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Coordinated *Wh*-Questions in English: A Corpus-Based Perspective*

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Park, Youn-Gyu and Jong-Bok Kim. 2025. **Coordinated *Wh*-Questions in English: A Corpus-Based Perspective.** *Korean Journal of Linguistics,* 50-1, 1-32. English coordinated *wh*-questions (Coord-WhQs) allow two or more *wh*-phrases to be licensed in the sentential initial position (e.g., *When and why did you see Kim?*), inducing a *single-pair* reading. While English typically does not permit two wh-phrases to appear in the sentential initial position (i.e., **When why did you see Kim?*), multiple *wh*-phrases are allowed to be licensed in Coord-WhQs when joined by a conjunction. Previous studies assume that the *wh*-phrases of Coord-WhQs share their syntactic structure. Our comprehensive corpus investigation challenges this '*structure-sharing*' strategy, suggesting that a more viable one is to directly license English Coord-WhQs with no derivational processes. **(The University of Texas at Austin, Kyung Hee University)**

Key words: English Coordinated *Wh*-Questions, Corpus Investigation, Filler-Gap Dependency Relations, Coordination, Structure-sharing

1. Introduction

In English, there are two possible ways to license more than one *wh*-phrase in a single interrogative: Multiple *wh*-questions (Multiple-WhQs; (1a)) and Coordinated *wh*-questions (Coord-WhQs; (1b)):

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(1) a. *Why* did you see Kim *when*?
b. *Why and when* did you see Kim? (Citko 2013: 6)

In Multiple-WhQs like (1a), one *wh*-phrase appears in the sentential initial position, while the other remains *in-situ*. In contrast, Coord-WhQs like (1b) allows both *wh*-phrases to appear in the sentential initial position, necessarily coordinated by a conjunction (i.e., *Why *(and) when did you see Kim?*) (Bîlbîie and Gazdik 2012; Citko 2013; Citko and Gračanin-Yüksek 2013, 2020).

This study focuses on the licensing patterns of English Coord-WhQs. Previous studies report that Coord-WhQs and their *wh*-pairs are subject to complex pairing restrictions. However, it remains unclear whether these restrictions hold in authentic usage. For instance, earlier studies assume that a subject wh-phrase cannot conjoin with a non-subject *wh*-phrase (Browne 1972; Citko 2013, among others):

(2) * *Who and with what* broke the window? (Browne 1972: 223)

In (2), the *wh*-phrases consist of a subject *wh*-word *who* and an instrument *wh*-phrase *with what*. The sentence is considered ungrammatical due to the pairing of *wh*-phrases. However, there are cases where two phrases with different grammatical functions can be conjoined (Whitman 2002a, b):

(3) It is not known exactly *why or who* burned the village. (Whitman 2002a: 82)

Such examples call for a more detailed investigation of the licensing conditions for Coord-WhQs. This paper aims at examining whether the restrictions reported by previous studies are valid for describing authentic usage data of these constructions from various corpora.

Another question concerns the syntactic structures of Coord-WhQs. The derivation-based approaches typically assume that the conjoined *wh*-phrases "*share*" their syntactic structure (Merchant 2001; Gribanova 2009; Lipták 2011; Citko and Gračanin-Yüksek 2020, among others):

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(4) a. *What and when* did you eat?
b. [*What* (did you eat)] and [*when* did you eat]

According to this "*structure-sharing*" strategy, the Coord-WhQ in (4a) consists of two clauses, with the first *wh*-phrase (wh_1) sharing its clausal structure with the second *wh*-phrase (wh_2), as shown in (4b). However, this approach cannot explain certain authentic cases, such as:

(5) a. *Why and what* would we be fighting for? (COCA 1990 NEWS)
b. [**Why* would we be fighting for] and [*what* would we be fighting for]

Under the derivation-based approaches, the Coord-WhQ in (5a) would be derived from an ungrammatical structure such as (5b). Then, how a sentence can be acceptable despite its underlying structure being ungrammatical? We argue that this calls for an alternative analysis.
The final question we can have has to do with the semantic properties of Coord-WhQs. These constructions receive a single-pair interpretation (Lipták 2011; Gračanin-Yuksek 2017, among many others):

(6) Q: *When$_i$ and where$_j$* were the children examined?
A: On Monday$_i$ in the school$_j$. (Bîlbîie and Gazdik 2012: 3)
POSSIBLE ANSWERS:
$\langle\{\langle \text{temporal}_1\text{: place}_1\rangle, \#\langle \text{temporal}_2\text{: place}_2\rangle, \ldots\}\rangle$

In (6), the Coord-WhQ can only be answered by a paired answer linked to a unique event (e.g., $\langle \text{temporal}_1, \text{place}_1\rangle$), rather than a list of multiple situations (i.e., a *pair-list* reading; e.g., $\langle \text{temporal}_1, \text{place}_1\rangle$; $\langle \text{temporal}_2, \text{place}_2\rangle$, ...). This semantic property is unusual, as Multiple-WhQs can be answered with either a *single-paired* or a *pair-listed* propositions.

In order to answer these three questions, this study conducts a comprehensive corpus investigation of Coord-WhQs and discusses theoretical implications from the authentic data. In the following sections, we first introduce the linguistic properties and restrictions related to English Coord-WhQs in Section 2. Section

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3 reviews previous derivation-based analyses, focusing on the structure-sharing strategy. Section 4 and 5 demonstrate the findings from our corpus investigation and discussions on the theoretical implications drawn from the investigation. We argue that the structure-sharing derivation-base approaches is not adequate for analyzing English Coord-WhQs and then briefly suggest a discourse-based perspective as an alternative. Finally, Section 6 summarizes and concludes the paper.

2. Linguistic Properties of English Coord-WhQs

2.1. Syntactic Properties

Canonical wh-questions exhibit the filler-gap dependency relation, and so do Coord-WhQs in most cases.

(7) a. *What* did John put in the box? (Kim and Michaelis 2020: 246)
b. *What and where* did Kelly drink? (Gračanin-Yüksek 2017: 4)

In (7a), the *wh*-phrase what serves as the filler for the gap in the direct object position of *put*. On the other hand, the verb drink in (7b) takes multiple gaps, one of which is in the direct object position and the other in the modifier positions. Each *wh*-phrase serves as a filler, discharging their corresponding gaps, respectively.

Nonetheless, Coord-WhQs have its unique patterns in terms of their filler-gap dependency relations. For example, *p*-stranding is not permitted in Coord-WhQs. Consider the following examples (Gračanin-Yüksek 2017: 6):

(8) a. About whom and when did Bob speak?
b. * *Whom and when* did Bob speak about?

The wh_1 *whom* serves as a filler for the gap in the prepositional object of *about* in both sentences, so their dependency relations seem to be satisfied.

