Wh&wh coordinations

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Abstract: The paper examines wh&wh coordinations like Bulgarian *Koj e kakvo kupil* (literally who and what bought), arguing that what makes them possible in a language is not the availability of multiple wh-fronting, as was previously assumed, but the availability of an indeterminate system. It is argued that wh&wh coordinations involve derivational coordination formation via sideward merger where the affected elements undergo movement before derivational coordination formation, sideward merger more generally not being allowed directly from interpreted positions, and the derivationally formed coordination itself undergoes movement upon insertion into the structure. The proposed derivation also captures a clause-mate requirement on elements involved in wh&wh coordinations, the ordering constraints on these elements (which are shown not to track superiority effects with multiple wh-fronting), and the single-pair reading restriction on wh&wh coordinations. The paper also discusses more general properties (and a typology of) derivational coordination formation.
Keywords: coordination, indeterminates, multiple wh-fronting, quantifiers, sideward merger, superiority

1. Introduction

The goal of this paper is to examine w&wh coordinations like Bulgarian and Serbo-Croatian (1)-(2), in the attempt to shed light on a broader question what is needed to make such coordinations possible in a language. In the attempt to answer that question, the paper will also establish several restrictions on such coordinations.

(1) a. Koj and kakvo e kupil?
     who and what   is bought
     'Who bought what?'   (Bulgarian)
(2) Ko   i   šta   kupuje?
    who and what is-buying
    'Who is buying what?   (Serbo-Croatian/SC)

There are many works on such coordinations. Since their analysis is closest to what will be argued for in this paper and because they address the larger question this paper is concerned with, noted above, I will discuss here only one previous work, namely Citko & Gračanin-Yuksek (2013) (CG). CG argue that constructions like (3) cross-linguistically can involve either larger (i.e. clausal) coordination, where only the wh-phrase is realized in the first conjunct, or coordination of wh-phrases. Bulgarian (1) involves wh&wh coordination and English (3) clausal coordination, with the first conjunct a clause.[1]

(3) What and where did you eat?

As one of their arguments, they note that in English, it's not possible to have obligatory arguments in such coordinations ((4); (1) is also disallowed in English). This follows under the clausal coordination analysis, where (3) involves coordination of two clauses, *what did you eat and where did you eat*?

(4) *What and where did you buy?

(1) then indicates that in Bulgarian, we are dealing with wh&wh rather than a clausal coordination. What is also important here is that it is not possible to coordinate a subject and an object of the same

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[1]For different clausal coordination approaches to (3) see also Giannakidou and Merchant (1998) and Larson (2012); see also Potter and Frazier (2021) for an opposing view. This paper will focus on (1)-(2).

clause; this means that (1) cannot involve base coordination which then undergoes movement: the coordination can only be formed after movement (I return to this issue below).

CG also note that wh-DP external material can occur within the relevant ConjP in English, as in *what did Peter and why did Peter eat*, which is not possible in Bulgarian.

Turning to SC, SC allows both obligatory arguments and DP-external material in the coordinations in question (5), which means SC allows both wh&wh and larger clausal coordination.

(5) Ko je i   šta   je kupio?
   who is and what is bought
   'Who bought what?'

In the next section, I will discuss an argument CG give that also addresses the broader question regarding the crosslinguistic availability of wh&wh coordinations noted at the beginning of this paper.

2. Superiority/ordering effects
As another argument for the wh&wh coordination account of (1), CG observe that Bulgarian wh&wh coordinations show superiority effects. They argue that this would not be expected if (6) involves coordination of two clauses, where each clause would have only one wh-phrase.

(6) a. Koj i   kakvo e kupil?   b. *Kakvo i koj e kupil?
    who and what is bought

Multiple wh-fronting (MWF) languages differ regarding whether they exhibit superiority effects under MWF. Bulgarian shows such effects with MWF (7), just as it does with wh&wh coordinations.

(7) a. Koj kakvo e kupil?   b. *Kakvo koj e kupil?
    who what is bought
    'Who bought what?'

Based on this, CG tie the possibility of wh&wh coordinations to the possibility of MWF. Bošković (2022), however, notes several problems with the superiority argument. First, it is not clear why MWF should be relevant here. Under CG's analysis, the interrogative C in (1) has only one Spec, which is filled by the ConjP. Under the standard account of superiority effects with MWF, the superiority effect in (7) arises as a result of the wh-C attracting two wh-phrases, where the wh-phrases undergo separate wh-movements, occupying separate CP Specs. This is not the case with (6) under CG's analysis, where the coordination of the wh-phrases (more precisely, the ConjP that dominates the wh-phrases) is merged into SpecCP—there are then no two separate wh-movements or two CP Specs in (7).

Furthermore, SC does not show matching in the ordering of wh-phrases in MWF and wh&wh coordinations. SC does not show Superiority effects in simple MWF constructions like (8).

(8) a. Ko šta   kupuje?   b. Šta ko kupuje?
    who what is-buying
    'Who is buying what?'

However, it does show ordering effects with wh&wh coordinations.[2]

(9) a. Ko i   šta   kupuje?   b. *Šta i ko kupuje?
    who and what is-buying

Recall that SC also allows larger coordinations involving wh-phrases: additional material can be present within what appear to be wh&wh conjuncts.

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[2](9b) improves with a pause following the first wh-phrase, which is not necessary in (8b). I return to this issue below. (That prosodic factors may matter to the ordering of conjoined wh-phrases was also noted by Lipták 2003 for Hungarian.)

(10) Ko je i   šta   (je) kupio?
     who is and what is   bought

The presence of the aux-clitic in (10) indicates the first conjunct is a clause. Interestingly, such cases, which must involve coordination that is larger than wh&wh, do not display superiority effects.[3]

(11) Šta   je i   ko (je) kupio?
     what is and who is   bought

When there is nothing between the first wh-phrase and the coordinator there is a superiority effect, cf. (9) and (12), where the clitic follows the wh-phrases.

