]. \end{array} \right.$
- (3) a. Lily loathes $\left\{ \begin{array}{l} [\text{FR } \textit{how} \text{ all thieves work } [\text{PP } __]] - \textit{secretly}. \\ [\text{NP } \textit{the way} \text{ that all thieves work } [\text{PP } __]] - \textit{secretly}. \end{array} \right.$
- b. Jack works $\left\{ \begin{array}{l} [\text{FR } \textit{how} \text{ all thieves work } [\text{PP } __]] - \textit{secretly}. \\ [\text{PP } \textit{in the way} \text{ that all thieves work } [\text{PP } __]] - \textit{secretly}. \end{array} \right.$

Another puzzle, which has not been previously noticed, concerns the nature of the gap within w/w/h FRs. Despite the syntactic behavior of the w/w/h FR with respect to the matrix verb, the gap inside the w/w/h FR is always a PP gap, as shown by the labeled gaps in (1)-(3). Whether the whole w/w/h FR behaves like a PP (4)a or an NP (5)a, an NP gap cannot be licensed within it – even if the predicate in the w/w/h FR selects for an NP. Notice that an NP gap can be easily licensed within the corresponding headed relatives, independent of the properties of their heads ((4)b and (5)b).

- (4) a. ?* Lily always naps $[\text{FR } \textit{where/when/how} \text{ Jack despises } [\text{NP } __]]$.
- b. Lily always naps $[\text{PP } \{\textit{in the place}\}/\{\textit{at the time}\}/\{\textit{in the way}\} \text{ that Jack despises } [\text{NP } __]]$.

(5) a. ?* Lily adores [_{FR} *where/when/how* Jack despises [_{NP} ___]].

b. Lily adores [_{NP} {*the place*}/{*the time*}/{*the way*} that Jack despises [_{NP} ___]].²

An important exception to the ban on NP gaps within w/w/h FRs is that an NP gap can be licensed as the complement of an overt P in a w/w/h FR that is introduced by *where* (in §3.3, we discuss similar examples introduced by *when*). For example, the w/w/h FR introduced by *where* in (6)a allows for an NP gap in the complement position of the P *past*, which can only take NP complements. The whole FR behaves like an NP - it can be replaced and paraphrased with the bracketed complex NP in (6)b. Similarly, the w/w/h FR in (7)a licenses an NP in the complement position of the P *through*, though it behaves like a PP, as shown in (7)b.

(6) a. Jack disliked [_{FR} *where* we just ran [_{PP} [_P **past**] [_{NP} ___]]] – it smelled funny.

b. Jack disliked [_{NP} the place we just ran [_{PP} [_P *past*] [_{NP} ___]]] – it smelled funny.

(7) a. Lily lives [_{FR} *where* we have to fly [_{PP} [_P **through**] [_{NP} ___]]] on our way to Vancouver].

b. Lily lives [_{PP} in the area we have to fly [_{PP} [_P *through*] [_{NP} ___]]] on our way to Vancouver].

To sum up, w/w/h FRs have the same distribution as PPs or NPs, yet only a PP gap seems to be licensed inside them, unless an overt P occurs. In that case, an NP gap is licensed in the complement position of the overt P.

2. The proposal

We first discuss the proposed syntactic structures for the examples in (1) above. In (1)a, a *where* FR occurs as the complement of an NP-selecting matrix predicate. The crucial components of the syntactic structure we argue for are highlighted in (8).

(8) Lily adores $[_{CP} [_{NP} \text{where}_m]]$ this very tree grows $[_{PP} [_{P} e] [_{NP} t_m]]$.