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However, the sentence in (8b) is ruled out simply due to the *p*-stranding restriction on English Coord-WhQs.

Moreover, English *wh*-questions canonically exhibit the superiority effect between *wh*-phrases, which usually fades in Coord-WhQs (Gračanin-Yüksek 2017; Potter and Frazier 2021, among others). First, consider the following Multiple-WhQ examples:

(9) a. *Who* saw *what*?
b. **What* did *who* see? (Ginzburg and Sag 2000: 247)

In (9), the two Multiple-WhQs have different acceptabilities because of the superiority of the *wh*-phrases; the direct object *what* cannot precede the subject *who*. Now, compare to the following Coord-WhQs:

(10) a. *Why and what* did you eat?
b. *What and why* did you eat? (Gračanin-Yüksek 2017: 6)

The ordering of the two *wh*-phrases *why* and *what* in (10a) seem to violate the superiority effect (e.g., **Why did you eat what?*). Nonetheless, the ungrammaticality is resolved in Coord-WhQs.

2.2. Combinatorial Restrictions on *Wh*-pairs

In Coord-WhQs, *wh*-phrases can violate the Law of Coordination of Likes (LCL) (Bîlbîie and Gazdik 2012, among others).

(11) a. Let me know *if and when* you see John.
b. *Who and where* did you teach?

In (11a), the conjunction coordinates the complementizer if and the adverb when, syntactically violating the LCL. In (11b), the Coord-WhQ exemplifies the semantic violation of the LCL: the wh1 who with the semantic role of THEME is conjoined with the wh2 where with that of LOCATION.[1]

Despite of this less restrictive coordination, previous studies report that there

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are restrictions on *wh*-pairs. First, they predict that no subject *wh*-phrase can be paired with a non-subject *wh*-phrase in English (Browne 1972; Gračanin-Yüksek 2017).

(12) a. * *Who and what* bought? (Grimshaw 1978: 3)
b. * *Who and with what* broke the window? (Browne 1972: 223)

In (12), the sentences are ruled out as the subject wh_1 *who* is conjoined with the non-subject wh_2 *what*. However, the prediction can be borne out. For instance (Whitman 2002b: 3):

(13) a. Does anyone have any idea *where or who* would be able to locate parts?
b. So *who*$_i$ *or why* would **you**$_i$ even need this thing.

In (13a), although a subject wh_2 *who* is conjoined with a non-subject wh_1 *where*, the sentence is acceptable. In (13b), we can see that, if the a *wh*-phrase (i.e., *who*) is licensed in the wh_1, a pronominal expression in the subject position of the verb (i.e., *you*) can resolve the unacceptability (Whitman 2002b).[2] Note that the sentence gets significantly degraded without overt pronominal subject (e.g., * ***Who or why*** *would even need this?*).

The pairing restrictions become more complex when considering the transitivity of verbs. Previous studies claim that English Coord-WhQs are sensitive to the type of transitive verbs inside their gapped clause. If the verb is an optionally transitive (e.g., *eat*, *sing*, *teach,* ...), a Coord-WhQ can freely coordinate *wh*-phrases (Whitman 2002a, b; Lipták 2011; Bîlbîie and Gazdik 2012; Citko and Gračanin-Yüksek 2020; Potter and Frazier 2021):

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[1] In Giannakidou and Merchant (1998), sentences like (11a) are described as 'reverse sluicing' where *if* is derived via elliptical deletion operation. For further details, see Giannakidou and Merchant (1998) and Ha (2008).

[2] Such pronominal expressions behave similar to resumptive pronouns but differ in specific syntactic and semantic properties.

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(14) a. *When and what* did John **eat**?
b. *What and when* did John **eat**? (Potter and Frazier 2021: 356)

In (14), the *wh*-phrase *when* serves as a modifier and *what* as a complement (a direct object) of the verb *eat*. Both the MOD(ifier)-COMP(lement) and COMP-MOD *wh*-pairs are acceptable, since the verb eat is an optionally transitive, In contrast, obligatorily transitives (e.g., *fix*, *devour*, ...) limit the possible combinations of *wh*-phrases (Potter and Frazier 2021: 357):

(15) a. *When and what* did John **fix**?
b. * *What and when* did John **fix**?

In (15), the transitivity of verb fix allows the MOD-COMP combination, while the MOD-COMP order is blocked (Citko 2013; Citko and Gračanin-Yüksek 2020).

Lastly, previous studies claim that verbs with multiple complements (e.g., ditransitives) cannot be licensed in any Coord-WhQ cases (Citko 2013; Potter and Frazier 2021).

(16) a. * *What and where* did you **put**? (Citko and Gračanin-Yüksek 2020: 3)
b. * *What and to which students* did James **give**? (Potter and Frazier 2021: 356)

The ditransitives take a COMP-COMP *wh*-pair in (16a), and a COMP-MOD *wh*-pair in (16b). The verbs *give* and *put*, which require more than one complements, cannot be licensed even if the filler-gap dependencies seem to be satisfied (Browne 1972; Potter and Frazier 2021).

2.3. *Single-Pair* Interpertation and Coord-WhQs

In many languages including English, Multiple-WhQs can induce both *single-pair* and *pair-list* readings, whereas Coord-WhQs most naturally receive a *single-pair* interpretation (Lipták 2011; Citko and Gračanin-Yüksek 2020, among others):

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(17) a. Q : *Who* admires *whom* in this department?
A : Miller admires Brendan.
A' : Miller admires Brendan; Sigmund admires Carl...
(Ginzburg and Sag 2000: 143)
b. Q : *When and where* were the children examined?
A : On Monday in the school. (Bîlbîie and Gazdik 2012: 21)
A' : #Mary on Monday at school and John on Friday at home.

The *single-pair* reading of Coord-WhQs restricts their interpretation to propositions linked to a single, unique event as in (17b), whereas Multiple-WhQs, as in (17a), can accommodate multiple, *pair-listed* events, as in (17a).

3. Previous Analyses

The derivation-based approaches commonly claim that Coord-WhQs are derived from underlying syntactic structure. Based on their core assumptions, these approaches can be categorized into two main groups: mono- and bi-clausal analyses (Gribanova 2009; Lipták 2011; Citko and Gračanin-Yüksek 2013, 2020; Potter and Frazier 2021).

3.1. Mono-Clausal Analysis

The mono-clausal analysis assumes that both *wh*-phrases are generated in a single clausal source. Each *wh*-phrase then undergoes the sidewards movement to the clause initial position, merging with the remainder of the sentence (cf., Gribanova 2009; Potter and Frazier 2021):

(18) *What and where* did you eat?
a. You ate *what where*
b. [$_{\&'}$ and *where*$_i$] ([you ate what t_i])
c. [$_{\&P}$ *what*$_j$ [$_{\&'}$ and *where*$_i$]] ([you ate t_j t_i])
d. [$_{CP}$ [$_{\&P}$ *What*$_j$ and *where*$_i$] [IP did you eat t_j t_i]]?

