

On Binary Features and Disagreeing Natural Classes: Evidence from Cheyenne and Serbian

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Abstract: In this paper we offer new arguments for bivalence of morphological features. In the domain of person, we argue in support of the system using the features [\pm speaker] and [\pm hearer], on the basis of plural marking in Cheyenne. In the domain of gender, we argue in support of the system using the features [\pm masculine] and [\pm feminine], on the basis of gender agreement in Serbian coordinate structures. The property of binary systems crucial for our proposal is that they allow combinations of *disagreeing* feature values, given that in such systems every morphological category is represented as a combination of two values. Our main empirical goal is to show that some languages treat such combinations of disagreeing feature values (as well as combinations of agreeing values) as natural classes (e.g., Noyer 1992).

Keywords: binary features, person, gender, Cheyenne, Serbian

1. Introduction

In this paper we offer new arguments for bivalence of morphological features. An important property of bivalent feature systems, which is at the core of our investigation, is that they can capture three or four-way category distinctions without positing a separate feature for each member of the category. For example, a hypothetical four-way distinction can be captured by a system based on only two bivalent features [\pm F₁] and [\pm F₂], as illustrated in (1):

- (1) A = [+F₁, +F₂]
 B = [-F₁, -F₂]
 C = [+F₁, -F₂]
 D = [-F₁, +F₂]

Our primary concern in this article is the representation of the categories C and D in (1), as opposed to A and B. Since in binary systems morphological categories are represented as combinations of two feature values, the logical space includes combinations of *disagreeing* feature values. This particular property of such representations, we argue, allows for a different conception of what may constitute a natural class. In particular, one may expect that certain languages could in principle treat combinations of disagreeing feature values (as well as combinations of agreeing values) as natural classes, i.e., that C and D in (1) could behave as a natural class. Our main empirical goal is to show that this is indeed true. In the domain of person, we argue in support of the system based on the features [\pm speaker] and [\pm hearer] (e.g., Bobaljik 2008, Noyer 1992, Silverstein 1976, Watanabe 2013 etc.), with evidence coming from Cheyenne plural marking. This is the topic of section 2, which also presents the typological and theoretical background for our analysis. In section 3, we examine gender agreement in Serbian coordinate structures and argue that the three-way gender system involving masculine, feminine and neuter gender should be represented with [\pm masculine] and [\pm feminine] features. Throughout the article we also compare our analysis to alternative approaches. Section 4 is the conclusion.

2. Binary features and person: plural marking in Cheyenne

Cheyenne is a Plains Algonquian language spoken in Montana and Oklahoma. As in other Algonquian languages, the verbal prefix position in Cheyenne is reserved for person marking, as shown in (2) and (3) (e.g., Bloomfield 1946, Leman 2011).

(2) *Animate intransitive independent indicative paradigm (Leman 2011:28)*¹

'pray'	Singular	Plural	
1	<i>Ná-háóéna</i>	<i>Né-háóena-ma</i>	<u>inclusive</u>
		<i>Ná-háóéna-me</i>	<u>exclusive</u>
2	<i>Né-háóéna</i>	<i>Né-háóéna-me</i>	
3	<i>É-háóéna</i>	<i>É-háóena-o'o</i>	

(3) *Cheyenne person prefixes*

- a. **Ná-** 1st person
- b. **Né-** 2nd person (includes both first person inclusive and second person)
- c. **É-** 3rd person

A well-known property of Algonquian languages is that in the person prefix position the same prefix marks first person inclusive and second person; in the case of Cheyenne, this is *né-*, as shown in (3b) (see Macaulay 2009 for a discussion and summary of the relevant Algonquian facts). That is, first person inclusive and second person are treated as identical in the prefix position (i.e., *né-*). Cheyenne is in this respect quite similar to other Algonquian languages. Cheyenne plural suffixes, on the other hand, display a unique behavior, which we focus on here (see (4)):

- (4) a. **-ma**: first person inclusive (1INCL)
- b. **-o'o**: third person plural (3PL)
- c. **-mé**: both first person exclusive (1EXCL) and second person plural (2PL)

The significant property of these suffixes is that *-mé* groups together *first person exclusive* and *second person plural*, to the exclusion of first person inclusive and third person plural, which are marked by separate morphemes. In other words, first person exclusive and second person plural are treated as a *natural class*. Importantly, this is not an obscure corner of the Cheyenne grammar, but a productive pattern, which we illustrate here with reflexive and passive verbs:

(5) a. *Reflexive verbs (Leman 2011:55)*

<i>Ná-vóom-ahtse</i>	I saw myself	<u>Singular</u>
<i>Né-vóom-ahtse</i>	You saw yourself	
<i>É-vóom-ahtse</i>	He saw himself	

¹ Cheyenne Orthography: \check{V} voiceless vowel, \acute{V} high pitch vowel, \tilde{V} mid pitch vowel, \check{s} voiceless alveolar fricative (IPA: ʃ), ' glottal stop (IPA: ʔ). All final vowels are voiceless (not marked, by convention), but their underlying pitch can affect the pitch of other vowels (see Leman 2011 for more details).