(12) a. Ko   i   šta   je kupio?   b. *Šta i ko je kupio?
        who and what is   bought

When the clitic follows the first wh-phrase, which unambiguously shows that the first conjunct is larger than the wh-phrase itself, there are no superiority effects (10)-(11).

   What this shows is that when there is no additional material following the first wh-phrase (i.e. when there is nothing intervening between the first wh-phrase and the coordinator) we have a wh&wh coordination. Additionally, these data show that there is no parallelism between Superiority effects in MWF and wh&wh constructions, cf. the contrast between (8b) and (9b) (the parallelism shown by Bulgarian (7) and (6) is apparently accidental, as the discussion below wil make clear).

   Why is it that when there is no material following the first wh-phrase we have wh&wh coordination? One possibility is that this may be an economy of representation effect (see Bošković 2011): when both a smaller and a larger structure are in principle available for X, if there is no evidence for the latter X is analyzed in terms of the former.

   There is, however, an alternative. Recall (9b) improves with a pause following the first wh-phrase (cf. fn 2). Wh&wh and clausal coordination may then be associated with two distinct prosodic patterns when there is nothing (but the coordinator) intervening between the coordinated wh-phrases: the prosodic pattern with a pause following the first wh reflects a clausal coordination structure.[4] This prosodic pattern is forced by a superiority violation, which is disallowed on the wh&wh derivation.[5]

   Bošković (2022) points out another issue regarding superiority. Bošković (2002) shows that when the superiority effect is found in regular MWF it holds only for the first and second wh-phrase; beyond that the wh-ordering is free. Bulgarian (13) illustrates this: when only two objects undergo wh-movement, the IO must precede the DO—a superiority effect since IO is higher than DO before wh-movement. Importantly, when another, higher wh-phrase is present, the ordering of the objects is free. This is also illustrated by SC (14), where the superiority effect also holds only for the first and the second wh-phrase (as discussed in Bošković 2002, SC shows superiority effects in certain contexts).

(13) a. Kogo kakvo e pital Ivan?   b. ?*Kakvo kogo e pital Ivan?
        whom what is asked Ivan
        'Who did Ivan ask what?'
     c. Koj kogo kakvo e pital?   d. Koj kakvo kogo e pital?
        who whom what   is asked
        'Who asked whom what?'   (Bošković 2002:366)

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[3]There may be a null subject in the first conjunct (SC is a pro-drop language) and a null object in the second conjunct. On null objects in similar constructions, see Zanon (2015).

[4]At least for some speakers, this is the most natural prosody for English (3) and the corresponding example in Italian.

[5]CG report no superiority effects with wh&wh coordinations in Croatian. Since they don't seem to have controlled for prosody, this may be reflecting the prosodic pattern associated with clausal coordination (this may also be behind what they report as speaker variation in Bulgarian, and with the reported free ordering of wh-phrases in Romanian in Comorovski (1996) (the ordering was also reported to be free in Russian in Kazenin (2000) but prosody does matter in Russian (Ksenia Zanon, p.c.).

(14) a. ?Ima kome kako da pomogne.   b. *Ima kako kome da pomogne.
        has whom how part helps
        '(S)he has someone to help somehow.'
     c. ?Ima ko kako kome da pomogne.
        has who how whom part helps
        'There is someone who can somehow help somebody.'   (Bošković 2002:367)

As noted above, SC shows ordering effects with wh&wh coordinations with two wh-phrases. But the effect extends to all wh-phrases. When there are more than two wh-phrases there is strict ordering for all of them.

(15) a. Ko kome i šta prodaje?   b. *Ko šta i kome prodaje?
        who whom and what is-selling
        'Who is selling what to whom?'

This is, then, another case of a divorce between superiority effects with MWF and the ordering effects in wh&wh coordinations.
        Additionally, Stjepanović (2020) shows that if MWF involves multiple left-branch extraction there are ordering effects (16)-(17). Importantly, wh&wh coordinations differ from MWF regarding these ordering effects (18)-(19), which confirms there is no Superiority parallelism between the two. (Note that the factor Stjepanović argues is responsible for the effect in (16)-(17) doesn't arise in (18)-(19)—what is crucial in her account is that the left-branch alone undergoes wh-movement in (16)-(17) (and has the uK feature that drives movement in Bošković's 2007 system); what undergoes it in (18)-(19) under the analysis adopted below is ConjP (so the ConjP has the uK feature driving movement).)

(16)*Čiji$_i$ kakva$_j$ danas [t$_i$ otac] kupuje [t$_j$ kola]?
     whose what-kind-of today   father is-buying car
     'Whose father is buying what kind of a car today?'
(17) Kakva$_i$ čiji$_j$ danas [t$_j$ otac] kupuje [t$_i$ kola]?
(18) Čiji$_i$ i kakva$_j$ danas [t$_i$ otac] kupuje [t$_j$ kola]?
     whose and what-kind-of today   father is-buying car
     'Whose father is buying what kind of a car today?'
(19) *Kakva$_i$ i čiji$_j$ danas [t$_j$ otac] kupuje [t$_i$ kola]?

The ordering effect in wh&wh coordinations is thus quite clearly independent of Superiority. CG take the superiority parallel in Bulgarian (7)/(6) to indicate that MWF is needed for wh&wh coordinations. That wh&wh coordinations do not track MWF regarding Superiority suggests the two should be divorced. The lack of MWF should then not be the reason why English disallows wh&wh coordinations.

3. A different factor matters
Consider now coordination outside of wh-movement/wh-phrases. (20a-b) are ungrammatical. As discussed in Bošković (2004a), the fronting in (20a) can in principle involve topicalization, focalization, or scrambling: the example is apparently ruled out on all these options, in clear contrast with (2). (20) then seems to show the coordination in question is limited to wh-movement/wh-phrases.