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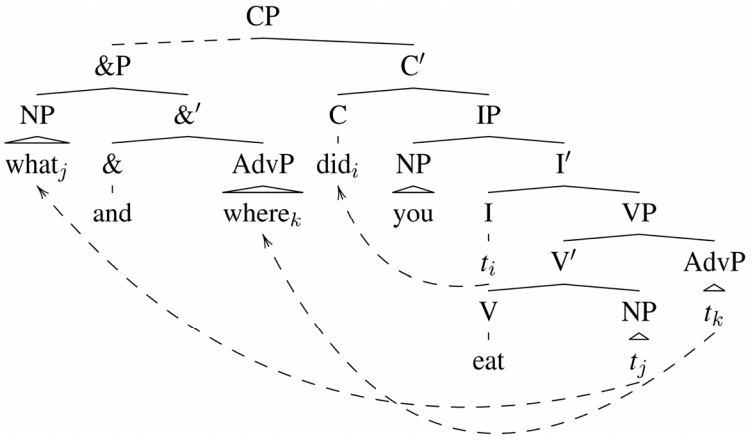
The derivation begins from the mono-clausal source, as in (18a). The *wh*-phrase *where* first undergoes the sidewards movement to the wh_2 position in a separate workplace. Then it conjoins with the semantically vacuous &P head *and*, as in (18b). The remaining *wh*-phrase *what* moves to the Spec, &P position as in (18c), serving as a wh_1. Finally, the *wh*-pair merges with the remaining IP structure, gaining its surface structure in (18d). The Coord-WhQ in (18) thus has the following structure:

(19)



This mono-clausal analysis can naturally induce the *single-pair* reading, as the two *wh*-phrases belong to a single CP. The conjunction head blocks the structural adjacency between the two *wh*-phrases, which, in turn, semantically derives a *single-pair* reading and prevents English Coord-WhQs from inducing a *pair-list* reading (Gribanova 2009).

However, this analysis struggles to account for Coord-WhQs that violates the superiority effect:

(20) a. *Where and what* did you eat?
b. *You ate *where what*

While the surface form in (20a) is acceptable, its potential underlying source in (20b) is infelicitous. This approach requires further demonstration to explain

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how Coord-WhQs with ungrammatical source structures can be felicitous in its surface structure (cf., Citko and Gračanin-Yüksek 2013).

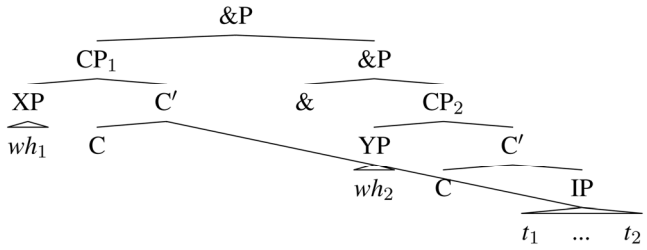
3.2. Bi-Clausal Analyses

The bi-clausal analyses assume that Coord-WhQs derive from a bi-clausal source (Giannakidou and Merchant 1998; Citko and Gračanin-Yüksek 2013, 2020). These analyses can be further divided into two subtypes: the bi-clausal (non)-bulk sharing analyses and the backward sluicing analysis.

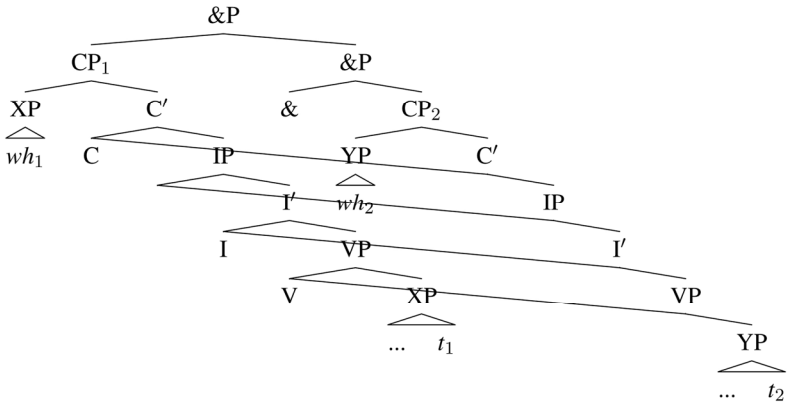
3.2.1. Bi-Clausal (Non)-Bulk Sharing Analysis

In the bi-clausal (non)-bulk sharing analysis, the two *wh*-phrases belong to two separate CPs, as in (21) (Citko 2013):

(21) a. **Bi-clausal bulk shairing analysis**



b. **Bi-clausal non-bulk shairing analysis**



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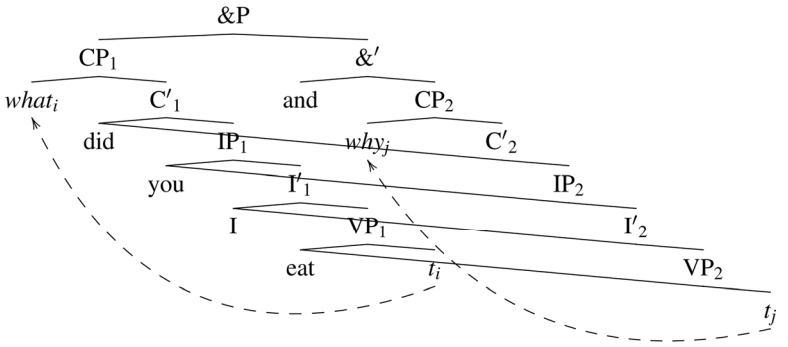
As shown, the bi-clausal bulk-sharing analysis claims that the CP_1 shares the whole structure of the second IP, whereas in the non-bulk sharing analysis, each of the clausal heads in the CP_1 shares its structure with the CP_2.

English Coord-WhQs are generally considered to follow the non-bulk sharing structure (For further details and discussion, see Lipták 2011; Citko and Gračanin-Yüksek 2020, among others). For instance (Citko and Gračanin-Yüksek 2020: 4):

(22) a. *What and when* did you eat?
b. [$_{\&P}$ [$_{CP}$ *What*$_i$ (did)$_k$ (you)$_l$ (eat)$_m$ t_i]
[$_{\&'}$ and [$_{CP}$ *when*$_j$ did$_k$ you$_l$ eat$_m$ t_j]]]?



Each *wh*-phrase is base-generated in separate CPs first. The CP_1 shares nodes selectively with the CP_2, and both *wh*-phrases independently undergoes the fronting operation to the Spec, CP position. The structure-sharing mechanism allows the CP_1 to retain its semantic meaning despite its structural deficit.