For simplicity, we assume w/w/h FRs are bare complement clauses (CPs) without any overt or covert external element or head, though the syntactic nature of FRs is controversial and has generated considerable debate (see Grosu (2003) and van Riemsdijk (2005) for an extended overview). Crucial for our purposes is the PP inside the FR. We assume (i) that the VP of the FR is modified by the PP inside the FR, which has a silent P head e and a wh-trace t_n as its NP complement, and (ii) that the wh-word $where_n$ is the NP that has moved from the complement of PP to the Spec of CP of the FR, thereby stranding its silent P. The whole FR occurs as the complement of the matrix predicate *adores*, which selects for an individual-denoting complement. How does a FR end up denoting an individual? Roughly, the IP of a FR denotes a set of (singular and plural) individuals, as the result of lambda-abstrating over the variable introduced by the wh-trace. The ontology is assumed to include individuals like locations/places, times/situations, and manners. In (8), *where* applies to the set of all individuals (people, objects, places, times, and manners) that affect/modify the growth of ‘this very tree’ and returns the subset containing just the place in which ‘this very tree’ grows. When this wh-clause is interpreted as a FR (i.e. it occurs as the argument of a predicate like *adores* – and not of an interrogative predicate like *wonder*), a type-shifting operation applies that turns the set of individuals denoted by the wh-clause into its unique (maximal) individual. (See Jacobson (1995), Caponigro (2004), and Caponigro and Pearl (to appear) for the formal details of the semantic derivation just sketched.) We turn now to (1)b, in which what looks like the same FR as the one just discussed occurs as an adjunct to the matrix VP. The crucial components of our syntactic analysis are highlighted in (9).

(9) Lily napped [**PP₂ [P₂ e]** [_{CP} [_{NP} *where_m*]] this very tree grows [_{PP₁} [_{P₁} e] [_{NP} *t_m*]]]

The structure in (9) is almost identical to the structure in (8), except that now there is a second PP (PP₂, just after *napped*) with a silent preposition P₂. PP₂ is adjoined to the matrix VP and takes the CP of the FR as its complement. On the semantic side, the CP of the FR denotes what it denoted before: an individual, namely the place in which this very tree grows. This individual combines with the denotation of the silent P₂ to produce the denotation of a PP. This is why a FR like the one in (9) has the same distribution and interpretation as a PP. FRs introduced by *when* and *how* like those in (2) and (3) above can receive an analogous analysis.

To sum up, we have proposed that the wh-words *where*, *when*, and *how* are always NPs base-generated as the complement of a possibly silent P. It follows that w/w/h FRs always contain a PP whose head P is possibly silent and whose NP complement is the wh-trace of the wh-word that has moved to the Spec of CP of the FR, while the P is stranded. As such, these FRs behave always and only like NPs syntactically and semantically. We have argued that when it looks as if FRs behave like PPs, it is actually that the FRs are the complement of a PP with a silent head. This solves the first puzzle about the NP/PP behavior of w/w/h FRs. As for the second puzzle – the PP nature of the gap within w/w/h FRs – this is an artifact of the requirement for *where*, *when*, and *how* to be base-generated as complement of a P. The actual gap of a w/w/h FR is always an NP gap, since the moved wh-word is always an NP. This is clearly shown by examples (6) and (7) above, where the P head is overt. On the other hand, the P head is often silent and the combination of a silent P and an NP wh-trace as its complement give the illusion of a PP trace (or gap).³

3. Further evidence

3.1. Overt Ps

We have argued that the *wh*-trace within the FR is always the complement of a P, and that the whole FR can be the complement of another P, though these two Ps are often silent. Nevertheless, there are cases where one or both of them are overt, as in (10)-(14). This directly supports our hypothesis of two distinct P heads.

- (10) Jack disliked [_{FR} where_m we just ran [_{PP} [_P **past**] [_{NP} *t_m*]]] – it smelled funny.
- (11) Lily lives [_{PP1} [_{P1} **near**] [_{FR} where_m we have to fly [_{PP2} [_{P2} **through**] [_{NP} *t_m*]]] on our way to Vancouver]].
- (12) Lily was sick [_{PP1} [_{P1} **from**] [_{FR} when_m Jack arrived [_{PP2} [_{P2} *e*] [_{NP} *t_m*]]]] [_{PP3} [_{P3} **to**] [_{FR} when_p he left [_{PP4} [_{P4} *e*] [_{NP} *t_p*]]]]].
- (13) Lily's schedule can't accommodate [when_m Jack needs the car [_{PP} [_P **by**] [_{NP} *t_m*]]]].
- (14) Lily knew that Jack was about to get upset based [_{PP1} [_{P1} **on**] [_{FR} how_m he was looking at her [_{PP2} [_{P2} *e*] [_{NP} *t_m*]]]]]