(20) a. *Ivanu   i kola   prodaju.
        Ivanu$_{DAT}$ and car$_{ACC}$ they-are-selling
        'They are selling Ivan a car.'
     b. *Ivan   i kola   kupuje.
        Ivan$_{NOM}$ and car$_{ACC}$ is-buying
        'Ivan is buying a car.'   (SC)

There are, however, exceptions: such constructions are possible with indefinite, negative concord, NPI, and universal quantifier pronouns (21) and the corresponding adjectives in (22).[6]

(21) a. Neko   i   nešto   kupuje.
       someone and something buys
        'Someone is buying something.'
      b. Svako   i   svašta   kupuje.
        everyone and everything buys
       c. Niko   i   ništa   ne kupuje.
         nobody and nothing not buys
       d. Nije nam rekao da li   iko   i   išta   kupuje.
          isn't us   told whether anybody and anything buys
          'He didn't tell us whether anybody is buying anything.'

(22) a. Nečiji/svačiji   i   nekakva/svakakva otac   kupuje kola.
        someone's/everyone's and some kind/all kind father buys car
         'Someone's/everyone's father is buying some kind/all kind of cars.'
       b. Ničiji   i   nikakva otac ne kupuje kola.
         nobody's and no-type father not buys   car
          'Nobody's father is buying any type of a car.'
       c. Nije nam rekao da li   ičiji   i   ikakva otac kupuje kola.
          isn't us   told whether anybody's and any   type father   buys car
          'He didn't tell us whether anybody's father is buying any type of a car.'

There is something all these have in common, namely, an indeterminate system. In many languages, the forms that are used for wh-words have a variety of other usages, like existentials, universal quantifiers, negative concord/NPI items, free choice, depending on the context where they occur. SC has an indeterminate system where an affix is added to a wh-phrase, illustrated with a partial paradigm below.

(23) i. a. ko 'who' b. *i*ko 'anyone' c. *ni*ko 'no one' d. *ne*ko 'someone' e. *sva*ko 'everyone'
     ii. a. šta 'what' b. *i*šta 'anything' c. *ni*šta 'nothing' d. *ne*što 'something' e. *sva*šta 'everything'

I take this to indicate that an indeterminate system (Bulgarian also has it) is a prerequisite for the coordination in question. This in itself rules it out in English, which does not have an indeterminate system (note that we are dealing here with a <u>one-way</u> correlation).[7,8]

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[6]For examples with other quantifiers from other languages, see e.g. Kazenin (2002), Lipták (2003), Paperno (2010), Przepiórkowski (2022). Note that mixing of different types of quantifiers is disallowed—it seems plausible that this is due to a parallelism requirement along the lines of traditional coordination-of-likes (see also Appendix; this actually confirms that the relevant cases don't involve clausal coordination+ellipsis; rather, what is coordinated is the quantifiers themselves).
(i) *Neko   i   svašta   kupuje.
    someone and everything is-buying
    'Someone is buying everything.'

[7]Incidentally, Oda (2022) observes that indeterminate systems are found only in languages without articles and languages with affixal articles, they are not found in languages with free standing articles.

[8]What is important here is that the relevant language has an indeterminate system. There can still be a quantifier in such a language that could undergo the kind of coordination investigated here even if it is not transparently morphologically related to a wh-phrase; in that case whatever syntactic and semantic relations the morphology normally reflects in the relevant language type would still be present abstractly. This could be an appropriate treatment for (i), where the quantifier is not part of an indeterminate system. Notice, however, that (i) is somewhat worse than (21) ((21b) is especially interesting given that it also involves a universal quantifier).
(i) (?)?Svi   i   sve   kupuju.
        all_NOM and all_ACC are-buying
There is another issue: the indeterminate requirement holds for arguments in wh&wh coordinations (which is what I'll focus on whenever possible). It is less clear whether it holds for adjuncts/non-arguments, where it is also harder to rule out

(24), involving D-linked wh-phrases, provides a confirmation that an indeterminate status matters:

(24) ?*Koja žena   i   koju kuću kupuje?
       which woman and which house is-buying

Note that this is not simply an issue of D-linking since (25), which also involves D-linked wh-phrases, is acceptable. There is, however, a difference between the two: the wh-phrase in (24) is not part of the indeterminate system, while the one in (25) is (cf. *ičija/ničija/nečija/svačija*).[9]

(25) Čija   žena i čiju   kuću kupuje?
      whose wife and whose house is-buying

Note also that both (26) and (27) are fine in Russian; importantly, the wh-phrase in both examples is part of the indeterminate system.

(26) Kakaja studentka i   kakuju knigu kupila?
      which student   and which book bought
(27) Čej   student i   č'ju   stat'ju pročital?
      whose student and whose article read

Above, we have seen evidence against the MWF account of wh&wh coordinations (i.e. an account that ties wh&wh coordinations to the possibility of MWF). There is, however, somewhat of a correlation with MWF, but through a third factor. The indeterminate system also turns out to be involved in MWF.

Bošković (2020), noting that there are different types of indeterminate systems, defines a particular type, dubbed sub-wh-system: a fully productive system where addition of an inseparable affix to a wh-phrase results in a series of meanings shown in SC (23), with a morphological subset-superset relation between the wh (i.e. question) usage and other usages (28).

(28) sub-wh system: who+X for other pronouns (inseparable, fully productive, order does not matter)

What is a not a sub-wh system is the situation in Chinese, where the same form can have different functions (e.g. *shenme* can mean 'what', 'something', 'anything'), or Japanese, where a particle occurs on each function (in some cases inseparable, in same cases separable; note that *-ka*, which is always separated on the wh-usage in Standard Japanese, need not be separated in Okinawan). English also does not have a sub wh-system since the relevant system is not fully productive (*some*where, *every*where, *no*where, *any*where but **some*who/*every*who/*now*ho), i.e., it is lexicalized.