This analysis predicts the ungrammaticality of obligatorily transitives with a COMP-MOD *wh*-pair (Citko 2013: 305):

(23) a. **What and why* did you devour?
b. [$_{\&P}$ [$_{CP}$ *What* (did)$_i$ (you)$_j$ (devour)$_k$]
[$_{\&'}$ and [CP **why* did$_i$ you$_j$ devour$_k$ ____]]]?

In (23b), the CP2 is ungrammatical because the obligatorily transitive devour lacks its direct object.[3] However, this analysis undergenerates some

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Coord-WhQs. For instance, it struggles with the MOD-COMP wh-pairs with an obligatorily transitive, Coord-WhQs still can accept the MOD-COMP wh-pairs (cf., Lewis et al. 2012; Potter and Frazier 2021: 357):

(24) a. * *What and when* did John **fix**?
(= [$_{\&P}$ [$_{CP}$ *What* (did)$_k$ (John)$_l$ (fix)$_m$]
[$_{\&'}$ and [CP * *when* did$_k$ John$_l$ fix$_m$ ____]]]?)
b. *When and what* did John **fix**?
(= [$_{\&P}$ [$_{CP}$ *When* (did)$_k$ (John)$_l$ (fix)$_m$]
[$_{\&'}$ and [CP * *whau* did$_k$ John$_l$ fix$_m$ ____]]]?)

If each node of the CP_1 structure-shares each node of the CP_2, the CP_1 in (24b) would also be ungrammatical; the verb *fix* lacks its complement. Moreover, it fails to explain Coord-WhQs with subject *wh*-phrases conjoined with a non-subject *wh*-phrases (data from Whitman 2002b: 681):

(25) It is not known exactly *why or who* burned the village.
(= ... [$_{\&P}$ [$_{CP}$ * *Why* (burned)$_i$ (the village)$_j$]
[$_{\&'}$ or [CP *who* burned$_i$ the village$_j$]]])

In (25), although the surface structure is felicitous, the underlying structure for the MOD-SUBJ *wh*-pair would be ruled out because the CP_1 lacks a subject.

3.2.2. Backward Ellipsis Approach

The backward sluicing analysis assumes that the wh_1 is a remnant of a sluiced CP, conjoined with an intact interrogative containing the wh_2 (Giannakidou and Merchant 1998). This analysis can be supported by the parallelism between sluicing and Coord-WhQs: *swiping*, the sluicing-specific phenomenon (Merchant 2001). For instance (Lipták 2011: 160):

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[3] As for bi-clausal bulk-sharing analysis, since it shares the whole IP, including the main verb, it can easily accommodate the argument structure of the given verb. This analysis, however, can only be applied to languages that allow multiple *wh*-fronting, such as Polish, Romanian, Japanese, and Korean (see Lipták 2011; Citko and Gračanin-Yüksek 2013; Jung 2018).

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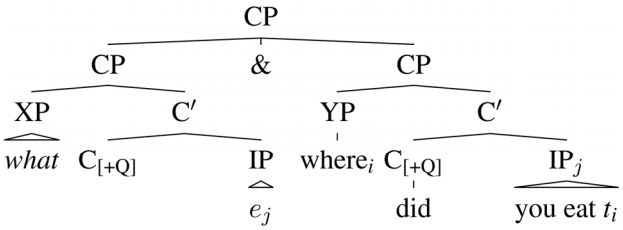
(26) a. * *Who from* did Mary receive a package?
b. Mary received a package, but I don't know *who from*.

The canonical *wh*-question in (26a) does not allow the *wh*-phrase *from who* to undergo swiping, whereas the sluicing in (26b) permits. Coord-WhQs permit its wh_1 to be realized in such form (Lipták 2011: 160):

(27) a. *Who from and why* did Mary receive a package?
b. *Who to and when* did Chomsky lecture about syntax?

In (27), the pied-piped wh_1s *from who* and *to who* are realized as *who from* and *who to*, supporting their claim. As for the structural retrieval of the ellipsis site for sluicing, Giannakidou and Merchant (1998) assume the sluiced IP of the CP_1 anaphorically refers to the structure of the CP_2 (cf. Chung et al. 1995; Merchant 2001):

(28) a. *What and where* did you eat? (Lipták 2011: 160)
b. [$_{CP}$ *What* [$_{IP}$ did you eat]] and [$_{CP}$ *where* did you eat]?



While this analysis offers some explanatory power, it inherits the empirical challenges of structure-sharing mechanism, including the aforementioned issues with obligatorily transitive verbs and subject wh-phrases.

Given the limitations of existing analyses, key questions remain: What is the proper structure of Coord-WhQs? Is structure-sharing an adequate framework for explaining these constructions? To answer to these questions, we conducted a corpus investigation to derive theoretical implications for the properties of Coord-WhQs.[4] Given the limitations of existing analyses, key questions remain: What is the proper structure of Coord-WhQs? Is

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structure-sharing an adequate framework for explaining these constructions? To answer to these questions, we conducted a corpus investigation to derive theoretical implications for the properties of Coord-WhQs.

4. A Corpus Investigation

4.1. Methodology

The corpus investigation was conducted using the online corpora, including COCA (Corpus of Contemporary American English, Davies 2008-), BNC (British National Corpus, Davies 2004), and COHA (Corpus of Historical American English, Davies 2010). To extract tokens of Coord-WhQs, the following search strings were employed:

(29) **Search strings:**[56]
  a. wh-words and wh-words
  b. PREP wh-words and
  c. wh-words and PREP
  d. how many¦much ((PREP) NOUN¦PRON) and wh-words

These strings were designed to capture examples like the following:

(30) a. *How and when* were you notified? (COCA 2002 SPOK)
  b. *From where and whom* does it draw its strength? (BNC CCH)
  c. *To whom and in what form* does it pass? (COHA 1861 ACAD)
  d. *How much and who* do you tip? (COHA 1993 MAG)

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4 Furthermore, the anaphoric e violates the Backward Anaphora Constraint, as it refers back to an antecedent following it (cf., Langacker 1969).

5 The string **y* indicates punctuation markers.

6 The followings are what '*wh*-words' indicates: '*what*¦*when*¦*where*¦*who*¦*whom*¦*which*¦*whose*¦*why*¦how.'

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The initial dataset comprised 1,381 tokens of Coord-WhQs. For each search string, 100 random examples were collected when possible; otherwise, the full set of results was used. Irrelevant data were manually excluded, such as:

(31) a. [...] exactly [*what* happened, *why*] *and what* the context was, etc. (COCA 2018 NEWS)
b. [...] telling the student *what*, *how and when* to study something. (COCA 1990 ACAD)

In (31a), although the token includes *wh*-phrase conjoined by and, the wh_1 *why* is not part of a Coord-WhQ; instead, it is a matrix sluicing construction related to the preceding clause *what happened*. We also excluded *wh*-phrases followed by a *to*-infinitive, as In (31b).

