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## LAST IN, FIRST OUT: PATTERNS OF REDUCTION IN ROMANCE DEMONSTRATIVE SYSTEMS\*

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**ABSTRACT** Demonstrative forms encode deictic features, which define the location of a referent in the external world in relation to a deictic centre. The encoding of deictic oppositions is however not diachronically stable, most commonly leading to poorer demonstrative systems over time: this paper explores the patterns of reduction attested by Romance (at face value) ternary demonstrative systems. Assuming that demonstrative forms are derived by person features, an account for such semantic reductions is proposed in terms of feature loss. More concretely, it is argued that change can be captured by a combination of featural and structural factors: the former determine computationally complex person(-related) categories, the latter determine which feature may be lost to ease said computational complexity.

### 1 INTRODUCTION

The semantic organisation of indexical systems is generally regarded as the quintessential example of diachronic stability: in spite of changes in their phonology and morphology, the meaning of indexical forms (that is, beyond their specific context-dependent referent, how that referent is determined) shows outstanding diachronic continuity. The organisation of pronominal paradigms, for instance, has been shown to be fundamentally stable in diachrony (see e.g. Nichols 1992), and the relatively few exceptions to this trend have been brought back to contact-induced change (for some examples, see

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\* Earlier versions of this work were presented at NELS 51, IGG 46, and DiGS 22, whose audiences I would like to thank for their valuable questions and feedback. I owe special thanks to three anonymous reviewers for their careful and helpful comments and insightful discussion points, from which this paper benefited enormously. This work is part of my doctoral research: for extensive and crucial discussions on and support with various stages of this work, I am deeply grateful to my supervisors, Roberta D'Alessandro, Martin Everaert, and Luigi Andriani. All errors are of course my own. This research was initially funded by the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement: CoG 681959\_MicroContact).

Siewierska 2004: chapter 7).

Against this background, this paper discusses the case of exophoric demonstrative systems, or sets of demonstrative forms that are used spatially to define the location of an actual referent in the external world in relation to a deictic centre (Diessel 1999; Levinson 2004; among many others). In particular, this paper addresses both demonstrative pronouns and adjectives (jointly referred to here as nominal demonstratives, 'N:DEM': e.g. *this* (*hedgehog*), referring to a hedgehog located near the speaker) and locative, or spatial, adverbs (here labelled adverbial demonstratives, 'A:DEM': e.g. *here*, referring to the location of the speaker, or to a region loosely identifiable with it). Contrary to the general stability of indexical elements, demonstrative systems are remarkably unstable diachronically (see, for original observations in this respect, Frei 1944).

Concretely, this paper discusses how the encoding of deictic features (and the resulting deictic oppositions) in Romance demonstrative systems undergoes change, resulting over time in new demonstrative systems with fewer or more forms (for a comprehensive overview, see Ledgeway & Smith 2016; for a general introduction to Romance demonstratives, see instead the various contributions in Jungbluth & Da Milano 2015). In what follows, the focus is restricted to the patterns of reduction attested by Romance ternary demonstrative systems, that is, demonstrative systems that encode a three-way deictic opposition between the speaker-related deictic domain ('near me'), the hearer-related deictic domain ('near you'), and the non-participant-related deictic domain ('far from us').<sup>1</sup> These systems are shown to reduce into binary systems, which only partition the deictic space in two. Similar reductions have been described, beyond the Romance domain, for Uralic languages (Abondolo 1998), Greek (Manolessou 2002), Indo-Aryan and Dravidian languages (Bhat 2004: 181–182), and Bulgarian (Vulchanova & Vulchanov 2011).

This paper explores in detail the patterns of reduction attested by Romance ternary demonstrative systems and aims at accounting for them in a principled way (see instead Stavinschi 2012 for an analysis of how Romance binary demonstrative systems expanded into ternary systems). Assuming that demonstrative forms are derived by means of person features, the reduction patterns are descriptively captured as resulting from feature loss, which is argued to derive from a combination of featural and structural factors. The former determine computationally complex person(-related) categories, which may be prone to simplification; the latter determine which

<sup>1</sup> Here, the label “ternary” is used pre-theoretically to refer to demonstrative systems that display three forms with contrastive deictic values; a subset of these systems will however be analysed as underlyingly encoding a four-way deictic contrast, as discussed in Section 3.2.

specific feature may be lost to ease said computational complexity. The main novel theoretical contribution of the present work lies in the proposal that featural stability is determined by structural factors, and specifically by the merge position of the relevant feature.