Bošković (2020) identifies 12 MWF languages (SC, Romanian, Polish, Russian, Bulgarian, Macedonian, Slovenian, Ukrainian, Hungarian, Basque, Mohawk, Latin) and shows they all have this type of indeterminates (note that (29) is a one-way correlation).

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the larger ellipsis option (larger ellipsis cases are in fact most productive with adjuncts; note that for this reason all left-branch extraction cases discussed in the paper should be taken with some reservation). In this respect, *svi/sve* also have an attributive (essentially adjunct) function where they modify a noun like an adjective. It's not out of question that this is what we are dealing with here given that SC quite productively allows free-standing adjectives without an overt noun (see Bošković 2013b).

[9] Mixed cases, where one wh-phrase is an indeterminate and the other one not, have an intermediate status (note that *kakvu* is part of an indeterminate system).
(i) ???Koja žena   i čiju/kakvu   kuću prodaje?
       which woman and whose/what-kind-of house is-selling
       'Which woman is selling whose/what-kind-of-a house

(29) If a language has multiple wh-fronting, it has a sub wh-system.

Particularly interesting is Romance. Latin was a MWF language (Ledgeway 2012, Dadan 2019) with a fully productive sub-wh system. The system got lost in all modern Romance languages but one: Romanian, which is the only modern Romance language that still has MWF, a strong confirmation of (29). An indeterminate system is thus a prerequisite for both wh&wh coordinations and MWF.

　　　Given this, it is not surprising that there is a great deal of overlap between MWF languages and languages allowing wh&wh coordinations. However, the above discussion doesn't rule out the possibility of a non-MWF language allowing wh&wh coordinations. This is in fact attested. Haida and Repp (2011) note that Greek, which is not an MWF language (cf. (30)), allows wh&wh coordinations, based on (31).

(30) Pjos agorase ti?
　　 who bought what
(31) Kséro pjos　ce　ti　　píre.
　　 I.know who and what took
　　 'I know who took something and what he took.'

Haida and Repp (2011) note only (31) but the coordination is not limited to wh-phrases:

(32) Ka-pjos　ce　ka-ti　　　agorázei
　　　someone and something is-buying
　　　'Someone is buying something.'

Importantly, Geek has an indeterminate system, as discussed in Oda (2022).[10]

(33)	who	existential	neg-polarity	free choice
person	pjos	ka-pjos	kanenas, kanis	o-pjos-dhipote
thing	ti	ka-ti	ti-pota	o-ti-dhipote
place	pu	ka-pu	pu-thena	o-pu-dhipote
time	pote	ka-pote	pote	o-pote-dhipote

4. Derivation and an account of the ordering restriction

I now turn to the derivation of wh&wh coordinations, which will also account for the ordering restriction. As noted above, it is not possible to coordinate a subject and an object of the same clause, which means (1) cannot involve base coordination which then undergoes movement: the coordination can only be formed after movement. CG suggest that wh&wh coordinations indeed involve derivational ConjP formation, with the wh-phrases in Bulgarian (1) sideward merged (see also Zhang 2007, Haida and Repp 2011 for sideward merger in wh&wh coordinations and Nunes 2004 on sideward merger in general) into a ConjP, which is inserted in SpecCP. I will also adopt this overall approach, fleshing out the details of the derivation in a way that will capture the ordering restriction as well as another restriction discussed below. The main suggestion regarding derivational coordination formation is given in (34) (cf. Bošković 2022), where the merger in question involves sideward merger (pending section 5, which introduces a slight complication, the reader can take (34) to mean that sideward merger with the coordinator occurs right after regular merger of the relevant element; see also fn 15 regarding motivation for (34)).

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[10]It is not quite as productive as in SC. As discussed in Oda (2022:222-224), what is derived from indeterminate pronouns in Greek are indefinite pronouns (this may in fact be what is important for the availability of wh&wh coordinations). As observed by Oda, universal quantifiers are missing from the indeterminate system in Greek, in contrast to SC. It is possible that a broader indeterminate system, which would include universal quantifiers, is needed for MWF.

(34) Merge the relevant element with the coordinator <u>as soon as</u> possible.

The derivation of (9) ('who and what bought', using English words) observing (34) is given below.

(35) a. [$_{VP}$ bought what]
     b. [and what]   (sideward merger)
     c. [$_{vP}$ who bought what]
     d. [$_{ConjP}$ who and what] (sideward merger)

Given (34), 'what' has to undergo sideward merger with the coordinator as soon as possible, which means before the subject wh-phrase enters the structure (cf. the step in (35b)). After the subject wh-phrase enters the structure it also undergoes sideward merger into the ConjP (cf. (35d)). The condition in (34) imposes a strict ordering of the wh-phrases. While I have illustrated this with constructions involving two wh-phrases, nothing changes if there are more than two: if there are more than two wh-phrases strict ordering is crucially imposed on <u>all</u> conjuncts, not just one (in contrast to what is found with superiority effects). Furthermore, (34) has no relevance for clausal coordination, which does not involve a derivationally formed coordination: both 'who is & what is' (see (10)) and 'what is & who is' (see (11)) are then allowed with wh&wh coordination that is derived from clausal coordination.
       Note also that the wh-phrase that enters the structure first may not need to undergo merger with the coordinator immediately, but simply before the other wh-phrase enters the structure. This is the case if the wh-phrase *kakva kola* in (36) moves in front of the verb before *kakva* undergoes sideward-merger into the derivationally formed ConjP.