After filtering, the final dataset contained 546 tokens Coord-WhQs. Table 1 shows the distribution of wh-phrase combinations.

Table 1. Distribution of *Wh*-words in the *Wh*-pairs

***wh*-pair**		wh_2										**Totals**
		what	*when*	*where*	*which*	*who*	*whom*	*whose*	*why*	*how*	*how many/much*	
wh_1	what	0	5	30	1	8	1	3	2	7	8	65
	when	10	0	52	2	2	5	0	13	29	0	113
	where	15	29	0	0	11	2	0	7	20	0	84
	which	2	0	0	0	0	0	0	0	0	0	2
	who	34	1	28	0	0	0	0	0	6	3	72
	whom	4	0	0	0	0	3	0	0	0	0	7
	whose	1	0	0	0	0	0	0	0	0	0	1
	why	10	2	2	0	2	2	0	0	5	1	24
	how	20	35	17	1	6	6	0	52	1	0	138
	how many/much	29	0	6	1	4	0	0	0	0	0	40
Totals		125	72	135	5	33	19	3	74	68	12	546

The analysis of the dataset employed the following variables:

(32) a. **Grammatical functions and categorical combinations of *wh*-phrases:**
- [$_{wh1}$ SUBJ / COMP / MOD] x [$_{wh2}$ SUBJ / COMP / MOD]
- [$_{wh1}$ NP x $_{wh2}$ NP] / [$_{wh1}$ NP x $_{wh2}$ PP] ...

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b. **Verb subcategorization:**
   - optionally / obligatorily transitive, ditransitive, ...
c. **Structure-sharing of conjoined *wh*-phrases:**
   - [Complete / Partial] structure-sharing

These variables provide theoretical insights into the restrictions on *wh*-pairing, the structure-sharing mechanisms between conjoined *wh*-phrases in Coord-WhQs, and their overall syntactic structure.

4.2. Data Distribution and Findings

4.2.1. Grammatical Functions and Categorical Combinations of *Wh*-phrases in *Wh*-pairs

Based on the combination of the wh-phrases and their grammatical functions, the data were categorized into two groups: **match** and **mismatch**. In match cases, the grammatical functions of the two *wh*-phrases are identical:

(33) a. If so, *who and what* are to determine their policies? (COHA 1928 MAG)
b. *What and whose stories* do(n't) these canonized texts tell? (COCA 2015 ACAD)
c. *How and why* do they do it? (COCA 2013 ACAD)

In (33), the *wh*-phrases share identical grammatical functions: serving as a SUBJ, a COMP, and a MOD, respectively. Accordingly, they are tagged as SUBJ-SUBJ, COMP-COMP, and MOD-MOD *wh*-pairs.

In contrast, the mismatch cases involve *wh*-phrases with different grammatical functions:

(34) a. *What and how* do students learn? (COCA 2019 ACAD)
b. They come to your house, *when and what* do they do? (COCA 2003 SPOK)
c. *Where and why* are there differences? (COCA 2019 ACAD)

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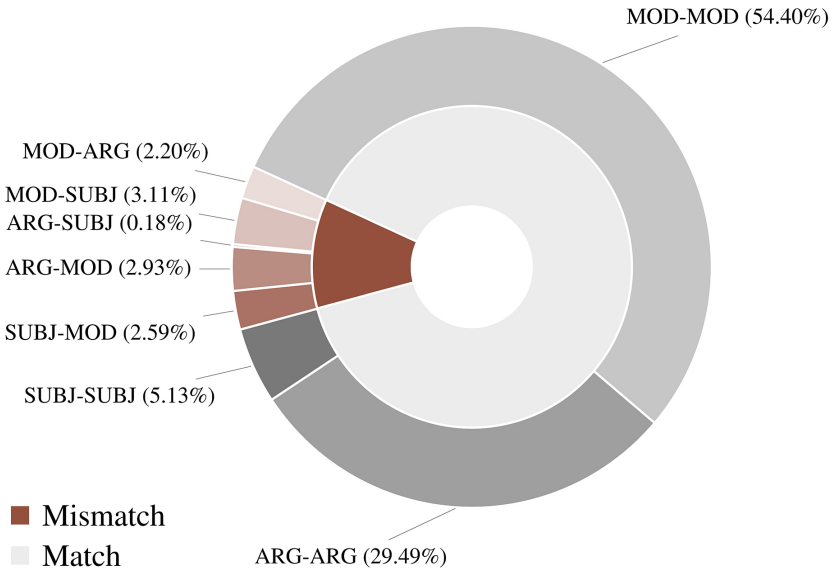
d. *How and who* is fulfilling the on-demand app services? (COCA 2016 MAG)
e. And *how much and who* gets to spend the new money? (COCA 1990 SPOK)

In (34a), the wh_1 *what* serves as a COMP of the verb *learn*, whereas the wh_2 *how* as a MOD, forming a COMP-MOD *wh*-pairs. Similarly in (34b), *when* is a MOD, and *what* is a COMP. This classification can be applied to the *wh*-pairs in (34c-e), which are tagged as COMP-MOD, MOD-SUBJ, and COMP-SUBJ *wh*-pairs, respectively.[7]

Overall, most of the Coord-WhQ data in the dataset fall under the match category (89.01%). Still, the mismatch type Coord-WhQs are found more than 10% (see Figure 1).



[7] In (34e), the wh_1 *how much* serves as a COMP of the verb *gets*, while the wh_2 *who* as a SUBJ. This example is a unique one with the COMP-SUBJ *wh*-pair in our dataset.

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Type	*wh*-pair	Freq.	Total
Match	MOD-MOD	297	486
	ARG-ARG	161	
	SUBJ-SUBJ	28	
Mismatch	MOD-SUBJ	17	60
	ARG-MOD	16	
	SUBJ-MOD	14	
	MOD-ARG	12	
	ARG-SUBJ	1	
Total			546

Figure 1. Distribution of *Wh*-Pairs and their Grammatical Functions (Raw Freq.)

The data challenges some previously proposed restrictions on *wh*-pairing. For instance, a subject *wh*-phrase can be paired with a non-subject *wh*-phrase (31 tokens, 5.68%). Furthermore, both match and mismatch chases proves that the *wh*-phrases can differ in their syntactic categories and semantic roles, violating the LCL:

(35) *Where and when* will this inequality end? (COCA 2016 FIC)

(36) a. *How and in what way* have you betrayed me? (COHA 1985 FIC)
b. Have we forgotten the lessons of Vietnam so soon? *Why and what* would we be fighting for? (COCA 1990 NEWS)

In (35), the *wh*-pair consists of the AdvPs *where* and *when*, serving as modifiers of the verb *end*, matching both syntactic categories and grammatical function. However, in (36a), the *wh*-pair takes the AdvP *how* and the PP *in what way*. While they match in their grammatical function, they differ in lexical category. In (36b), the AdvP *why* and the NP *what* differ in both lexical category and grammatical function.