This paper is organised as follows: in Section 2, the patterns of semantic and formal reduction of demonstrative systems across Romance varieties are reviewed. Section 3 sketches a comprehensive featural approach to the (micro-)variation attested by demonstrative systems and lays out a generalisation over the attested patterns of change: semantic reduction is formalised as the loss of the last person feature to enter into the derivation. To account for this, Section 4 introduces two feature-related considerations that, together, define complex person categories: description length (Kolmogorov complexity) and monotonicity of the derivation. Section 5, instead, explains the structural constraint whereby only the last feature to be merged in a given functional sequence may undergo loss, following a “Last in, first out” logic; this is then shown to correctly derive all and only the attested patterns of semantic and formal variation in the evolution from ternary to binary demonstrative systems. Section 6 concludes.

## 2 PATTERNS OF EVOLUTION

This section introduces the patterns of reduction attested by Romance ternary systems, i.e. systems that display three contrastive forms to encode the deictic domain associated to the speaker, that associated to the hearer, and that not associated to the discourse participants. As regards their semantics, the loss of one of the three original oppositions encoded in ternary systems yields either a speaker-based system, with the ‘near me’ *vs* ‘not near me’ opposition (Section 2.1); or a participant-based system, with the ‘near us’ *vs* ‘not near us’ opposition (Section 2.2).<sup>2</sup> On top of this, the new reduced systems also display formal variation: for both semantic types, the form that originally expressed the semantic value that underwent loss either disappeared as well, or was reinterpreted and preserved, to the expense of another form in the original system. Note that ternary demonstrative systems were already unstable in Latin; a full investigation of this issue exceeds the scope of the present research, but see Terenghi (2023: 2.2) for discussion.

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<sup>2</sup> Binary systems may further reduce to unary systems, i.e. systems where no deictic opposition is encoded on demonstrative forms (see French *ce/celui* ‘N:DEM’, not specified for any deictic value, in isolation). This process of reduction is captured by the same analysis proposed in this work (see Section 5.2.3); however, given their limited availability across Romance languages (in line with general cross-linguistic tendencies: see Diessel 2013), these systems are largely disregarded in the present study.

The following overview is based on the work by [Ledgeway & Smith \(2016\)](#), which constitutes the most comprehensive survey of demonstrative systems across Romance languages, with 239 systems reported (including both nominal and adverbial demonstratives and different diachronic stages of single varieties; see also [Ledgeway 2015](#) for Italo-Romance data only and [Ledgeway 2020](#) for a parametric analysis of this variation). A quantitative review of those systems follows in (1):

(1) Deictic contrasts	Nominal DEM	Adverbial DEM	Total
Three-way	68	43	111
Two-way, participant-based	45	8	53
Two-way, speaker-based	40	35	75
Total	153	86	239

The systems reported in (1) are classified according to the maximum amount of deictic contrasts that can be encoded in each domain; some of these contrasts are however realised compositionally, by combining a (poorer) nominal demonstrative systems with a (richer) adverbial one, yielding demonstrative-reinforcer constructions (e.g. French *ce N-ci/-là*: see [Bernstein 1997](#); [Brugè 1996](#); [Roehrs 2010](#); [Terenghi 2021a](#)). Thus, some nominal demonstrative systems labelled here as ternary and binary are in fact unary, whenever considered in isolation (and likewise, some ternary systems are in fact binary): this is the case for nine varieties, as briefly discussed in Section 5.2.3.

### 2.1 Speaker-based semantics

Speaker-based binary systems which resulted from the reduction of ternary systems are defined by the conflation of the two non-speaker-oriented deictic domains. Formally, two patterns of evolution are attested:

(2) Semantics	DEM.1	DEM.2	DEM.3
Realisation	1	2	3
Formally conservative systems	1	3	
Formally innovative systems	1	2	

In the first case, the original speaker-oriented and non-participant-oriented forms (respectively indicated by ‘1’ and ‘3’ in (2), to abstract away from the attested variation) are retained and the latter expands its deictic sphere to subsume the hearer-related deictic domain (DEM.2), too (if the hearer does

not fall into the speaker-related domain). This pattern is labelled as “conservative” because it preserves reflexes of the old Latin forms, e.g. nominal demonstratives *ISTE* and *ILLE*. In the second case, instead, the original non-participant-oriented term (‘3’) falls out of use and is substituted by the hearer-oriented form (‘2’), which broadens its semantics to also denote the wider non-participant-related domain (DEM.3). This pattern is referred to as “innovative”, because original Latin demonstrative forms (e.g. nominal *ILLE*) are lost to the advantage of Romance innovative forms for DEM.2 (e.g., in the nominal domain, a reflex of Latin anaphoric or emphatic pronoun *IPSE*, itself not a demonstrative).