<i>Né-vóom-áhtse-ma</i>	We(INCL) saw ourselves	<u>Plural</u>
<i>Ná-vóom-áhtsē-me</i>	We(EXCL) saw ourselves	
<i>Né-vóom-áhtsē-me</i>	You(PL) saw yourselves	
<i>É-vóom-áhtse-o'o</i>	They saw themselves	

b. -ahtse: reflexive/reciprocal marker

(6) a. Passives (Leman 2011:55)

<i>Ná-vóom-āne</i>	I was seen	<u>Singular</u>
<i>Né-vóom-āne</i>	You were seen	
<i>É-vóom-e</i>	He was seen	
<i>Né-vóom-ane-ma</i>	We(INCL) were seen	<u>Plural</u>
<i>Ná-vóom-ané-me</i>	We(EXCL) were seen	
<i>Né-vóom-ané-me</i>	You(PL) were seen	
<i>É-vóom-e-o'o</i>	They were seen	

b. -e: 3rd person passive marker
 -ané: non-3rd person passive marker

2.1. Cross-linguistic distribution

Cheyenne is quite exceptional within the Algonquian family in this respect, since to the best of our knowledge this pattern does not appear in any other Algonquian language. And in more general terms, this pattern is typologically rare; for instance, Cysouw (2003: 156-157) notes that the homophony between first person exclusive and second person plural is attested in Austronesian languages “on and around the island of Timor” (Kisar, Lamalera, Dawanese, Sika, Roti), Australian languages Tiwi and Burarra and the Tungusic language Udihe (see (7a)). Noyer (1992) also discusses the same type of pattern in Mam, a Mayan language spoken in Guatemala (see (7b)). In particular, the enclitic *-a* of the plural verbal paradigm appears only with 1st person exclusive and 2nd person plural verbs (in the singular paradigm it also appears only with 1st and 2nd person).

(7) a. Udihe Subject Suffixes

Cysouw (2003: 157)

	Singular	Plural	
1	*	...-fi	<u>inclusive</u>
1	...-mi	...-u	<u>exclusive</u>
2	...-i	...-u	
3	...-ini/ili	...-iti	

b. *Mam Suffixes*

Noyer (1992: 158)

	Singular	Plural	
1	*	<i>q</i> -...	<u>inclusive</u>
1	<i>n-/w</i> -... -a	<i>q</i> - ... -a	<u>exclusive</u>
2	<i>t</i> - ... -a	<i>ky</i> - ... -a	
3	<i>t</i> - ...	<i>ky</i> -...	

2.2. *Theoretical assumptions: representing person features*

We argue that the above Cheyenne facts provide support for a two-valued, binary feature system based on [\pm speaker] and [\pm hearer] (e.g., Bobaljik 2008, Noyer 1992, Silverstein 1976, Watanabe 2013 etc.). The binary value system in question derives the inclusive/exclusive distinction as in (8), where plural is marked with [$-$ singular]

(8) Plural paradigm of [\pm speaker], [\pm hearer]

we(inclusive) = [+spk,+hr] [$-$ singular]	we(exclusive) = [+spk,-hr] [$-$ singular]
you(PL) = [$-$ spk,+hr] [$-$ singular]	they = [$-$ spk,-hr] [$-$ singular]

On this approach to person categories, there is no ‘third person’ feature – ‘third person’ is a combination of the minus values of [\pm speaker] and [\pm hearer]. As discussed in Bobaljik (2008) (and references therein) this particular characteristic of this system derives certain important cross-linguistic generalizations. For instance, systems based on the three traditional features (1, 2, 3) allow for the expression of a seven-way contrast along the dimension of person (independent of any other feature, such as number):

(9) *The seven meta-persons*

Bobaljik (2008: 205)

- 1+2 speaker(s) and hearer(s); no “others”
- 1+2+3 speaker(s), hearer(s), and other(s)
- 1 speaker(s) only
- 1+3 speaker(s) and other(s); hearer(s) excluded
- 2 hearer(s) only
- 2+3 hearer(s) and other(s)
- 3 other(s) only

Certain distinctions are, however, never morphologized, despite the logical possibility of a seven-way contrast.²

(10) Person universals (as restrictions on contrasts)

U1 No language distinguishes [1+1] from [1+3].

U2 No language distinguishes [2+2] from [2+3].

U3 No language distinguishes among [1+1+2], [1+2+2] and [1+2+3].

The maximal attested contrast (holding all else constant) is the four-way contrast in (11b). The binary system of [\pm speaker] and [\pm hearer] in (11c) "... yields exactly the maximally attested contrasts and excludes precisely those distinctions that are unattested." Bobaljik (2008: 207). Thus, this quite simple theory is able to derive striking typological patterns in a straightforward manner, and this is one of the main reasons why we adopt this particular binary feature system.³

(11) a. Possible b. Attested c. Binary

1+2	inclusive	[+spk +hr]
1+2+3		
1	exclusive	[+spk, -hr]
1+3		
2	second person	[-spk, +hr]
2+3		
3	third person	[-spk, -hr]

It is important to clarify how these person features are supposed to be interpreted, especially when it comes to interaction between person and number. We adopt here the statement in (12) from Watanabe (2013: 471):

(12) *Semantic interpretation of person features*

The positive value is interpreted as inclusion of the relevant discourse participant.

In other words, the speaker is included in the entity denoted by the expression containing [+speaker]. The speaker is not included in the case of [-speaker] (e.g., Zwicky 1977, Heim 2008 etc.). Thus, first person plural includes the speaker, plus an additional set of individuals.⁴

However, for the purposes of this paper, the crucial property of the system based on [\pm speaker] and [\pm hearer] is that it also allows for a different conception of what may constitute a natural class. In particular, since in this model each person category is automatically expressed as a combination of two feature values, it becomes possible to define certain categories without mentioning the features at all: two pluses necessarily represent first person inclusive, and two

² See Bobaljik 2008 for more details. Many languages have a distinct form referring to {2} (a set containing just the hearer) as opposed to {2,3} (a hearer and one other), but this is a contrast in number not in person. Thus, it is important to keep in mind that other features have to be held constant. Also, these universals hold of contrasts in monomorphemic, i.e., unsegmentable, person markers.