Among the grammatical function match cases, 144 of 486 tokens (29.63%) exhibit lexical category mismatches. In grammatical function mismatch cases, 48 of 60 tokens (80%) show lexical category mismatches. Altogether, 192 of 546 tokens (35.16%) involve lexical category mismatches.

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Table 2. Grammatical Functions and Lexical Category Match and Mismatch in *Wh*-Pairs (wh_1-wh_2)

Gram. Fn. Combinations	Match	Mismatch					Total
		NP-ADVP	ADVP-NP	ADVP-PP	ADVP-AP	PP-NP	
MOD-MOD	248	1	0	46	1	1	297
ARG-ARG	72	61	27	0	1	0	161
SUBJ-SUBJ	22	3	3	0	0	0	28
Subtotal	342	144					486
SUBJ-MOD	4	10	0	0	0	0	14
ARG-SUBJ	1	0	0	0	0	0	1
ARG-MOD	6	10	0	0	0	0	16
MOD-SUBJ	0	0	17	0	0	0	17
MOD-ARG	1	0	10	0	0	1	12
Subtotal	12	48					60
Total	354	85	57	46	2	2	546

A two-by-two two-tailed Fisher's exact test was conducted using the R software (version 4.3.0., R Core Team 2020) to evaluate the relationship between grammatical function match/mismatch and lexical category mismatches (see Table 2). The results were statistically significant (p = .000), indicating that mismatched grammatical functions are more likely to coincide with lexical category mismatches. Nonetheless, the dataset also shows that even when grammatical functions match, lexical category mismatches can still occur (29.63% of tokens in match cases).

4.2.2. Verb Subcategorization

The dataset reveals Coord-WhQ tokens with a range of verb types:

(37) a. *When and where* were you happiest? (BNC C9E)
b. *How and when* will it be closed? (COHA 1868)
c. *How and why* did this terrible event begin? (COCA 2019 MAG)
d. *What and how* am I teaching and why? (COCA 2001 ACAD)
e. *What and how* do students learn? (COCA 2019 ACAD)
f. I said, *what and how much* did you give? (COCA 2010 SPOK)

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As shown, Coord-WhQs license verbs including: a copula *be* (37a), a passive *be closed* (37b), an intransitive *begin* (37c), an optionally transitive *teach* (37d), an obligatorily transitive *learn* (37e), and a ditransitive *give* (37f). Each verb type can license multiple *wh*-pair types, with the exception of SUBJ-COMP *wh*-pairs, which were not observed in the dataset (see Table 3).

Table 3. Verb Subcategorization and *Wh*-Pairs

Verb types		**Cop**	**Pass**	**V_i**	**V_{t}_opt**	**V_{t}_obl**	**V_{dt}**	**Total**
Match	SUBJ-SUBJ	9	8	2	2	7	0	28
	COMP-COMP	125	4	0	3	21	8	161
	MOD-MOD	21	66	85	21	102	2	297
Mismatch	SUBJ-COMP	0	0	0	0	0	0	0
	SUBJ-MOD	2	1	3	2	6	0	14
	COMP-SUBJ	0	0	0	0	1	0	1
	COMP-MOD	1	1	0	13	0	0	16
	MOD-SUBJ	3	1	2	2	9	0	17
	MOD-COMP	3	0	0	1	8	0	12
Total		164	81	92	45	154	10	546

* Cop = copula; Pass = passive; V_i = intransitive; V_{t}_opt = optionally transitive; V_{t}_obl = obligatorily transitive; V_{dt} = ditransitive

The dataset generally supports the claim that obligatorily transitive verbs cannot license COMP-MOD *wh*-pairs. Nonetheless, exceptions are found, suggesting this restriction may not be absolute *wh*-pair. Nonetheless, the dataset yields obligatorily transitives taking COMP-MOD *wh*-pair, indicating the restriction may not be absolute (cf., Citko and Gračanin-Yüksek 2020; Potter and Frazier 2021):

(38) While music teachers are not reading teachers, *how and what* do music educators **do** to support these important initiatives while still teaching music with integrity? (COCA 2012 ACAD)

The dataset also challenges the *p*-stranding restriction, although it does not occur frequently in our dataset (cf., Potter and Frazier 2021):

(39) *Why and what* would we be **fighting for**? (COCA 1990 NEWS)

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The dataset largely supports the claim that ditransitive verbs cannot take multiple argument *wh*-phrases with different grammatical functions (i.e., indirect object wh-phrase pairing with direct object wh-phrase; Bîlbîie and Gazdik 2012; Potter and Frazier 2021). However, exceptions include interesting cases such as:

(40) *How many cows*$_1$ and *where* are you taking **them**$_1$? (COHA 1956 TV/MOV)

In (40), the wh_1 *how many cows* appears coindexed with the direct object of the verb *taking*, which requires both THEME and GOAL as its verbal complement. This indicates that a gap may be realized as a resumptive-like pronominal expression *them*$_1$, coindexed with the SUBJ *wh*-phrase in (13). Such cases violate the traditional filler-gap dependency relations.

4.2.3. Structure-Sharing of Conjoined *Wh*-phrases

In order to evaluate the validity of the structure-sharing strategy in analyzing authentic uses of Coord-WhQs, we adopted the basic assumption for the bi-clausal non-bulk sharing analysis (cf., Giannakidou and Merchant 1998; Gračanin-Yüksek 2017; Citko and Gračanin-Yüksek 2020; Potter and Frazier 2021). For instance:

(41) *When and where* did you see them? (Browne 1972: 223)
(= '[*When* did you see them] and [*where* did you see them]?')

As given, the (underlined) gapped clause following the wh_2 is copied to the position between the wh_1 and the conjunction *and*. Tokens are tagged as '**complete-sharing**' if the putative structure is grammatically intact.

In cases where the two *wh*-phrases match their grammatical functions, all instances are classified as complete-sharing cases, regardless of the verb's subcategorization in the gapped clause, as demonstrated below:

(42) a. But here the question returns: *Whom and what exactly* do I respect? (COCA 1998 ACAD)

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(= '[*Whom* do I respect] and [*what exactly* do I respect]')

b. If you're a jazz musician, *how and where* did you learn how to play? (COCA 2011 SPOK)

(= '[*How* did you learn how to play]
and [*where* did you learn how to play]?')