The formally conservative pattern is exemplified here by Sardinian nominal demonstratives, (3), and Italo-Romance adverbial ones, (4):

- (3) Nominal demonstratives: Sardinian (Blasco Ferrer 1984: 248)

	N:DEM.1	N:DEM.2	N:DEM.3
Conservative Logudor. (e.g. Orròli)	kústu	kússu	kúḍḍu
Innovative Logudorese	kústu	kúḍḍu	

- (4) Adverbial demonstratives: Italo-Romance (Giannelli 1976: 30; *own knowledge*)

	A:DEM.1	A:DEM.2	A:DEM.3
Florentine	qui	costì	lì
Standard Italian	qui	lì	

Both input varieties (conservative Logudorese varieties and Florentine, still attested as ternary in synchrony) show a ternary semantic organisation of the demonstrative system, with the contrastive expression of the deictic domain related to the speaker (DEM.1, ‘this/here near me’), that related to the hearer (DEM.2, ‘that/there near you’), and that not related to the discourse participants (DEM.3, ‘that/there far from us’); in both cases, DEM.2 and DEM.3 are eventually conflated and the forms that encoded the hearer-related deictic value (*kússu*, *costì*) fell out of use. This pattern of evolution in either or both demonstrative systems is very well represented across the Romance domain (see Aromanian, many Latin American Spanish varieties, some Gallo-Romance varieties).

The formally innovative pattern is illustrated in the following examples from the Latin American Spanish nominal domain, (5), and the Occitan adverbial one, (6):

- (5) Nominal demonstratives: Latin American Spanish (Kany 1945: 135)
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	N:DEM.1	N:DEM.2	N:DEM.3
European Spanish	este	ese	aquel
Latin American Span.	este	ese	

- (6) Adverbial demonstratives: Occitan (Ledgeway & Smith 2016: 895)

	A:DEM.1	A:DEM.2	A:DEM.3
Conservative varieties	aicí	aquí	alai
Innovative varieties	aicí	aquí	

In this case, too, the erstwhile ternary systems, which contrastively encoded the speaker-, hearer-, and non-participant-related deictic domains (DEM.1, DEM.2, DEM.3) evolved into systems in which the distinction between DEM.2 and DEM.3 is collapsed in the grammar, the two original domains corresponding to an undifferentiated non-speaker-related area (DEM.2/3). Here, however, the terms that expressed the hearer-oriented semantics (*ese*, *aquí*) are retained and their usage is extended to cover the non-participant-oriented domain, too, yielding the wider non-speaker-oriented domain; instead, the original exponents for DEM.3 (*aquel* and *alai*) underwent loss. This pattern of evolution is considerably rarer than the previous one, but still well attested, especially in the nominal domain (some Sardinian and Occitan varieties).

Interestingly, some varieties display both formally conservative and formally innovative systems at once: in Rioplatense Spanish (Andrés Saab, p.c.), the nominal series is as in (5), whereas the adverbial series patterns with the conservative type in (4): *acá–allá*. Likewise, in some Occitan varieties the adverbial series is innovative, (6), but the nominal series presents conservative *aquest(e)–aquel/aquéu*, akin to (3) above (Ledgeway & Smith 2016: 879).

## 2.2 Participant-based semantics

Romance ternary systems evolved otherwise into participant-based binary systems, which define a two-way opposition between the domain of the par-

<sup>3</sup> Jungbluth's (2005) work on Ibero-Romance, and in particular on European Spanish, highlighted a different semantics for the ternary system in (5): not one that parallels the organisation of personal pronouns, but a substantially distance-oriented one, where *este* encodes proximity to the speaker (and the hearer), *ese* encodes an intermediate distance from the speaker, and *aquel* encodes a greater distance from the speaker. Importantly, in present-day Spanish, these two semantics are understood to co-exist, and to be in use under different conversational configurations, as per Jungbluth's research. Whether the latter system was available to older varieties of Spanish (which evolved as in (5)) is unclear at present.

ticipants and that of the non-participants. As such, in this case the erstwhile speaker-related and hearer-related semantics (DEM.1 and DEM.2, respectively) are conflated into a more general participant-related domain (DEM.1/2). Also here, two formal patterns of reduction are attested, as shown by (7):

(7)

Semantics	DEM.1	DEM.2	DEM.3
Realisation	1	2	3
Formally conservative systems	1		3
Formally innovative systems	2		3

As already discussed for speaker-based binary systems, the conservative option is for the new participant-based binary systems to retain the original speaker-oriented and non-participant-oriented forms ('1' and '3', respectively), with the former expanding its deictic sphere to include that of the hearer, too, thus yielding the participant-related domain. Alternatively, the reduced systems retain the new Romance hearer-oriented form ('2') in the new participant-oriented use, and lose the original speaker-oriented one ('1').