³ An important dimension of feature typology that we cannot go into here is *animacy*; see Quinn (2005) and references therein for discussion of implications from Algonquian.

⁴ [+speaker] is not a simple identification with the speaker, i.e., *inclusive* [+speaker, +hearer] does not mean 'someone who is the speaker and the hearer at the same time'.

minuses third person. The common property of first person exclusive and second person, on the other hand, is that they each have one [+] and one [-] value. In other words, the two categories necessarily *disagree* in their values. It is, thus, expected on this approach that some languages could in principle treat these three different combinations of [+] and [-] values as natural classes:

$$(13) \quad A = [+spk,+hr] \qquad B = [-spk,-hr] \qquad C = [+spk,-hr],[-spk,+hr]$$

Consider then again Mam suffixes in (7b), repeated below as (14). As Noyer (1992: 159) points out, the clitic *-a* shows up in the first person singular, first person plural exclusive (but not inclusive), and second person singular and plural, which are all and only those categories where the values for [\pm speaker] and [\pm hearer] *disagree*; i.e., (13C) above. The contrast between (13C) and (13A) comes out more clearly in plural, since the combination of two agreeing [+] values (i.e., [+spk,+hr]) is not possible in singular. The Mam data presented here does not exclude the elsewhere analysis of *-a*; see Noyer (1992) for more details.

(14) *Mam Suffixes*

Noyer (1992: 158)

	Singular	Plural	
1	*	<i>q-...</i>	<u>inclusive</u>
1	<i>n-/w-... -a</i>	<i>q- ... -a</i>	<u>exclusive</u>
2	<i>t- ... -a</i>	<i>ky- ... -a</i>	
3	<i>t- ...</i>	<i>ky-...</i>	

Finally, we believe that this particular system can account for the Cheyenne facts in a more effective way than other binary systems based on different sets of person features. For instance, Nevins (2007) (see also Harbour 2006, etc.) defends a system based on features: [\pm participant] and [\pm author], where [+author] refers to a set containing the speaker, and [+participant] to a set containing one of the discourse participants (i.e., speaker or hearer). On this analysis, the standard three person system would be represented as in (15a). To account for languages with an inclusive/exclusive distinction, however, Nevins (2007) proposes that they incorporate an additional feature, [addressee], which is privative, and thus doesn't have a distinction between + and - values; this is illustrated in (15b). Though this system has advantages (e.g., it is successful in modeling different types of PCC effects and characterizing the "spurious *se*" effect in Spanish), we think it introduces an unnecessary complication in terms of a third feature and might not be best suited to deal with the Cheyenne facts. We also think that there might be a deeper problem with this system, since introducing the privative feature [addressee] effectively makes [\pm participant] redundant. That is, the four way system we see in languages with an inclusive/inclusive distinction could also be easily represented with only [\pm author] and [addressee], as shown in (15c). Note then that (15c) ends up looking very much like the [\pm speaker]-[\pm hearer] system argued for here, the only difference being that [addressee] in (15c) is privative (see Watanabe 2013 (also footnote 5) for arguments that [addressee]/[hearer] has [-] values).

(15) a.

[+auth, +part]	1 st person
[-auth, +part]	2 nd person
[-auth, -part]	3 rd person
[+auth, -part]	logically impossible

b.

[+auth, +part]	1 st person exclusive
[+auth, +part] [addressee]	1 st person inclusive
[-auth, +part] [addressee]	2 nd person
[-auth, -part]	3 rd person
[+auth, -part]	logically impossible
[-auth, -part] [addressee]	logically impossible

c.

[+auth]	1 st person exclusive
[+auth] [addressee]	1 st person inclusive
[-auth] [addressee]	2 nd person
[-auth]	3 rd person

2.3. Analyzing Cheyenne plural marking

The three Cheyenne plural morphemes in (4) above exhibit exactly the pattern illustrated in (13) which incorporates the idea that combinations of disagreeing values can form a natural class. The suffix *-mé* marks first person exclusive ([+spk,-hr]) and second person ([-spk,+hr]). These are all and only those categories where the two person features *disagree* in their values: they both consist of one [+] and one [-] value. The suffix *-ma* marks the only category that is comprised of two [+] values (1st person inclusive, [+spk,+hr]), and *-o'o* marks the only category, which is based on two [-] values (3rd person, [-spk,-hr]). This can be represented as in (16) and (17) (see also Noyer's (1992) α -notation)⁵, which creates the pattern in (13), where *p* in (16) stands for *person* (speaker and hearer):

- (16) a. +/+ p [-singular] ⇔ **-ma** ([+spk,+hr]) pattern **A** from (15)
 b. -/- p [-singular] ⇔ **-o'o** ([-spk,-hr]) pattern **B** from (15)
 c. +/-p [-singular] ⇔ **-mé** ([+spk,-hr], [-spk,+hr]) pattern **C** from (15)

(17)

	speaker	hearer	singular	Cheyenne
1INCL	+	+	-	-ma
1EXCL	+	-	-	-mé
2PL	-	+	-	
3PL	-	-	-	-o'o

⁵ On Noyer's (1992) analysis, which uses α -notation (where α is a variable over [+] and [-]), *-mé* would correspond to [α speaker] [(- α)hearer].