The FR in (10) is introduced by *where* and behaves like an NP. Our analysis predicts *where* to be base-generated as the complement of a P within the FR. In (10), the P is overtly realized as *past*. (11) shows both Ps overtly realized: the one whose complement position *where* was base-generated in (*P₂ through*) and the one that takes the whole FR as its complement (*P₁ near*). (12) shows two FRs that are both introduced by *when* and occur as the complement of an overt P (*from* or *to*). Notice that each instance of *when* has been base-generated as the complement of a silent preposition *e*, according to our analysis. The silent P is replaced by the overt P *by* in the FR introduced by *when* in (13). (14) shows a FR introduced by *how* that occurs as the complement of the overt P *on*.

We have been unable to find any example in which the trace of *how* can occur as the sister of an overt P. Although we do not have an account for this asymmetry of *how* with respect to *where* and *when*, we note two possibly related facts. First, a headed relative clause with the nominal *way* as its head, the most natural paraphrase for a *how* FR, can be optionally followed by the complementizer *that* or, crucially, by the relative pronoun *which* preceded by the P *in*. No other P can occur between *way* and *which* (15).

(15) Lily knew that Jack was about to get upset based [[on] [the way
 [(that)/(in/*by/*with which) he was looking at her]]].

Second, the overt P *in* never occurs as the sister of the trace of *where*, *when*, or *how*. Suppose, for whatever reason, *in* is the only overt P in English compatible with very general manner expressions like *way*, but at the same time is incompatible with *where*, *when* and *how*. We might then expect no overt P to ever take the trace of *how* as its complement.

We note also that Ps like *past*, *through*, or *by* can take an NP complement, but not a PP one (*past the house* vs. **past at the house*; *through the grass* vs. **through on the grass*; *by the store* vs. **by at the store*). Since *where* and *when* can be base-generated as the complement of Ps like *past*, *through*, or *by* it follows that they must be NPs, rather than PPs. We extend the same conclusion to *how* by analogy.

3.2. *wh*-interrogative clauses

We have proposed that *where*, *when*, and *how* are always NPs and occur as the complement of a P in all the *wh*-constructions they introduce. Therefore, we predict them to be base-generated as the complement of overt/silent Ps in *wh*-interrogatives as well as FRs. This prediction is borne out, as shown by the *wh*-interrogatives introduced by *where*

in (16) and (17) and the one introduced by *when* in (18).⁴

(16) Where_m did we just run [PP [P **past**] [NP *t_m*]]?

(17) Where_m do we have to fly [PP [P **through**] [NP *t_m*]] on our way to Vancouver?

(18) When_m does Jack need the car [PP [P **by**] [NP *t_m*]]?

Also, if no overt P is present, interrogatives introduced by *where*, *when*, and *how* cannot license NP gaps ((19)a); only what looks like PP gaps on the surface are allowed ((19)b).

This is the same behavior that we observed in w/w/h FRs.

(19) a. * Where/when/how did Lily despise [NP ___]?

b. Where/when/how did Lily sleep [PP ___]?

3.3. Adverbial NPs

There are a restricted number of phrases in English that look like NPs and exhibit the same double syntactic/semantic behavior as FRs. Larson (1985) labels them *bare NP-adverbs*, while McCawley (1988) calls them *adverbial NPs*. Like w/w/h FRs, adverbial NPs behave like NPs or PPs and are restricted to the same semantic areas: time (20), location (21), or manner (22) (all a. examples from Larson 1985).

(20) a. John arrived [that day]/[Sunday]/[yesterday]. *PP-like*

b. [That day]/[Sunday]/[Yesterday] was fantastic. *NP-like*

(21) a. You have lived [few places that I cared for]/[there]. *PP-like*

b. [Few places that I cared for]/[There] are/is really beautiful. *NP-like*

(22) a. You pronounced my name [that way]/[every way one could imagine]. *PP-like*

b. [That way]/[Every way one could imagine] was not feasible. *NP-like*

NPs from other semantic areas do not exhibit the same behavior (23).