The formally conservative patterns are exemplified by two southern Italo-Romance varieties: Neapolitan, for nominal demonstratives in (8), and Tarantino, for adverbial ones in (9):

- (8) Nominal demonstratives: Neapolitan (Ledgeway 2004)

	N:DEM.1	N:DEM.2	N:DEM.3
Old Neapolitan	chisto	chisso	chillo
Modern Neapolitan	chisto		chillo

- (9) Adverbial demonstratives: Tarantino (Ledgeway & Smith 2016: 892)

	A:DEM.1	A:DEM.2	A:DEM.3
Reconstructed Tarant.	qua	addò	addà
Current Tarantino	qua		addà

In both cases, the original ternary systems of the older varieties (DEM.1, DEM.2, DEM.3) were reduced to participant-based binary systems, in which the original speaker-related and hearer-related deictic domains are conflated to yield the general participant-oriented reading (DEM.1/2). In Neapolitan and Tarantino, the exponent for this new, unified domain is the original speaker-oriented form (*chisto*, *qua*); the original hearer-oriented one, instead, falls out

of use.<sup>4</sup> Note that, in systems of this type, the original hearer-oriented form has been shown to have a particular status, and concretely to mainly occur in pragmatically marked contexts (see the seminal investigation in [Ledgeway 2004](#)). This aspect will be reviewed further in Section 3.2 below and will be taken to support a different description for the systems that evolved into participant-based bipartitions. Similar systems are very well attested across southern Italo-Romance varieties, both in the nominal and in the adverbial domains, but also in the nominal system of innovative Catalan varieties (e.g. the Barcelona one), in some other Sardinian varieties, and in Judaeo-Spanish.

Participant-based binary systems that instead retained and expanded the hearer-oriented form ('2') are represented, in the following examples, by Brazilian Portuguese, in the nominal domain (10), and by Catalan, in the adverbial one (11):

- (10) Nominal demonstratives: spoken Brazilian Portuguese ([Meira 2003](#))

	N:DEM.1	N:DEM.2	N:DEM.3
European Portuguese	este	esse	aquele
Spoken Brazilian Pg.		esse	aquele

- (11) Adverbial demonstratives: Catalan ([Ledgeway & Smith 2016: 892](#))

	A:DEM.1	A:DEM.2	A:DEM.3
Conservative varieties	aicí	aquí	allí
Innovative varieties		aquí	allí

Again, the original ternary systems (DEM.1, DEM.2, DEM.3) evolved into participant-based binary systems; however, the exponent for the general participant-related domain (DEM.1/2) is, at face value, an original hearer-oriented form (*esse, aquí*); this is to the detriment of the original speaker-oriented terms (*este, aici*), which instead undergo loss. This pattern of evolution is well attested among southern Italo-Romance varieties, too, and particularly widely found in Apulian dialects.

Note that, as was discussed for Latin American and Occitan varieties in Section 2.1, Catalan shows a formal mismatch across the adverbial domain, in (11), and the nominal one, which instead patterns with (8): *aquest–aquell*.

<sup>4</sup> Tarantino, like the vast majority of (non-standardised) Italo-Romance varieties, is predominantly spoken in nature and has only been documented in the last couple of centuries (its first description dates back to a 19th-century dictionary: [de Vincentiis 1872](#)). The dedicated hearer-oriented form has not been documented for Tarantino, but can be reconstructed on the basis of the outcomes of present-day adverbial demonstrative systems in close-by dialects.



### 2.3 Overview

To sum up, the foregoing provided a comprehensive review of the developments attested by demonstrative systems. The process of reduction shows clear differences as concerns both the semantic organisation of the new binary systems (speaker-oriented, Section 2.1; participant-oriented, Section 2.2) and the realisation of the new two-way oppositions (formally conservative *vs* formally innovative systems).

However, despite semantic and formal variation, reduction of ternary systems into binary ones uniformly result into the loss of the contrastive encoding of the hearer-oriented semantics: in speaker-based binary systems, DEM.2 is merged with the non-participant-oriented domain (DEM.3) to yield the non-speaker-oriented semantics (DEM.2/3); likewise, in participant-based binary systems, DEM.2 is merged with the speaker-oriented domain (DEM.1), resulting in the general participant-oriented semantics (DEM.1/2). The general instability of the hearer-related domain notwithstanding, its form ('2') was retained in some varieties, either in nominal and adverbial demonstratives alike, or in one series alone, providing instances of etymological mismatches across the two systems within one and the same language (as mentioned for some Latin American Spanish, Occitan, and Catalan varieties).