An important implication of this pattern is that both [+] *and* [-] values must be visible to the morphological component. Compelling independent arguments for *negative* values are given in Harbour (2013), Watanabe (2013), and references therein.⁶

We need to make two additional points here. First, approaches to person features which crucially rely on [Participant] feature, without invoking both [\pm speaker] and [\pm hearer], do not seem to be able to characterize the split in (16)/(17) in a natural way. As discussed in Watanabe (2013), such approaches can be classified into two groups: (i) those that are completely based on privative features (18a), and (ii) those that are partially based on privative features (18b):^{7,8}

- (18) a. Completely privative (Harley and Ritter 2002, McGinnis 2005)
 [\pm speaker] [\pm hearer] [\pm participant]
 b. Partially privative (Harbour 2006, Nevins 2007)
 [\pm speaker] and [\pm hearer] [\pm participant]

Without making *-mé* an elsewhere case (discussed below), it is not clear if privative approaches could explain how first person exclusive and second person plural can be grouped together as opposed to first person inclusive, since all of these categories are characterized by some version of participant feature ([\pm participant] in (18a) or [\pm participant] in (18b)). The system using [\pm speaker] and [\pm hearer], on the other hand, does not face the same challenge, as argued above.

Second, it is important to show that is not plausible to analyze as an elsewhere case the suffix which groups together first person exclusive and second person (i.e., *-mé*). One may argue, for instance, that *-mé* is better explained as in (199), where it represents the least specific, empty feature set, which is consistent with any environment and therefore constitutes the default realization of the plural suffix slot.

- (19) a. **-ma** \Leftrightarrow [+spk,+hr]
 b. **-o'o** \Leftrightarrow [-spk,-hr]
 c. **-mé** \Leftrightarrow <elsewhere>

The distribution of *-mé* in (19) would be governed by the Elsewhere Principle or Subset Principle (e.g., Kiparsky 1973, Halle 1997 etc.) which states that the application of a specific rule overrides the application of a more general rule. Thus, (19c) would apply whenever the conditions for the application of (19a) and (19b) are not met, which yields exactly first person exclusive and second person plural.

Now, since the defining characteristic of elsewhere items is that they are in principle compatible with any environment, their distribution is often quite varied and cannot be captured

⁶ See Watanabe (2013), in particular, for convincing arguments for the existence of [-hearer]. In a nutshell, Watanabe shows that in relative tense and subjunctive clauses in Fula, subject markers appear preverbally only with categories which must include the feature [-hearer] in their representation, namely, third person singular and plural and first person plural exclusive, but not inclusive (note that in first person singular [-hearer] may be omitted without any loss of information). This shows that there are natural classes that are based just on [-hearer]; at the same time, this pattern cannot be defined in systems that do not include [-hearer] or have just the privative version [hearer].

⁷ As already discussed, the privative feature [hearer] is required in (18b) since a binary system based only on [\pm speaker] and [\pm participant] fails to draw the distinction between inclusive and exclusive.

⁸ Watanabe (2013) also considers a system based on three binary features: [\pm participant], [\pm speaker] and [\pm hearer], which is also compatible with our proposal.

by a single rule. That is, the contexts in which elsewhere items occur often do not form a natural class (e.g., Bonet 1995 on ‘spurious’ *se* in Spanish); for this reason, it might be tempting to argue that *-mé* is in fact the elsewhere case in Cheyenne. Given this line of reasoning, we would expect *-mé* to show up in “unexpected places”, which, however, is not the case. As described above, *-mé* consistently occurs in the contexts of first person exclusive and second person plural and its distribution is in this sense quite limited. But, more importantly, the Cheyenne verbal paradigm already contains a much more plausible candidate for the elsewhere case, and since there cannot be two elsewhere items, we are led to conclude that the analysis in (19) is not on the right track. The more plausible elsewhere case is the suffix *-vo*, whose basic properties we summarize in the next few paragraphs.

In the interest of clarity and accessibility, we have illustrated the basic properties of the Cheyenne plural suffixes so far with intransitive verbs (see (3) and also (5)/(6)). But in order to show that *-mé* should not be analyzed as the elsewhere item, we need to introduce the transitive paradigm, which is more complex in several ways. First, transitive animate verbs have an additional set of plural markers, in which first person exclusive and second person plural are not treated as a natural class. Rather, each of them is marked with a separate morpheme:

- (20) a. *Ná-vóom-ó-ne* ‘We(EXCL) saw him’ (Leman 2011:55)
 b. *Né-vóom-o-ne* ‘We(INCL) saw him’
 c. *Né-vóom-ó-vo* ‘You(PL) saw him’

As shown in (20), second person plural is marked with the suffix *-vo*, while first person exclusive with *-ne*.⁹ In contrast to simple intransitive verbs, transitive verbs also have a voice suffix (*-o* in (20)), which indicate who is acting upon who. Since there is only one person prefix position, this suffix is particularly important; without it we wouldn’t be able to tell the person features of the subject from the object. The person prefixes (see (22)) always expresses person features according to the hierarchy in (21), regardless of the syntactic position of the argument.