(36) Čiji$_i$ i   kakva$_j$ [t$_i$ otac] [t$_j$ kola] prodaje?
    whose and what-kind-of   father   car is-selling

There is, however, another possibility, where *kakva* undergoes sideward merger into ConjP before the object moves in front of the verb in (36). Under this analysis, (36) would involve a remnant-like fronting of the object, where the remnant is created by sideward merger. I leave teasing apart these possibilities open here. What is important is that either way, (37) is underivable.

(37) *Kakva$_j$ i   čiji$_i$ danas [t$_j$ kola] [t$_i$ otac] prodaje?
    what-kind-of and whose today   car   father is-selling

Crucially, the derivationally formed ConjP cannot be inserted directly into SpecCP (contra CG; they actually simply assume this without arguing for it). Sideward merger voids islandhood (Nunes 2004). The wh-phrases cannot be merged directly from their theta-positions into ConjP, with the ConjP inserted directly into SpecCP, since that would void islandhood effects, but islandhood effects are present with wh&wh coordinations, as illustrated by (38).[11]

(38) *Koj i   kakvo si jadosan zaštoto e kupil?
    who and what are angry   because is bought
    'You are angry because who bought what?'   (Bulgarian)

5. Another factor: mobility of the conjuncts
As discussed above, SC also allows wh&wh coordinations, which can involve other indeterminates. Crucially, only mobile elements can be involved in such coordinations. In other words, such coordinations are subject to the not-directly-from-the-interpreted-position requirement: the relevant elements have to be mobile.

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[11] Russian allows wh&wh coordination out of subjunctive but not indicative clauses (Kazenin 2002), which parallels the well-known locality effect found in Russian, indicative but not subjunctive clauses disallowing wh-extraction.

To show this, consider Bošković' (2013a) observation that genitive complements of nouns in SC cannot move, while inherently case-marked complements of nouns can move. The former is illustrated by (39b) and the latter by (40b). Importantly, the same pattern is found in the corresponding wh&wh coordinations, as shown by (39a) and (40a).

(39) a. ?Neko$_i$ i   nekome$_j$ t$_i$ podržava [otpor t$_j$].
        someone$_{NOM}$ and someone$_{DAT}$ supports   resistance
        'Someone is supporting resistance to someone.'
    b. cf. Nekome$_j$ podržava [otpor t$_j$].
          someone$_{DAT}$ supports   resistance
(40) a. *Neko$_i$ i   nečega$_j$ t$_i$ podržava [vlasnike t$_j$].
        someone$_{NOM}$ and something$_{GEN}$ supports   owners
        'Someone is supporting owners of something.'
    b. cf. *Nečega$_j$ podržava [vlasnike t$_j$].
          something$_{GEN}$ supports   owners

Another argument is provided by deep left-branch extraction. Bošković (2013a) observes that the same kind of genitive/inherent case contrast is found with deep left-branch extraction (i.e. left-branch extraction from a nominal complement). Such extraction is disallowed in the genitive case environment but allowed in an inherent case environment, as (41)-(42) show.

(41) *Kakvih$_i$ je vidio vlasnike [$_{NP}$ t$_i$ kuća]?
        what-kind-of$_{GEN}$ is seen   owners   houses$_{GEN}$
        'What kind of houses did he saw owners of?'
(42) ?Čijem$_i$ je podržao otpor   [$_{NP}$ t$_i$ kongresu]?
        whose$_{DAT}$ is supported resistance   congress$_{DAT}$
        'Whose congress did he support resistance to?'

The parallelism again extends to wh&wh coordinations (43)-(44), confirming that only mobile elements can participate in the construction in question. This indicates that the elements participating in the coordination in question must undergo movement on their own.

(43) *Kakva$_i$ i   čije$_j$ je [t$_i$ djevojka] vidjela podstanara [$_{NP}$ t$_j$ kuće]?
        what-kind-of$_{NOM}$ and whose$_{GEN}$ is   girl$_{NOM}$ seen   tenant   houses$_{GEN}$
        'What kind of a girl saw a tenant of whose house.'
(44) ??Kakva$_i$ i   čijem$_j$ je [t$_i$ djevojka] podržala otpor   [$_{NP}$ t$_j$ kongresu]?
        what-kind-of$_{NOM}$ and whose$_{DAT}$ is   girl$_{NOM}$ supported resistance   congress$_{DAT}$
        'What kind of a girl supported resistance to whose congress?'

Getting more precise about the derivation of wh&wh coordinations in light of the mobility effect just discussed, the relevant elements apparently need to undergo a step of regular movement prior to sideward merger into the derivationally formed ConjP. In (40a), the problem arises with this regular step of movement (of *nečega*, cf. (40b)). After the step of regular movement, the relevant elements form a ConjP through sideward merger.[12] This ConjP is then inserted into the structure (in the clause where the relevant elements are interpreted, see below) and undergoes movement to its final position (hence the more general islandhood effect noted earlier). The short step of movement can be tied to the

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[12]Sideward merger into ConjP could actually take place even before the step of regular movement—in that case the original copy of the affected element would undergo both sideward merger and the step of regular movement (this option would, however, eliminate one of the two accounts of the clause-mate effect discussed directly below, see fn 14). Note here the lack of a c-command relation—even the ConjP does not c-command anything before integration into the structure.

indeterminate nature of the relevant elements since indeterminates in general undergo movement (see Bošković 2008; the need for indeterminates to be licensed may also matter here, see Appendix).

Note also that the ConjP must be inserted in the clause where the relevant elements are interpreted. [13] The reason for this is is that there is a ban on cross-clausal derivational coordination formation: since the wh-phrases come from different clauses in (45a)/(46a), derivationally formed ConjP, which cannot be inserted before the higher wh-phrase enters the structure, is inserted outside of the clause where the lower wh-phrase is interpreted. (Note that simple MWF (46b) differs from (46a).)