An overview of the discussion is given in (12):

#### (12) Patterns of change: Summary

Input: DEM.1 *vs* DEM.2 *vs* DEM.3 = 1-2-3

<i>Pattern</i>	<u>Speaker-based</u>	<u>Participant-based</u>
<i>I</i>	1-3-3 (Sard., (3); It.-Rom., (4))	1-1-3 (Neap., (8); Tarant. (9))
<i>II</i>	1-2-2 (Lat.Am.Sp., (5); Occ. (6))	1-1-2 (—)
<i>III</i>	2-3-3 (—)	2-2-3 (Braz. Pg, (10); Cat. (11))

Similar patterns of reduction are attested for Romance languages in contact contexts: see e.g. Terenghi 2022b for heritage Italo-Romance varieties and Terenghi 2020 for Romance-based creoles.

The summary in (12) raises questions as concerns the status of the attested patterns of reduction and of the reported gaps (i.e. accidental or principled),<sup>5</sup> as to what determines the high instability of the hearer-related domain (DEM.2: how can its systematic loss be accounted for?), and, more in general,

<sup>5</sup> Note that the unavailability of Pattern III in speaker-based systems seems to be contradicted by the evolution pattern attested in the transition from Latin to Romance, where the erstwhile hearer-oriented term *iste* ('2') is eventually retained in the speaker-oriented function across Ro-

as to what underlies the instability of demonstrative systems, as opposed to other indexical systems. The remainder of this paper provides answers to these questions.

### 3 A PERSON-BASED APPROACH TO VARIATION

This section lays out the main assumptions that underlie the account proposed in this paper for the patterns of reduction illustrated in Section 2. In short, the current proposal rests on the premises that demonstrative systems are person-oriented and, as such, derived by means of person features (Section 3.1), and that some of the original demonstrative systems reviewed in the foregoing are to be derived as quaternary systems, rather than as ternary systems (Section 3.2). These two assumptions, in turn, make it possible to define a descriptive generalisation over the patterns of change (Section 3.3): namely, that the attested patterns of reduction result from the loss of the last feature to enter into the derivation. The theoretical goal of this paper is to account for this novel empirical generalisation.

#### 3.1 *Demonstratives are person-oriented and person-based*

In what follows, it is assumed that the deictic oppositions encoded by demonstrative systems are best described as person-oriented and, in turn, that they are derived by person features.

The person-oriented nature of deictic contrasts, at least in Romance languages, is plainly suggested both by participant-based binary systems and by ternary ones and, more specifically, by the different deictic centres available to these systems. In participant-based binary systems, the deictic domain occupied by either or both participants is opposed to that not occupied by either (DEM.1/2 ‘near me and/or you’ vs DEM.3 ‘far from us’; see Neapolitan *chistochillo* in Section 2.2 above); in ternary systems, the space is partitioned in three areas, which roughly correspond to the three persons (see for instance the original Spanish system in (5)): the speaker (DEM.1 ‘near me’: *este*), the hearer (DEM.2 ‘near you’: *ese*), and the other(s) (DEM.3 ‘far from us’: *aquel*). In both

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mance languages, while the erstwhile non-participant-oriented term *ille* (‘3’) is employed for the wider non-speaker-related domain (DEM.2/3), yielding a 2–3–3 pattern. However, and crucially, this evolution was *not* direct: before becoming speaker-oriented forms, reflexes of Latin *iste* were employed in the general participant-oriented function (DEM.1/2 of a novel binary system, already in Late Latin; see e.g. Ledgeway & Smith 2016: 880 and references therein). As such, the reduction of Latin original ternary system does not constitute an instance of speaker-based Pattern III, but rather of participant-based Pattern III, which is independently available. ISTE’s subsequent evolution from a participant-oriented term into a speaker-oriented one can be construed as a case of subjectification, following Stavinschi (2012).

cases, the position of the hearer is relevant for the semantics of at least one of the forms in the system (DEM.1/2 and DEM.2). This person-based description, where the hearer (beside the speaker) is a deictic centre, stands in opposition to a distance-oriented characterisation of demonstrative systems. The latter is in fact centred on the (relative) distance of the demonstrative's referent from the speaker alone and does not allow for the (distinctive) encoding of the hearer's deictic domain (Anderson & Keenan 1985): said otherwise, only the speaker may be the deictic centre in distance-oriented demonstrative systems. As such, a distance-oriented approach cannot be straightforwardly applied to (Romance) demonstratives, since they also refer to the position of the hearer.<sup>6</sup>