Some Coord-WhQs, however, cannot be properly analyzed using the structure-sharing strategy. Such instances are tagged as '**partial-sharing**' cases. The partial-sharing cases can further be categorized based on the factors causing ungrammaticality: **no gap** and **unfilled gap** types. In 'no-gap' type cases, one of the shared clause lacks a gap corresponding to a wh-phrase, while in 'unfilled-gap' cases, a shared clause lacks a filler for the gap. Consider the following 'no gap' case first:

(43) **No gap type partial-sharing:**

Where and why are there differences? (COCA 2019 ACAD)

(= '[* *Where* are **there** differences]
and [*why* are there differences]?')

In (43), the wh_1 *where* is expected to function as a COMP of the verb *be*, and the wh_2 *why* as a MOD. However, the absent of a corresponding gap for the wh_1 -- already filled with the pronominal expression *there* -- causes ungrammaticality in the underlying structure.

Now, given below is an instance of 'unfilled-gap' case:

(44) **Unfilled gap type partial-sharing:**

a. *How and who* is fulfilling the on-demand app services? (COCA 2016 MAG)

(= '[**How* is fulfilling the on-demand app services]
and [*who* is fulfilling the on-demand app services]?')

b. *Where and how much* do you think the Syrians have? (COCA 2004 SPOK)

(= '[* *Where* do you think the Syrians have]
and [*how* much do you think the Syrians have]?')

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c. [...], *how and what* do music educators do to support these important initiatives while still teaching music with integrity? (COCA 2012 ACAD)
(= '[**How* do music educators do to support...]
and [*what* do music educators do to support...?'])

In (44a), the first clause lacks a SUBJ; in (44b-c), the first clause lacks a COMP. These unfilled gaps result in ungrammaticality in the underlying structure under the bi-clausal non-bulk sharing analysis, as shown above.

Table 4. Structure-Sharing between *Wh*-Words

***wh*-pair**		**Complete-sharing**	**Partial-sharing**		**Total**
			No gap	Unfilled gap	
Match		486	-	-	486
Mismatch	SUBJ-MOD	-	1	13	14
	COMP-SUBJ	-	1	0	1
	COMP-MOD	-	15	1	16
	MOD-SUBJ	-	14	3	17
	MOD-COMP	-	10	2	12
Total		486	41	19	546

The dataset shows a majority of complete-sharing cases (486 tokens, 89.01%), with only 60 tokens (10.99%) classified as partial-sharing due to structural ungrammaticality in the underlying source (see Table 4). This indicates that the structure-sharing accounts for approximately 90% of authentic Coord-WhQ usage. However, the rest cases remain problematic and may be overlooked in previous analyses.

5. Discussion

5.1. Structure-Sharing and English Coord-WhQs

The corpus investigation highlights significant challenges faced by derivation-based approaches, in accounting for the full range of Coord-WhQs.

The overridden superiority effect cases, for example, challenges the mono-clausal analysis (cf., Gribanova 2009; Potter and Frazier 2021):

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(45) *Where and how much* do you think the Syrians have? (COCA 2004 SPOK)
a. *You think the Syrians have *where how much*
b. [$_{\&P}$ and *how much*] (you think the Syrian have *where*)
c. [$_{\&P}$ *where and how much*] (you think the Syrian have)
d. [$_{\&P}$ *where and how much*] do you think the Syrian have?

Under the mono-clausal analysis, the Coord-WhQ in (45) derives from an ungrammatical sentence such as (45a), yet the surface structure of the question is felicitous.

Similarly, neither the non-bulk sharing nor the backward sluicing accounts adequately explain cases of partial-sharing (cf., Citko and Gračanin-Yüksek 2013, 2020). For example:

(46) a. *How and who* should teach from these texts? (COCA 2011 ACAD)
(= '[**How* should teach [...]] and [*who* should teach [...]]?')
b. *What and when* does that happen? (COCA 2019 ACAD)
(= '[**What* does that happen] and [*when* does that happen]?')

The underlying structures of the Coord-WhQs above face issues with their first clause. In (46a), the first clause lacks a SUBJ, while in (46b), the *wh*-phrase lacks a gap, leading to overridden filler-gap dependency relations in the first clause.

In our view, the limitations of previous literature arise from their assumption that Coord-WhQs derive from an underlying source structure. We assume that the approach that can alternatively address these issues is an non-derivational approach, inspired by frameworks such as Head-Driven Phrase Structure Grammar (HPSG, Pollard and Sag 1994) and Sign-Based Construction Grammar (SBCG, Ginzburg and Sag 2000), which does not posit any movement of a wh-phrase or the existence of an underlying structure.

5.2. Coordination of Unlikes and Subject Wh-phrases

The investigation results indicate that English Coord-WhQs can violate the

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Law of Coordination of the Likes (LCL). To solve the puzzle of the overridden LCL, we consider the concept of the "supercategory" (Bruening and Al Khalaf 2020).

Supercategory divides lexical categories into two main types: Pred (predicate parts, such as an NP or an AP inside a predicate) and Mod (modifiers, such as an AdvP modifying a predicate). While this concept resolves some LCL violations, it is insufficient for all cases of Coord-WhQs:

(47) a. [[$_{\text{Mod:AdvP}}$ *When*] and [$_{\text{Mod:PP}}$ *in which herd*]] was Mgeni born? (COCA 2017 FIC)
b. [[$_{\text{Mod:AdvP}}$ *When*] and [$_{\text{Pred:NP}}$ *whom*] did Otis marry? (COHA 1898 ACAD)

In (47a), both *wh*-phrases serve as Modifiers of the predicate *was born*, allowing the supercategory analysis to group them into the same category and satisfy the LCL. However, in (47b), the analysis fails because a Modifier (AdvP) is conjoined with a Predicate (NP), violating the LCL.

Further evidence is found in the coordination of subject *wh*-phrases. The data reveal that the restriction on SUBJ *wh*-phrases conjoined with a NON-SUBJ *wh*-phrase (e.g., **Who and with what broke the window?*) fades sometimes:

(48) a. Can the entrepreneurs remember the process, *where and why* are there inaccuracies? (BNC HJ0)
b. *How much and where* should the money be spent? (COCA 2002 NEWS)

In (48a), the *wh*$_1$ does not take a corresponding gap, as the gap position is already filled by the pronominal expression *there*. Similarly, in (48b), the gap for *wh*$_1$ *how much* is filled by an overt NP *the money*, overriding the filler-gap dependency relations.[8]

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[8] Similar data has been reported in the corpus investigation by Whitman (2002b). In addition, in Japanese Coord-WhQs, a resumptive pronoun can be realized in the subject gap position (Kasai 2016):

(i) Watasi-wa [*dare-ga*$_i$ *sosite* soitu-ga$_i$ *nani-o* tabe-ta-ka] sira-nai.
I-TOP *who*-NOM$_i$ and *he/she*-NOM$_i$ *what*-ACC eat-PST-QUE now-not

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Additionally, there are cases where the wh_2 serves as the subject:

(49) a. If so, when? And *how much and who* gets to spend the new money? (COCA 1990 SPOK)
b. *How and who* is fulfilling the on-demand app services? (COCA 2016 MAG)

In these examples, the wh_2 *who* functions as the SUBJ of the verb, while the wh_1 *how* and *how much* serves as a COMP or MOD of the given verbs.