- (21) Person Hierarchy: $2 > 1 > 3$ (([+hr]) > ([+spk]) > ([-spk] [-hr]))
 (22) **Né-** 2nd person (includes both first person inclusive and second person)
Ná- 1st person
É- 3rd person

Thus, the examples in (23), in which the positions of arguments are switched, differ from the ones in (20) only in the voice suffix. The suffix *-o* is called a ‘direct’ voice suffix since it indicates that the subject is higher on the hierarchy in (21) than the object, while *-ae* is an inverse voice suffix, indicating the object is higher (e.g., (24)):

- (23) a. *Ná-vóom-aē-ne* ‘He saw us(EXCL)’ (Leman 2011:55)
 b. *Né-vóom-ae-ne* ‘He saw us(INCL)’
 c. *Né-vóom-aē-vo* ‘He saw you(PL)’

⁹ Note that the marker for first person inclusive (*-né*) has a high pitch, in contrast to the marker for first person exclusive (*-ne*). However, this pitch distinction is not visible in (20) on the final vowels, which are voiceless, but affects the pitch of the preceding vowel.

(24) Voice suffixes

- a. **-o** ⇔ (1/2) >_(acting upon) (3) *direct*
b. **-ae** ⇔ (3) >_(acting upon) (1/2) *inverse*

And as shown in (25) and (26), third person plural is marked in the same way as in intransitives, with the suffix *-o'o*, which follows the plural markers for first and second person.

- (25) a. *Ná-vóom-ó-ne-o'o* 'We(EXCL) saw them' *direct* (Leman 2011:55)
 b. *Né-vóom-ó-ne-o'o* 'We(INCL) saw them'
 c. *Né-vóom-ó-vo-o'o* 'You (PL) saw them'
- (26) a. *Ná-vóom-ae-ne-o'o* 'They saw us(EXCL)' *inverse* (Leman 2011:55)
 b. *Né-vóom-ae-ne-o'o* 'They saw us(INCL)'
 c. *Né-vóom-ae-vo-o'o* 'They saw you(PL)'

The position following the voice suffix marks 1st and 2nd person plural. This position can be occupied with a suffix like *-vo* (e.g., (25c)/(26c)), but, importantly, it can also be occupied by *-mé*, as in (27):

- (27) a. *Né-vôom-ē-me* 'You(PL) saw me.' (Leman 2011:55)
 b. *Né-vôom-atsē-me* 'I saw you(PL).' (Leman 2011:55)

Here, for instance, *-mé* marks second person plural of the subject in (27a) and of the object in (27b). Again, the information about the grammatical function of the arguments comes from the voice suffix, as in (20)/(23). Thus, *-e* in (27a) indicates that second person is acting upon first person, while *-atse* (27b) indicates that first person is acting upon second person. Crucially, *-mé* competes for the same position in the Cheyenne verb template with the suffixes in (20), including *-vo*. This slot corresponds to the "central suffix" in Goddard (1979) or Slot 5 in Bloomfield (1962), follows the voice suffix in the above examples and marks only 1st and 2nd person plural. Thus, these affixes express the same set of features and compete for the same position in the verbal template - they do not co-occur. We therefore expect that only one of them could be the elsewhere item. And there is overwhelming evidence that this is in fact *-vo*. Specifically, unlike *-mé* whose distribution is completely consistent and predictable, *-vo* appears in a number of unrelated contexts. For example, in transitive animate interrogatives *-vo* marks both third and second person plural; the partial paradigm is given below:

Transitive Animate Interrogative

- (28) a. *Ná-vóom-o-vo-he?* 'Did I see them?' *direct* (Leman 2011:74)
 b. *Né-vóom-o-vo-he?* 'Did you(SG) see them?'
- (29) a. *Ná-vóom-ae-vo-he?* 'Did they see me?' *inverse* (Leman 2011:74)
 b. *Né-vóom-ae-vo-he?* 'Did they saw you(SG)?'

- (30) a. *Ná-vóom-o-ne-vo-he?* ‘Did we(EXCL) see them?’ *direct* (Leman 2011:74)
 b. *Né-vóom-o-ne-vo-he?* ‘Did we(INCL) see them?’
 c. *Né-vóom-o-vo-vo-he?* ‘Did you (PL) see them?’
- (31) a. *Ná-vóom-ae-ne-vo-he?* ‘Did they see us(EXCL)?’ *inverse* (Leman 2011:74)
 b. *Né-vóom-ae-ne-vo-he?* ‘Did they see us(INCL)?’
 c. *Né-vóom-ae-vo-vo-he?* ‘Did they saw you(PL)?’

The word final suffix *-he* above is the polar interrogative marker. Particularly revealing are the examples in (30c) and (31c), in which both second and third person are plural and they are both marked with the same suffix *-vo*. In addition to transitive animate interrogatives, *-vo* marks both third and second person plural in a number of other contexts, such as transitive inferential (dubitative), narrative (mediate) and hortative verbs. It also shows up with inanimate transitive verbs, as well as transitive animate verbs involving obviative pronouns. These facts (as well as (32) below) could be analyzed in a variety of different ways, which we will not explore in any detail here, since this is not the primary focus of our paper. One possibility, for instance, within the model of Distributed Morphology, would be to assume that *-vo* is the elsewhere item and that an *Impoverishment* operation deletes the features [*-spk,-hr*] of third person in the context of a feature like [*+interrogative*] prior to vocabulary insertion. We leave closer exploration of different possibilities for future research.