By virtue of the person-oriented nature of (Romance) demonstrative systems, it can be maintained that the primitives in the derivation of demonstrative forms are person features: as an in-depth review of this assumption exceeds the scope of this paper, a person-based analysis is simply assumed in what follows, but the reader can find a more detailed discussion of the issue in Terenghi (2021c, 2023: 3.2–3.4).<sup>7</sup> More concretely, the present work adopts the person system put forth by Harbour (2016).

Harbour posits that the person ontology comprises a single speaker ( $i$ ), a single hearer ( $u$ ), and one or more other(s) ( $o, o', o'', \text{etc.}$ ). The grammar manipulates the person ontology by means of three dedicated structures, which can be formally represented as lattices (that is, roughly: power sets of different subsets of the ontology) and which have the following denotations:

- (13) a.  $\llbracket \pi \rrbracket = \{i_o, iu_o, u_o, o_o\}$ <sup>8</sup>  
 b.  $\llbracket \text{author} \rrbracket = \{i\}$   
 c.  $\llbracket \text{participant} \rrbracket = \{i, iu, u\}$  (Harbour 2016: 73–74)

The  $\pi$  lattice, (13a), is the power set of the entire ontology and has a head status in the syntax. The author lattice ((13b); henceforth also 'A') and the participant lattice ((13c); henceforth also 'P'), instead, are the power sets of two subsets of the ontology, the former including the speaker alone and the

<sup>6</sup> The distance-oriented contrasts that can be identified in (Romance) demonstrative systems should be derived as optional modifications of the core person-oriented oppositions; see Terenghi 2021c, 2023 for discussion. Also note that the assumption of a basic person-oriented semantics for demonstratives is not fundamentally at odds with the wealth of additional pragmatic factors that affect the actual use of demonstratives in the context (see Peeters, Krahmer & Maes 2021). How to model these factors exceeds however the scope of this work.

<sup>7</sup> Note that this is not a necessary conclusion. For a locative-based analysis of person-oriented demonstrative systems, see Lander & Haegeman 2018: their proposal seeks to capture the variation across demonstrative systems by means of a [proximal], a [medial], and a [distal] feature, from a nanosyntactic standpoint.

<sup>8</sup> Subscript  $o$ 's indicate any number of others, as well as none of them (see Harbour 2016: 72).

latter including both speaker and hearer. In the syntax, they are the two person features proper, which are regarded here (*contra* Harbour 2016) as heads, under ‘1 Head–1 Feature’ assumptions (see e.g. Cinque & Rizzi 2010: 61).<sup>9</sup>

Following Harbour’s account, person features (successively) perform lattice-theoretic operations on the  $\pi$  lattice: the relevant operations are disjoint addition and joint subtraction, and they are denoted, respectively, by the positive feature value ‘+’ and by the negative one ‘–’. Simplifying matters, [+F] adds the denotation of  $\llbracket F \rrbracket$  to that of  $\llbracket \pi \rrbracket$  (or of the result of the operation performed by the other feature on  $\pi$ ), while [–F] strips the denotation of  $\llbracket F \rrbracket$  from that of  $\pi$  (or the result of a previous operation with  $\pi$ ). For instance, given the sequence +author( $\pi$ ), ‘i’ is added to all elements in  $\llbracket \pi \rrbracket$ , yielding as result a set that ultimately only contains  $i_o$  and  $iu_o$ . That is, these operations invariably result in a subset of  $\pi$ , which corresponds to the person category that is derived by the given features; given +A( $\pi$ ), for instance, the speaker-related category is yielded.<sup>10</sup>

According to how many features perform an action on  $\pi$  and to which feature composes with it first (if both [author] and [participant] are active), Harbour (2016) derives the entire cross-linguistic variation in person(-related) systems (thus, including demonstrative systems): this is shown in (14), where brackets indicate (successive) function applications:

(14) Partitions of  $\pi$ <sup>11</sup>

	$i_o$	$iu_o$	$u_o$	$o_o$
1	$\pi$			
2/P	+P( $\pi$ )			–P( $\pi$ )
2/A	+A( $\pi$ )		–A( $\pi$ )	
3	+P(+A( $\pi$ ))		+P(–A( $\pi$ ))	–P( $\pm$ A( $\pi$ ))
4	+A(–P( $\pi$ ))	+A(+P( $\pi$ ))	–A(+P( $\pi$ ))	–A(–P( $\pi$ ))

If no person feature is active,  $\pi$  is not partitioned into smaller subsets and the

<sup>9</sup> Note that, despite this assumption, the present paper follows (non-standard) Distributed Morphology approaches (see Terenghi 2023: 1.3 for discussion).