(45) a. *[Čiji$_i$ i   kakvu$_j$]   je [t$_i$ momak]   tvrdio da je vidio [t$_j$ djevojku]?
          whose and what-kind-of is   boyfriend claim that is seen   girl
          'Whose boyfriend claimed that he saw what kind of a girl?'
     b. cf. [Čiji$_i$ i   kakvu$_j$]   je [t$_i$ momak]   vidio [t$_j$ djevojku]?
          whose and what-kind-of is   boyfriend seen   girl
(46) a. *[Koga$_i$ i   šta$_j$] ubjedjuješ t$_i$ da je Petar kupio t$_j$?
          whom and what persuade   that is Peter bought
          'Who are you persuading that Peter bought what?'
     b. Koga$_i$ šta$_j$ ubjedjuješ t$_i$ da je Petar kupio t$_j$?
          whom what persuade   that is Peter bought

This can be accounted for if the ConjP created by sideward merger must be integrated into the structure at the CP level, in other words, if there can be only one root phrase if CP is a root phrase. The condition can actually be stated in terms of phases if vP is not a phase, as argued by Keine (2017), Keine and Zeijstra (2021), to the effect that there can be only one root once the phasal level is reached (if vP is a phase, the requirement can still be stated in phasal terms if the ConjP in constructions like (1)-(2) is inserted in higher SpecvP, see the derivation in (35)). I leave it open whether the one-root requirement should be stated in terms of CP or phases more generally. [14]

6. Pair-list vs single-pair readings

I now turn to a peculiarity of wh&wh coordinations that has been noted by a number of authors for various languages with wh&wh coordinations. Regarding regular MWF questions in SC, Bošković (2003) shows that (47) allows both pair-list and single-pair answers. (48), involving a wh&wh coordination, on the other hand, allows only the single-pair reading (see e.g. Gračanin-Yuksek 2007, Gribanova 2009 for this restriction in various wh&wh coordination languages).

(47) Ko   šta   kupuje?
      who what is-buying
      'Who is buying what?
(48) Ko   i   šta   kupuje?
      who and what is-buying   (SC)

Bošković (2003) provides an account of the different behavior of SC and English regarding (47) (in English only pair-list answers are allowed here) based on Hagstrom's (1998) semantics of questions. Its gist is that the Q-morpheme is an existential quantifier over choice functions which originates in a

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[13]I take the clause here to mean indicative clause. This evokes other types of clause-mate requirements; e.g. Villa-García (2015) shows arguments that are base-generated higher than the position in which they are interpreted in Spanish still must be generated in the same clause as the position where they are interpreted; see also Abels and Dayal (in press) on clause-mate effects with regular MWF in some MWF languages. I leave it open whether there can be some unification here.
[14]The phase alternative appears to require NPs not to be phases, or it would rule out examples like (18), (44) and (53) if sideward merger takes place from the base-position of the element extracted from the second conjunct—if NP is a phase there would then be two roots at the NP phase level. Recall, however, that there is also a step of regular movement. This movement, which precedes sideward movement, will take the relevant element outside the NP (see Bošković 2022 regarding (53)), obviating the problem in question.

clause internal position and then moves to the interrogative CP projection. There are two possibilities for movement in multiple questions: from the lower wh-phrase (Q is then merged with the lower wh-phrase), in which case the choice function variable left behind by Q-movement has the lower, but not the higher wh-phrase in its scope, or from a position above both wh-phrases (Q is then merged with a node dominating both wh-phrases), in which case the choice function variable left behind by Q-movement has both wh-phrases in its scope. The first option yields questions with pair-list answers and the second single-pair answers. Turning now to (48), merging the Q-morpheme with the lower wh-phrase in a wh&wh coordination will block its movement given the Coordinate Structure Constraint. The Q-morpheme can then only be merged with the coordination or above it. It then has both wh-phrases in its scope, yielding a single-pair reading only (for alternative accounts see e.g. Gribanova 2009, Haida and Repp 2011, Merchant 2017).

7. Conclusion

Citko & Gračanin-Yuksek (2013) took the superiority parallelism between Bulgarian (6) and (7) to indicate that the availability of MWF underlines the availability of wh&wh coordinations. We have seen that wh&wh coordinations actually do not track MWF regarding Superiority; the two should then be divorced. Rather, the availability of wh&wh coordinations depends on the availability of the indeterminate system (see Appendix for a possible deduction of the dependency; MWF also depends on the availability of a particular indeterminate system, so the two are actually related, but through a third factor).

I have argued that wh&wh coordinations involve derivational coordination formation via sideward merger (see also Zhang 2007, Haida and Repp 2011, Citko & Gračanin-Yuksek 2013), fleshing out the sideward merger analysis. We have seen that the affected elements undergo movement before derivational coordination formation and that the derivationally formed coordination itself undergoes movement upon insertion into the structure. There is also a clause-mate requirement on the elements involved in wh&wh coordinations. A derivation of wh&wh coordinations was proposed that captures all these properties as well as the ordering effect and the single-pair reading restriction on wh&wh coordinations.

Appendix: A short typology excursion

I will conclude with a short typological excursion and discussion of more general properties of derivational coordination formation that will also address the issue why an indeterminate system is a prerequisite for wh&wh coordinations.

Bošković (2022) argues that distributed coordination constructions (DCCs) with an additional lower coordination like (49) also involve derivational coordination formation (see also Zhang 2010).

(49) Which book$_i$, which papers$_j$, and which novel$_k$ did [Ann buy t$_i$], [Jon read t$_j$] and [Sue write t$_k$] respectively?
(50) The dogs and the roosters barked and crowed all night.

Such constructions parallel wh&wh coordinations in a number of respects (see Bošković 2022), e.g. regarding the ordering effect,[15] the mobility of the affected element requirement, the islandhood effect, which could then be taken to be general properties of derivational coordination formation.