Finally, *-vo* even appears with intransitive verb. For instance, in the interrogative paradigm it marks third person plural (e.g., (32g)).¹⁰ As illustrated in (32), the same paradigm includes the suffix *-mé*, which, recall, marks first person exclusive and second person plural.¹¹ For instance, the contrast between (32f) and (32g) is particularly revealing. Here, both *-mé* and *-vo* appear right before the suffix *-he*, but *-mé* marks second person plural as expected, while *-vo* surprisingly marks third person plural. This is again completely expected if we assume that *-vo* is the elsewhere item.

Intransitive Animate Interrogative

- (32) a. *Ná-hotse'óhe-he?* ‘Did I work?’ (Leman 2011:34)
 b. *Né-hotse'óhe-he?* ‘Did you (SG) work?’
 c. *É-hotse'óhe-he?* ‘Did he work?’
 d. *Ná-hotse'óhe-me-he?* ‘Did we(EXCL) work?’
 e. *Né-hotse'óhe-mane-he?* ‘Did we(INCL) work?’
 f. *Né-hotse'óhe-me-he?* ‘Did you (PL) work?’
 g. *É-hotse'óhe-vo-he?* ‘Did they work?’

All of this strongly suggests, in our view, that if anything should be posited as an elsewhere item it should be *-vo* and not *-mé*, and that an analysis along the lines of (19) would simply miss a

¹⁰ In intransitives, *-vo* also shows up as the marker of third person plural in inferentials and hortatives.

¹¹ Note that first person inclusive in this particular case is marked with *-mané* (32e), instead of *-ma*, which could plausibly be segmented into *-ma* and *-né*. We leave this question open here. In the Cheyenne dictionary (Fisher et al 2006), it is noted that *-mané* is a variant of *-ma*, potentially morphologically complex, and potentially optional, as in the following pair, which both mean ‘let’s go eat!’: *Nétáhémèsèhé-máne!* or *Nétáhémèsèhe-ma!* In any case, this does not affect our main point here.

significant generalization about the Cheyenne verbal plural marking. This, in turn, gives further support to our proposal that combinations of disagreeing feature values can form a natural class. In the next section we show how our analysis can be extended to the domain of gender.

3. Binary features and gender: agreement in Serbian

We have argued that the Cheyenne facts from the previous section support a binary feature system of person categories based on [\pm speaker] and [\pm hearer]. As discussed in the Introduction, an advantage of such bivalent feature systems is that they can capture three or four-way category distinctions without positing a separate feature for each member of the category. Thus, bivalent feature representations have been proposed for other categories as well, like number or gender (see Harbour 2013 for a recent overview). For instance, Nevins (2011) convincingly argues that in languages with dual, number category is based on features [\pm singular] and [\pm augmented] (see also Harbour 2006, Noyer 1992):¹²

- (33) a. Singular = [+singular, –augmented]
 b. Dual = [–singular, –augmented]
 c. Plural = [–singular, +augmented]
 d. The combination [+singular, +augmented] is impossible

According to (33), there is no separate feature ‘dual’; rather, dual is a combination of [–] values of [\pm singular] and [\pm augmented]. In this sense, dual is similar to third person in the person domain. Systems like (33), therefore, further illustrate the general importance of [–] values. We argue in this section that the three-way gender system involving masculine, feminine and neuter gender should be analyzed in a similar manner, namely using binary features [\pm masculine] and [\pm feminine].

We draw our arguments from Serbian, which has three grammatical genders: masculine, feminine and neuter. Our claim is that they should be represented via two binary gender features: [\pm masculine] and [\pm feminine], as shown in (34).

- (34) a. [GENDER \pm masculine and \pm feminine]
 b. **Masculine:** [+masc, –fem]
 c. **Neuter:** [–masc, –fem]
 d. **Feminine:** [–masc, +fem]
 e. *Not possible:* [+masc, +fem]

¹² [+augmented] here is defined as in (i):

$$(i) [+augmented] = \lambda P \lambda x \exists y [y \subset x \wedge P(x) \wedge P(y)]. \quad \text{Nevins (2011)}$$

In prose, “given some predicate P that is true of some set x, x is [+augmented] if there is a proper subset of x for which P is also true” (Nevins 2011, 422). A set of cardinality such as 100, for example, is [+augmented] for its value of [\pm singular] (i.e., [– singular]) because there is at least one proper subset of 100 which is also [– singular]. By the same logic, sets of cardinality 1 are always [–augmented] for their value of [\pm singular] (i.e., there is no proper subset of 1 which is also [+singular]). However, a set of cardinality 2, which is [–singular], is special because there is no proper subset of this set which is also [–singular]. For this reason, a set of cardinality 2 is [–augmented] for its value of [\pm singular].

Again, neuter is similar to third person in that there is no separate ‘neuter’ feature; i.e., neuter is a combination of minus values of [\pm masculine] and [\pm feminine]. Neuter is in this respect different from masculine and feminine, which each have one plus and one minus value. If our proposal from the previous section is on the right track, we should then find evidence that masculine and feminine, each having one plus and one minus value, pattern together, as opposed to neuter, which is based on two minus values. Certain puzzling gender agreement facts from coordinated structures show that this is indeed true. Consider the following contrasts:

- (35) When two *masculine* singular arguments are coordinated in the subject position, the participle shows *masculine* plural agreement.

Ovaj čovek i onaj dečak su stigl-**i**. *Masculine*
 This man and that boy are arrived-M.PL
 ‘This man and that boy arrived.’

- (36) When two *feminine* singular arguments are coordinated, the participle takes the plural *feminine* form.