If structure-sharing strategies were assumed, the wh_1 would lack a subject in its underlying form. This challenge to the structure-sharing analysis is further supported by Subject-Auxiliary Inversion (SAI) asymmetry cases:

(50) a. Real time... *What and when* does that happen?
b. *How and who* is fulfilling the on-demand app services?

While the Coord-WhQs as a whole override filler-gap dependency relations, the underlined *wh*-questions in (50) are syntactically intact. Interestingly, the SAI values of the remaining clausal items (e.g., does that happen for (50a)) align with the wh_2 in both examples, We claim that this evidences that the wh_2 belongs to a canonical interrogative clause, while the wh_1 attaches via conjunction, akin to the structure claimed by the backward sluicing analysis.

5.3. Towards a Discourse-Based Perspective

Finally, we can draw three key theoretical implications from the data. First, a wh-phrase can conjoin violating the LCL in Coord-WhQs, such as wh-pairs with a SUBJ and NON-SUBJ wh-phrases. Second, when such wh-pair occurs,

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Lit. 'I don't know *who$_i$ and what he/she$_i$* ate.' (Japanese, Kasai 2016: 135)

In (i), the gap position of the wh_1 *dare-ga* '*who*' is filled by a pronominal expression *soitu-ga* '*s/he*'. However, the example differs slightly from the English Coord-WhQs in (48); In the latter, the NP *the money* is not a pronominal expression, making it less likely to function as a resumptive pronoun. Instead, the trace of how much is realized as a pronominal form.

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the filler-gap dependency relation may be overridden, in which the structure-sharing mechanism fails to capture. Lastly, in these cases, the wh2 is a part of an intact wh-question with its associated gapped clause.

Based on the observations, we propose two possible structures for English Coord-WhQs. First, in cases where the grammatical functions of the *wh*-phrases match without any filler-gap dependency discrepancy, the two phrases are conjoined and licensed in the sentence-initial position, as illustrated below:

(51) **Conjoined wh-XP**
[$_{NP}$ [$_{NP}$ *Who*] and [$_{NP}$ *what*]] mediates the sacrificial exchange? (COCA 2017 ACAD)

In (51), the *wh*-phrases belong to the same syntactic category and share the same semantic roles, there is no violation of the Lexical Category Law (LCL). Regarding the relatively free word order of *wh*-phrases, we adopt insights from non-derivational frameworks such as Head-Driven Phrase Structure Grammar (HPSG, Pollard and Sag 1994) and Sign-Based Construction Grammar (SBCG, Ginzburg and Sag 2000; Goldberg 2006). These frameworks reject the notion of underlying deep structures or movement operations (i.e., *wh*-fronting). instead, all the lexical items, including *wh*-phrases, is base-generated in the sentence-initial position.

The non-derivational approach offers advantages over the mono- and bi-clausal analyses. Since it does not assume any *wh*-fronting, it can explain the superiority insensitivity of Coord-WhQs. The mono-clausal structure explains the *single-pair* readings observed in the constructions, which requires an additional explanation for the bi-clausal analyses.

In cases where the filler-gap dependency is overridden, we claim that the two *wh*-phrases belong to two separate clauses, taking the bi-clausal structure. The wh_2 occupies the clause-initial position of a canonical *wh*-question, with or without subject-auxiliary inversion (SAI). The wh_1 functions as a stand-alone fragment (a form of sluicing). The structure can be exemplified as follows:

(52) **Sluicing + canonical *wh*-question**
a. [$_{S}$ [$_{NP}$ *Who*]] and [$_{S}$ *why* would you even need this thing]? (COCA

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2017 ACAD)

b. It is not known exactly [$_S$ [$_{AdvP}$ *why*]] or [$_S$ *who* burned the village]]. (data from Whitman 2002a: 82)

For sluicing, this non-derivational frameworks focus on pragmatics rather than syntax, bypassing the need for structure-sharing strategies. Instead, they highlight the discourse features of the context, such as Question Under Discussion (QUD) or Salient Utterance (SAL-UTT). A series of contextual factors projects the phrasal expression of the wh_1 directly to a sentential-level expression, and the semantics is also resolved in the given discourse.[9]

Since we assume a bi-clausal structure in which the two *wh*-phrases belong to separate clauses, we must account for how Coord-WhQs yield the *single-pair* reading. To address this, we propose the Multiple-Coordination Construction (*multiple-coord-cxt*; a similar proposal can be found in Bîlbîie and Gazdik 2012), in which a fragmental wh_1 conjoins with the second interrogative clause under the Head-Functor Construction (*hd-functor-cxt*).[10]

By adopting this discourse-based analysis, we can effectively explain and predict the idiosyncratic forms and functions of English Coord-WhQs in a cohesive and streamlined manner.

6. Conclusion

This study focused on the idiosyncratic linguistic patterns and characteristics of English coordinated *wh*-questions (Coord-WhQs). In order to investigate the potential restrictions on Coord-WhQs reported in previous literature and to examine their constructional patterns and properties, we conducted a comprehensive corpus analysis. Our findings revealed that most Coord-WhQ tokens in the corpora consist of *wh*-pairs where the *wh*-phrases align in their

9 For further description on discourse factors licensing sluicing and relevant discussion, see, Ginzburg and Sag (2000); Kim (2021, 2025), among many others.

10 For further discussion on the constructions mentioned above, see Ginzburg and Sag 2000; Bîlbîie and Gazdik 2012; Ginzburg and Miller 2018; Abeillé and Chaves 2021.

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grammatical functions. These sentences generally exhibit intact filler-gap dependency relations and adhere to the Law of Coordination of the Likes (LCL). However, we also identified instances of Coord-WhQs that deviate from these norms, including violations of the LCL and overridden filler-gap dependency relations under the structure-sharing strategy proposed in earlier studies. Specifically, in the "no-gap" type, a *wh*-filler lacks a corresponding gap, as it is already filled by a resumptive-like pronominal expression. Conversely, in the "unfilled-gap" type, a gap exists without an associated *wh*-filler. These observations suggest that traditional derivational analyses -- whether mono-clausal or bi-clausal, or ellipsis-based -- may not fully account for the linguistic patterns observed in Coord-WhQs. Drawing from these findings, we outlined an two-folded alternative approach to understanding these constructions from a discourse-based perspective. This approach is expected to account for both the syntactic and semantic properties of Coord-WhQs without relying on the structure-sharing strategy.

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