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[15]As Bošković (2022) notes, there is a strict ordering effect in examples like (49); the indicated indexation gives the only possible interpretation. However, Steven Franks observes that in pragmatically conditioned cases like (50), there is no strict ordering requirement, (ia) also being possible. This is, however, only the case in the absence of *respectively*, as shown by (ib) (the judgment in (ia-b) is given for the dogs barked/roosters crowed reading). Another relevant case (provided by Donald Reindl) is given in (ic). As Steven Franks notes, the freedom of ordering is only there when the pragmatics fully distributes the conjuncts, as shown by the contrast in (id).
(i) a. The dogs and the rosters crowed and barked all night.
    b. *The dogs and the rosters respectively crowed and barked all night.
    c. Lightning and thunder crashed and flashed together in a perfect fury! (Carol Ryrie Brink, *Caddie Woodlawn* (1935))

It is worth noting here that Nunes (2004) treats parasitic gaps and across-the-board movement in terms of sideward merger. Locality effects found in those constructions indicate that the affected element must also undergo regular movement before undergoing sideward merger. There may then be a general condition to the effect that sideward merger is not possible from a base-position (what may be relevant here is that base-positions are the interpretation positions). There could also be a connection with other operations that are not possible from a base-position, e.g. Bošković (2004b) shows that quantifier float is not possible in the base-position (cf. *The students were arrested all). In Bošković's (2004b) account, Q-float involves an acyclic operation (the Q is accyclically adjoined to the relevant nominal). Sideward merger is also in essence acyclic (it doesn't make the tree bigger). Acyclicity could then be a connection here, where acyclicity could only be associated with positions that are not created by regular internal Merge. (Note that this would mean that only external merge adjunction could be acyclic.)

Returning to derivationally formed coordination, the coordination in such cases appears to be semantically expletive ((1) is interpreted as 'who bought what', there is no coordination of the wh-phrases in the interpretation of (1); Merchant 2017 in fact calls it spurios coordination,[16] see also Lipták 2003); the same holds for (49), which is interpreted as 'which book did Ann buy, which papers did Jon read, and which novel did Sue write', there is no coordination of the wh-phrases in the interpretation of (49). Semantic expletiveness can be taken as another general property of derivational coordination formation (see Bošković 2022).

While derivational coordination formation is possible both with (in DCCs) and without (in wh&wh coordinations) lower coordination, it doesn't mean that if it's possible with a lower coordination it will be possible without it. (English allows DCCs but not wh&wh coordinations; recall, however, that the latter are subject to the indeterminate system requirement, which the former are not).

SC allows both wh&wh coordinations and distributed extractions, which involve coordination in the lower position (see Bošković 2022 on the latter).

(51) Psi i   pjevci   su cijelu noć lajali i   kukurikali.
       dogs and roosters are all   night barked and crowed

However, distributed <u>wh-movement</u> coordinations are more restricted than in English. SC doesn't have a counterpart of *respectively*. This could be why the non-distributed reading where the wh-coordination undergoes ATB-movement from the object position of each verb is the only reading in (52).[17]

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d. The dog and the pig oinked/?*ate and barked all night.
For some but not all speakers the strict ordering requirement is also relaxed across coordinations in double coordination cases, as in (iic).
(ii) a. On every side, the birds and roosters, the distant dogs and cows, cooed and crowed, barked and mooed.
    b. On every side, the birds and roosters, the distant dogs and cows, crowed and cooed, mooed and barked.
    c. (??)On every side, the birds and roosters, the distant dogs and cows, cooed and mooed, crowed and barked.
The above cases all involve A-movement. The ordering requirement is also relaxed with pragmatically motivated A'-movement, (iiib) being only slightly worse than (iiia).
(iii) a. How many cakes and how many letters did Mary bake and Sue write (respectively)?
    b. ?How many cakes and how many letters did Mary write and Sue bake?
    c. *How many cakes and how many letters did respectively Mary write and Sue bake?
Bošković (2022) gives an account of the strict ordering effect in DDCs with *respectively* essentially along the lines of (34). For DCCs, the distributor *respectively* can be taken to impose it. There is no distribution of that kind in wh&wh coordinations though. (34), applying to both wh&wh coordinations and DCCs, can then be taken to be an interpretative mechanism—it is there to ensure proper interpretation so that it's not the case that anything goes. There is no need for that in pragmatically motivated cases, where the pragmatics ensures proper interpretation/interpretive "pairing", hence there is no need for (34).
[16]But see Paperno (2010) and Przepiórkowski (2022) for the semantics of wh&wh coordinations where the coordinator has its usual semantics.
[17]The same holds for the quantifier example in (i).
(i) [Neku knjigu i   neki magazin]$_i$ je Petar kupio t$_i$ i   Ivan prodao t$_i$?
     some book and some magazine is Petar bought and Ivan sold

(52) [Koju knjigu i   koji   časopis]$_i$ je Petar kupio t$_i$ i   Ivan prodao t$_i$?
      which book   and which magazine is Petar bought   and Ivan sold

This may also be an economy of representation effect, given that regular ATB is structurally simpler than distributed coordination extractions (see Bošković 2022 on the structure of the latter). Notice also that when the non-distributed ATB parse is blocked, distributed coordination is available with wh-phrases in SC. This is the case with (53), where the ATB parse is ruled out because the nouns *otpor* 'resistance' and *potragu* 'pursuit' take different prepositions in their complements.

(53) Prema kome$_i$ i   za kim   su podržavali [otpor t$_i$] i   [potragu t$_j$]?
      to   whom and for whom   are supported   resistance and pursuit
      'Resistance to whom and pursuit of who were they supporting?'