Ova žena i ona devojka su stigl-**e**. *Feminine*
 This woman and that girl are arrived-F.PL
 ‘This woman and that girl arrived.’

- (37) *However*, when two *neuter* singular arguments are coordinated, the participle unexpectedly does **not** show *neuter* plural agreement, but *masculine* plural agreement, even though the neuter plural form is otherwise possible (cf. (36)).¹³

Ovo dete i ono dete su ✓stigl-**i** / *stigl-**a** *Neuter*
 This child and that child are arrived-M.PL arrived-N.PL
 ‘This child and that child arrived.’

- (38) Deca su stigl-**a**.
 Children are arrived-N.PL
 ‘Children arrived.’

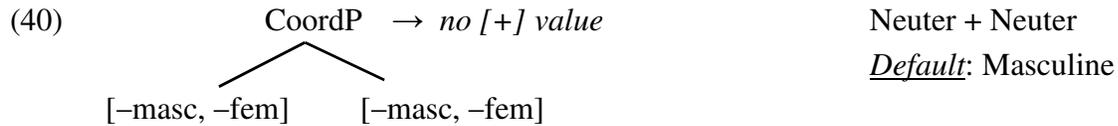
This is quite surprising if neuter is, just like masculine and feminine, represented with a separate feature. On our approach, on the other hand, this contrast falls out naturally under the following assumptions about Serbian coordination, which should be uncontroversial:

- (39) a. When two (or more) singular arguments are coordinated, CoordP is automatically assigned plural.

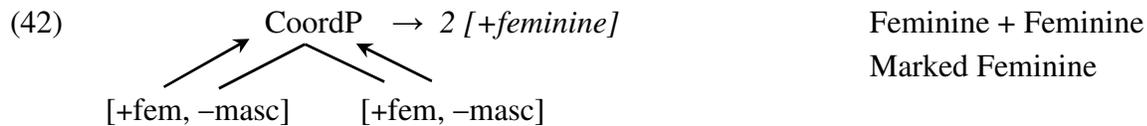
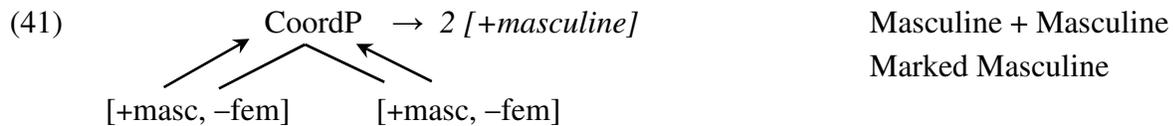
¹³ Note that the ungrammaticality of neuter plural agreement in (37) is remarkably strong. Also, it is important to keep in mind that these examples involve coordination of *singular* arguments; i.e., (37) shows an unexpected failure of agreement with two coordinated *singular* arguments of the same gender. For agreement with coordinated plural arguments see Bošković (2009) and for Slovenian Marušić et. al (2007).

b. In order for the verb to agree in gender with CoordP, each conjunct must contribute a [+] valued gender feature, which cannot be in conflict with each other; otherwise the verb takes the default masculine plural form.¹⁴

Thus, in (37) no conjunct contributes a [+] valued gender feature, since neuter has two [-] values, by hypothesis:

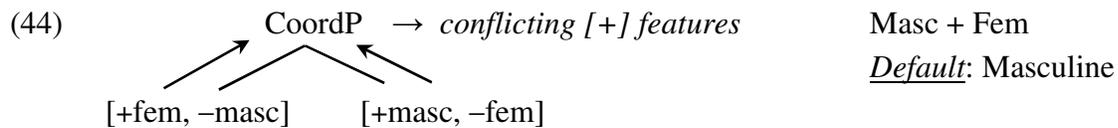


In (35) and (36), on the other hand, each conjunct contributes a [+] valued gender feature of the same type, as shown below:



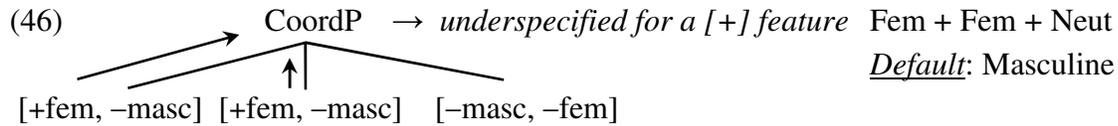
Serbian participles will take the default masculine plural form for two reasons: (i) when (at least) one of the conjuncts does not contribute a [+] gender feature value at all (i.e., neuter), as in (37) and (40), as well as (45) and (46), or (ii) when the [+] valued gender features of the conjuncts are in conflict as in (43) and (44).

(43) Čovek i žena su stigl-**i**.
 Man and woman arrived_{M.PL}
 ‘A man and a woman arrived’



(45) Žena, devojka i dete su stigl-**i**.
 Woman, girl and child arrived-M.PL
 ‘A woman, a girl and a child arrived.’

¹⁴ It is a commonplace assumption in Slavic linguistics that in such cases masculine is the default form; see the references cited in footnote 12, for instance.



Thus, in (45) (which is similar to (37)), the CoordP is *underspecified* for the gender feature, which also triggers the default form. Overall, the above facts show that masculine and feminine do pattern together, as opposed to neuter, in support of our proposal. Note that our analysis also provides a natural explanation for some core facts of the Serbian (and possibly Slavic) grammar. In particular, adjectives and participles agreeing with sentences take the *neuter* singular form:

- (47) Prihvatiti krivicu nije lak-**o**.
 Accept_{INF} fault not easy-N.SG
 ‘To admit one’s fault is not easy.’