<sup>10</sup> How these operations are performed exactly is not strictly relevant to the account to be developed here. It should however be noted that, because features may operate on the result of previous compositions with  $\pi$ , their interactions may be not trivial: I refer readers interested in the technical aspects of this feature system to Harbour (2016: chapter 4).

<sup>11</sup> Note that 3rd person in ternary systems may be derived either by –P(+A( $\pi$ )) or by –P(–A( $\pi$ )). For the ambiguous value of [author] in this derivation, see Section 4.2 below; for the time being, [ $\pm$ author] (which is used as a shortcut to capture both possibilities at once) will be simplified to [–author], as in (16) and (19) below.

resulting person system will only include one undifferentiated person category, which will be expressed by a single form (unary systems, ‘1’ in (14)).

If only one feature is active and composes with  $\pi$ , that feature partitions the  $\pi$  set into two subsets, yielding binary systems, i.e. systems that encode a two-way (person-based) opposition. If only [participant] is active (‘2/P’ in (14)), the system contrastively refers to the set of the participants ( $i_o, iu_o, u_o$ ) and to that of the non-participants ( $o_o$ ). If only [author] is active (‘2/A’ in (14)), the resulting binary system opposes instead the set that includes the speaker ( $i_o, iu_o$ ) and the set that does not include the speaker ( $u_o, o_o$ ). These two systems are extremely rare in pronominal paradigms, but straightforwardly capture the binary oppositions that are encoded in demonstrative systems, as reviewed in Section 2 above.

If, instead, both features are active, the composition ordering becomes meaningful: either [author] or [participant] will compose with  $\pi$  first in a given derivation, deriving two different systems. If [author] acts on  $\pi$  first, and [participant] acts on the result of that function application, the result of the different operations is a ternary system, i.e. a system that contrastively encodes three person categories (‘3’ in (14)): one in which the speaker is contained ( $i_o, iu_o$ ; 1st person); one in which the hearer, and possibly others, is contained, but not the speaker ( $u_o$ ; 2nd person); and one in which neither participant is contained ( $o_o$ ; 3rd person). Three-way deictic contrasts are extremely common in personal pronouns and they are also found in demonstrative systems, as reviewed in Section 2. If instead [participant] acts on  $\pi$  first, and [author] performs an action on the result of this first composition, the different operations result in a quaternary system, i.e. a system with four distinctive forms in the person domain (‘4’ in (14)). Quaternary systems make a clusivity distinction, whereby the first person plural (in pronominal non-number-neutral paradigms) must either exclude (1st exclusive, ‘1EXCL’:  $i_o$ ) or include (1st inclusive, ‘1INCL’:  $iu_o$ ) the hearer. Besides, quaternary systems contrastively refer to the hearer ( $u_o$ ) and the others ( $o_o$ ).

Thus, the binary and ternary systems reviewed so far can be captured by a person-based featural system.<sup>12</sup> Note that, to ensure a full differentiation between person deixis (e.g. pronominal and possessive paradigms) and space deixis (demonstrative systems), a minimally different ontology than the one proposed by Harbour is assumed in what follows (see Terenghi 2021c, 2023:

<sup>12</sup> The person-based assumptions adopted here for demonstrative systems ultimately predict that (likewise person-based) pronominal systems should be prone to undergo a similar reduction process as that documented in Section 2, contrary to facts. This issue is briefly addressed in Section 5.3, where the asymmetric development of pronominal and demonstrative systems is reduced to orthogonal internal structure differences across the two sets of forms, which overrides the shared primitives.

4.3, for more details): specifically, it is maintained that the atoms of the ontology for spatial deictics denote regions of space associated to individuals, rather than denoting individuals. This implementation is notated by a subscript  $\chi$  (from Greek *khôros* ‘space’; nominally inspired by Harbour 2016: 179 ff.):

- (15) a.  $\llbracket \pi_\chi \rrbracket = \{i_{o_\chi}, iu_{o_\chi}, u_{o_\chi}, o_{o_\chi}\}$   
 b.  $\llbracket \text{author} \rrbracket = \{i_\chi\}$   
 c.  $\llbracket \text{participant} \rrbracket = \{i_\chi, iu_\chi, u_\chi\}$