(23) a. Jack came [her/Lily/the person he is in love with]. **PP-like*

(cf. Jack came for/with/after [her/Lily/the person he is in love with].)

b. [She/Lily/the person he is love with] does not really like him. *NP-like*

Emonds (1976, 1987), McCawley (1988) argue that adverbial NPs are NPs behaving like PPs by virtue of a silent P that takes the NP as its complement.⁵ The independent postulation of silent Ps for a different data set exhibiting the same semantic restrictions observed in the FRs here further supports our proposal. Also, our proposal assumes that only *where*, *when*, and *how* can be base-generated as the complement of silent Ps, to account for the fact that FRs introduced by *who* and *what* only behave as NPs ((24)-(25)).

(24) a. Lily adores [_{FR} what Jack despises]/[_{NP} the things Jack despises].

b. Lily works * [_{FR} what Jack despises]/[_{PP} on the things Jack despises].

(25) a. Lily won't marry [_{FR} who the king chooses]/[_{NP} the person the king chooses].

b. Lily will dance * [_{FR} who the king chooses]/[_{PP} with the person the king chooses].

4. Problems with alternative accounts

4.1. Ambiguity approach

A potential alternative to our proposal could be to assume that *where*, *when*, and *how* are syntactically ambiguous: they are listed in the lexicon as both NPs and PPs. Bresnan and Grimshaw's (1978) proposal can be seen as an instantiation of this approach, since it assumes *where*, *when*, and *how* are inserted in the syntactic tree as either NP or PP with a missing/deleted P. There are at least two problems with this kind of approach. First, if *where*, *when*, and *how* were listed in the lexicon as both NPs and PPs, then they should license either NP or PP gaps in the clause they introduce. But this prediction is not borne out, since they license only PP gaps (recall examples (4) and (5) and related discussion).

Second, we would be dealing with the idiosyncratic behavior of three lexical items that are members of the same class (wh-words) and exhibit very similar syntactic behaviors (introduce wh-clauses, license both NPs and PP gaps, etc.). Also, we observe the same pattern in other languages with w/w/h FRs like Italian (although a careful crosslinguistic investigation is needed). This kind of (crosslinguistic) systematic ambiguity appears more like restating the generalization than an actual explanation.

4.2. PP approach

An alternative approach would be to assume that *where*, *when*, and *how* are always PPs, rather than being ambiguous. Unlike the ambiguity account, this approach would not postulate any systematic ambiguity and would easily account for why only PP-gaps are licensed within w/w/h FRs: if *where*, *when*, and *how* were always PPs, they would move and leave a PP trace within the FR, rather than an NP trace. Still this approach must say something special about those cases in which *where* and *when* occur with overt Ps that take only NP complements (see §3.1 above). Also, it runs into a semantic problem, which is common to all approaches that assume wh-PPs with no internal structure. The moved wh-PP leaves a PP trace over which λ -abstraction applies and returns a set of PP-denotations. No independently motivated type-shifting rule is available for this kind of set. Therefore, we end up with a semantic type mismatch between a FR denoting a set of PP-denotations and its matrix clause, which cannot combine with a set of PP-denotations, but only with one of its members.

4.3. Pied-piping approach

A third potential alternative could have the following properties: like ours, it assumes that *where*, *when*, and *how* are always base-generated as the NP complement of a possibly

silent P; unlike ours, it assumes that whenever the whole FR behaves like a PP, this is due to the whole wh-PP moving to the Spec of CP, rather than just the wh-word. This approach replaces the stranding of the silent P in the FR with its pied-piping, so that there would be no need to postulate the other silent P, which, according to our proposal, takes the whole FR as its complement. Still, this approach also faces problems. If the P head reconstructed back into its base-generated position or were stranded in its base-generated position, then the proposal would be missing the P that takes the whole FR as its complement, which we just saw to be necessary in order to account for w/w/h FRs that behave like PPs. Crucially, the reconstructed P – as any reconstructed material – would be interpreted just in its base-generated position, unless special assumptions are made that would require P to be interpreted both in its base-generated position and its moved one. But even with this ad-hoc solution, the pied-piping approach would not work. In fact, it would predict that the PP within the FR and the whole FR should always be interpreted as the same kind of PP, since their interpretation would depend on the very same silent or overt P. This prediction is not borne out. (26)a shows an example of a FR that, as a whole, is interpreted as a directional PP, given the selectional requirement of the matrix predicate *went*. The PP gap within the FR is interpreted as a locative PP, since the FR predicate *stayed* can take a locative PP, but not a directional one. This is made clear by the paraphrase in (26)c, which has to make use of two different Ps (underlined *to* and *at*) in order to render the meaning of (26)a. The predicted incorrect LF would have just the same P *at* in both positions, as shown in (26)b.