Why would this be the case? Why shouldn’t the adjective in (47) take the masculine or feminine form, for instance? At the same time, Serbian adverbs (VP-modifiers) are, in terms of morphological form, in fact always *neuter* singular adjectives (e.g., (48)), which begs the same question: why not masculine or feminine?

- (48) a. Marko trči spor-**o**. b. Jedno spor-**o** dete.
 M runs slow-N.SG One slow-N.SG child
 ‘Marko runs slowly.’ ‘One slow child.’

On a natural assumption that VPs and sentences are, in contrast to nouns, inherently genderless it is expected that the form with two [-] gender feature values (neuter) would be most compatible with them. In other words, VPs and sentences cannot be associated with grammatical gender because they do not fall into declension classes; i.e., unlike nominals, they do not decline in terms of case (see Despić 2017 and Wechsler and Zlatić 2003 for the relationship between grammatical gender and declension class in Serbian). The picture that emerges then is that neuter encompasses elements without grammatical gender/declension class while masculine is the default form in the domain of things that do have grammatical gender/declension class.

Further support for this kind of approach comes from the fact that coordinating two (or more) infinitives never leads to plural agreement – the predicate always takes the singular neuter form (49a). Also, coordinating VPs does not affect the form of the adverb (49b). This indicates to us that the neuter singular form appears in contexts where there is no agreement whatsoever; i.e., no ϕ -features to agree with, including number, as the facts in (49) suggest. As discussed in Despić (2017), when an agreement target agrees with something that has no ϕ -features at all (including gender), it is assigned two [-] gender values, i.e., neuter. This indicates the absence of ϕ -features on the agreement controller. On the other hand, when the agreement controller is CoordP with conflicting gender values, the default value is masculine (see Despić 2017 for more

details). Our approach is therefore able to make a meaningful connection between Serbian coordinate agreement and the facts in (47)-(49), while on other approaches any similarity between them appears completely accidental. For instance, an analysis that adopts only the masculine-as-default rule, but rejects the bivalency of features, might appear simpler, but such an analysis would be weaker in terms of empirical coverage since it would have nothing to say about (47)-(49); or, in other words, it would simply miss a potentially significant generalization. In addition, such an analysis would also incorrectly predict that the adjective in (47) should take the masculine form (since masculine is default).

- (49) a. Prihvatiti krivicu i izviniti se **nije** lak-**o** /***nisu** laki/laka
 Accept-INF fault_{ACC} and apologize REF not-AUX.SG easy-N.SG/not-AUX.PL easy-M.PL/N.PL
 ‘To admit one’s fault and apologize is not easy.’
- b. Marko trči i jede spor-**o**.
 Marko runs and eats slowly
 ‘Marko runs and eats slowly.’

Finally, we need to briefly mention cases like (50) below. Here, the participle agrees with the subject in number and gender, but the adverb modifying the participle still takes the neuter form.

- (50) Marko je trčao spor-**o**.
 Marko is run-PAST.PART.MASC.SG slowly
 ‘Marko ran slowly.’

This is expected as well on our approach, since the gender and number features on the participle are not its “inherent” properties, but are acquired strictly via agreement with the subject. That is, the participle is an agreement target not an agreement controller – it does not have lexically specified gender/declension class or number (or, in minimalist terms, its gender/number features are strictly uninterpretable). Although participles may show gender (and number) distinctions through agreement, they are nevertheless inherently “genderless” (i.e., they do not contribute any gender values on their own) and are therefore exactly expected to appear with the neuter singular form adverbs.

4. Conclusion

Both Cheyenne plural marking and gender agreement in Serbian coordinate constructions provide new arguments for bivalence of morphological features. The Cheyenne plural suffix *-mé* marks both first person exclusive and second person plural, which are the categories with disagreeing values for [\pm speaker] and [\pm hearer]. Agreement in Serbian coordinate structures treats neuter differently from masculine and feminine: masculine and feminine each disagree on their values for [\pm masculine] and [\pm feminine], in contrast to neuter, which is based on two minus

values. Both of these cases show that some languages treat combinations of disagreeing feature values as natural classes.

While not common, we do see these patterns across language families (e.g., Slavic, Algonquian, and Mayan) and in different domains (e.g., gender and person). The grouping of disagreeing values is most obvious in systems that incorporate the combination of two plusses, such as languages with an inclusive/exclusive distinction ([+speaker,+hearer]). In such languages, the combination of disagreeing values ([+,-], [-,+]), is contrasted both with two plusses ([+,+]) and two minuses ([-,-]). Within the domain of gender, the contrast is less obvious because the [+,+]) combination is logically impossible. This crucial difference between these two domains is the reason why different types of argumentation are needed in the different cases. However, the analysis of person that we provide for Cheyenne can easily be extended to languages like English, where there is no inclusive/exclusive distinction (no [+,+]). In present tense singular, English groups [+speaker,-hearer] (first person) and [-speaker,+hearer] (second person) together as opposed to [-speaker,-hearer] (third person). This type of syncretism is also found in other languages, such as Waskia, Hunzib, and Svan (Cysouw 2003). Like in the case of Serbian gender, this approach to English person is less obvious because of the absence of the [+,+]) combination, but follows from the proposed analysis at the general level.

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