It is also available in cases more similar to (52) if the pragmatics increases the saliency of the distributed reading. This is the case with (54) (another such case, with A-movement, is given in (51)). Note, however, that (54) is best with a different, i.e. clausal (cf. (55)-(56)) lower coordinator.[18]

(54) Koliko   jela i   koliko   pisama je Jovan skuvao a   Asmir napisao?
      how-many dishes and how-many letters   is Jovan cooked and Asmir wrote
      'How many dishes and how many letters did Jovan cook and Asmir write?'
(55) Jovan voli   Mariju i/*a Ivana.
       Jovan loves Marija and Ivan
(56) Ana misli da Petar voli Mariju i/a da Ivan voli Katarinu.
       Ana thinks that Peter loves Marija and that Ivan loves Katarina

A question then arises: are there languages that allow derivational coordination formation only if it doesn't involve extraction from a ConjP (i.e. languages that allow wh&wh coordination but not distributed coordination extraction/DCCs)? If not, this would mean that the availability of the former implies the availability of the latter (though there would be no two-way correlation here), i.e. we would have an implicational universal here. (Note Russian and Bulgarian allow DCCs like (57)-(58) (though Russian and Bulgarian seem to be more resistant to distributed wh-movement coordinations, which we have seen is also the case with SC; it should be noted that the A/A' movement distinction matters in the availability of DCCs crosslinguistically and that DCC head-movement is never allowed, see Bošković 2022).

(57) Sobaki i   petuxi vsju noč lajali i   kukarekali.
      dogs   and roosters all   night barked and crowed   (Russian)
(58) Kučetata i   petlite   laeha i   kukurigaha tsjala nošt.
      dogs.def and roosters.def barked and crowed   all   night   (Bulgarian)

There is also a typological gap if we consider interaction between regular coordination from which

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[18]Using *a* instead of *i* does not make a difference in (52), only the ATB reading is possible here even with *a*. Note also that *i* and *a* are not simply interchangeable with clausal coordination, as (i) shows.
(i) Jovan misli da će biti novca za taj posao i/*a da će ga Marija dobiti.
    Jovan thinks that will be money for that job   and that will it Marija get
    'Jovan thinks that there will be money for that job and that Marija will get it.'
Note also that SC patterns with English (cf. fn 15) in that the ordering requirement is relaxed in pragmatically conditioned cases, (ia-b) being only slightly worse than (51) and (54).
(i) a. ?Psi i   pjevci   su cijelu noć kukurikali i   lajali.
       dogs and roosters are all   night crowed   and barked
   b. ?Koliko   jela i   koliko   pisama je Jovan napisao a   Asmir skuvao?
       how-many dishes and how-many letters   is Jovan written   and Asmir cooked

movement takes place and derivationally formed coordination. The two can co-occur: (59) involves both a regular (lower) coordination from which movement takes place and a higher, derivationally formed coordination.

(59) Prema kome$_i$ i za kim$_j$ su podržali [otpor t$_i$] i [potragu t$_j$]?
　　　 to　　whom and for whom are supported resistance and pursuit　　(SC)

We also find constructions with only the latter, i.e. involving only a derivationally formed coordination (the higher coordination from (59)), without lower coordination.

(60) Ko i šta kupuje?
　　　 who and what is-buying

How about only the former, a construction with a regular coordination from which movement takes place (lower coordination from (59)) but without higher (derivationally) formed coordination. SC (61) illustrates how such a case would look like. Bošković (2022) shows SC disallows such constructions. I am in fact not aware of any language that would allow them.

(61) *Prema kome$_i$ za kim su podržali [otpor t$_i$] i [potragu t$_j$]?
　　　 to　　whom for whom are supported resistance and pursuit

These facts can be interpreted as indicating that there must be a reason for derivational coordination formation. It seems safe to assume that regular movement of different elements from a single ConjP is not possible, this is why (61) is unacceptable. Sideward merger makes it possible to get around that restriction (sideward merger was originally employed by Nunes 2004 to get around islandhood effects) and derivational coordination formation is what provides the needed sideward merger mechanism in (59). If there must be a reason for derivational coordination formation there would then need to be a reason for it with wh&wh coordinations too. The reason here may be tied to indeterminate licensing, with something like Higginbotham and May's (1981) quantifier absorption involved. A FASL referee in fact suggest that the "coordination structure in this case is the morphological realisation of what semanticists call absorption, the simultaneous binding of two variables by the same operator". We can then assume that indeterminates have a feature to be licensed/checked, and that in the coordination in question the feature is licensed through the coordination structure, not in its usual manner (see Oda 2022).

　　　 The above analysis can also provide a way of deducing the generalization from section 3 that an indeterminate system is needed for wh&wh coordinations. Such coordinations involve derivational coordination formation. As suggested above, derivational coordination formation needs to have motivation. With indeterminates, indeterminate licensing provides such motivation. Examples like (20) are then ruled out because there is no reason for derivational coordination formation in those cases. The same would also hold more generally for languages where the relevant elements are not indeterminates.[19]

　　　 The absorption analysis can also explain why mixing of different types of quantifiers is not allowed (see fn 6), given the natural assumption that quantifiers of different types cannot undergo absorption. It may also help us address the puzzle regarding the impossibility of adjunct MWF questions like (62a).

(62) a. *Zašto kako tuče　　　 Petra?　　　　　　 b. *Kako zašto tuče Petra?
　　　　 why how is-beating Petar
　　　　 'Why is he beating Petar how?'

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[19]Furthermore, indeterminates are standardly assumed not to have inherent quantificational force, their interpretation being determined by the licensing context in which they are found. In non-indeterminate languages, the relevant elements can be taken to have inherent quantificational force that requires a QR-like movement, which is not possible out of a coordination.

(63) Zašto i   kako tuče   Petra?
     why   and how is-beating Petar   (SC)

If regular licensing is not possible when there is more than one adjunct (*why* is actually crosslinguistically often degraded in multiple questions), (63) will not face that issue due to the alternative licensing through coordination.

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