(26) a. Lily just went [_{FR} where Jack stayed last year on vacation].

b. *Predicted incorrect LF of a:*

Lily just went [_{FR} [at where_m] Jack stayed last year [at t_m]on vacation]

c. *Paraphrase of a:*

Lily just went [_{PP} to the place at which Jack stayed last year on vacation].

The need for two different P heads can be made also for FRs that behave like PPs as a whole and contain an overt stranded P like (27)a. If the LF in (27)b is assumed, in which a copy of the stranded preposition is also pied-piped, then it would be predicted that the wh-PP and the whole FR should behave like the same kind of PP, i.e. a directional PP. This would be incorrect since while (27)a is understood as (27)c, in which the higher P is equivalent to the locative Ps *in* or *at*, while only the lower one is the directional P *to*.

(27) a. Lily lives [_{FR} where_m Jack is about to go [_{PP} to [_{NP} t_m]]].

b. *Predicted incorrect LF of a:*

Lily lives [_{FR} [_{PP} to where]_j Jack is about to go [_{PP} to [_{NP} t_m]]].

c. *Paraphrase of a:*

Lily lives [_{PP} in/at [_{NP} the place where_m Jack is about to go [_{PP} to [_{NP} t_m]]]].

Data like those in (26) and (27) support our conclusion that two different P heads are needed in any proposal that can account for w/w/h FRs that behave like PPs.

5. Conclusions

We have argued that the wh-words *where*, *when*, and *how* are NPs that are always base-generated as the complements of (possibly silent) Ps and then moved to Spec of CP, which goes against the common assumption that views them as PPs or Adverb Phrases. The main evidence comes from the syntactic and semantic properties of FRs (and wh-interrogatives) that are introduced by *where*, *when*, or *how*. We supported this proposal with evidence from adverbial NPs, which exhibit the same semantic restriction

and have independently received a similar analysis. Our proposal crucially hinges on the existence of silent Ps in the grammar. We think that the behavior of wh-clauses introduced by *where*, *when*, and *ho* further support silent Ps and may help future research concerning the precise nature and licensing conditions of silent (see Caponigro and Pearl (to appear) for some preliminary remarks).

Notes

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¹Bresnan and Grimshaw (1978: §5) only discuss examples of FRs introduced by *where* and *when*, without mentioning FRs introduced by *how*.

² An anonymous reviewer judged our example *Lily adores the way Jack despises* extremely marginal (“???”). We agree it requires some contextual help. If Lily adores that way (of singing), while Jack despises it, then *Lily adores the way (of singing) (that) Jack despises*.

³ Richard Larson and an anonymous reviewer have pointed out to us that we argue that silent Ps are always stranded. Though this is not particularly problematic for a language like English that allows for preposition stranding pretty extensively, the majority of languages that have w/w/h FRs do not allow for preposition stranding (e.g. Italian). Unfortunately, we are still far from a deep understanding of preposition stranding and why it is so rare across languages. Until then, preposition stranding cannot be used to

make a point against or in favor of our proposal. For instance, suppose that the ban on preposition stranding turns out to be phonological in nature (maybe due to the clitic-like nature of Ps in many languages). Then, it would not be surprising that silent Ps are always stranded, since they lack any phonological content by definition.

⁴ See Huang (1982:536) for a similar point.

⁵ Larson (1985) argues that adverbial NPs are syntactically NPs with the (lexical) property of self-assigning Case, but Emonds (1987) and McCawley (1988) convincingly show that Larson's proposal is empirically and theoretically problematic.

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