Accordingly, the different systems reviewed in Section 2 can be (provisionally) derived as illustrated in (16):

- (16) Ternary and binary demonstrative systems

System	Partitions/System			
	$i_{o_\chi}$	$iu_{o_\chi}$	$u_{o_\chi}$	$o_{o_\chi}$
2/P Neap.	$+P(\pi_\chi)$ <i>chisto</i>			$-P(\pi_\chi)$ <i>chillo</i>
2/A Sard.	$+A(\pi_\chi)$ <i>kústu</i>		$-A(\pi_\chi)$ <i>kúddu</i>	
3 Span.	$+P(+A(\pi_\chi))$ <i>este</i>		$+P(-A(\pi_\chi))$ <i>ese</i>	$-P(-A(\pi_\chi))$ <i>aquel</i>

### 3.2 *Clusivity distinctions in demonstrative systems*

Against this background, let us now turn to a more careful consideration of ternary systems. Although Section 2 treated ternary systems as a substantially uniform class, it was mentioned that some ternary systems display lower rates of use for the hearer-oriented term (Section 2.2).

This state of affairs has been discussed in great detail by Ledgeway (2004; see also, at least, Ledgeway 2009: 195–212, and in particular: 200–205) for the nominal demonstrative system of old Neapolitan (see (8) above), for the adverbial demonstrative system of modern Neapolitan, and (more swiftly) for other southern Italo-Romance varieties (Ledgeway 2004: 89–90, fn. 42). Building on the “confusion” between the purported speaker-oriented form (*chisto*) and the purported hearer-oriented one (*chisso*) in Old Neapolitan and up until the 19th century (as reported by coeval grammars), and on

the generalised lower frequency of the hearer-oriented form, [Ledgeway](#) proposed a revision of the original seemingly ternary demonstrative system of Old Neapolitan, as summarised in (17):<sup>13</sup>

(17) [Ledgeway's \(2004: 74\)](#) proposal

	<i>chisto</i>		<i>chisso</i>		<i>chillo</i>
	Exclusive	Inclusive	Exclusive	Inclusive	Exclusive
1st p.	+	+	–	+	–
2nd p.	–	+	+	+	–

Concretely, rather than straightforwardly corresponding to N:DEM.1 (*chisto* ‘this near me’) and N:DEM.2 (*chisso* ‘that near you’), the two participant-oriented forms are construed as having an ambiguous featural specification. Accordingly, two different readings are yielded: an exclusive one, whereby *chisto*<sub>[+1–2]</sub> and *chisso*<sub>[–1+2]</sub> are respectively used for the speaker-related and the hearer-related deictic domains only; and an inclusive one, under which *chisto*<sub>[+1+2]</sub> and *chisso*<sub>[+1+2]</sub> may be equally well employed to refer to the participant-related domain. In the latter case, the only reported semantic difference is that *chisto* underscores the role of the speaker as deictic centre, while *chisso* is centred on the hearer ([Ledgeway 2004: 74](#)).

Let us now recast [Ledgeway's](#) proposal in the action-on-lattice featural system assumed in this work. In order to do so, two remarks are in order. First, in [Ledgeway's](#) sample, *chisso* is only rarely used instead of *chisto* to (inclusively) refer to the speaker-related deictic domain, whereas the opposite substitution (*chisto* instead of *chisso*) is extremely common ([Ledgeway 2004: 78–79, 84](#)). However, this asymmetry does not follow from the featural definition in (17), which establishes a complete parallelism between the inclusive uses of *chisto* and *chisso*. This fact refutes the symmetric characterisation of *chisto* and *chisso* and suggests that only the former, but not the latter, may carry an inclusive value in the Old Neapolitan system.<sup>14</sup> Second, also the slight difference in interpretation identified by [Ledgeway](#) between the inclu-

<sup>13</sup> In [Ledgeway's](#) sample, the hearer-oriented form *chisso* occurs significantly less frequently than both the speaker- and the non-participant-oriented forms; besides, with respect to the hearer-oriented context alone, *chisso's* frequency is strikingly lower than that of the speaker-oriented term *chisto* ([Ledgeway 2004: 87–88](#)).

<sup>14</sup> For Romance varieties in which the erstwhile hearer-oriented form (‘2’; type *chisso*) was preserved to the expense of the original speaker-oriented one (‘1’; type *chisto*), as in (10)–(11), the opposite must have been true. That is, in those cases, the original hearer-oriented form must be construed as having an additional inclusive value, and not the speaker-oriented one. This will be better discussed in Section 5.2.2.

sive uses of *chisto* and *chisso* does not follow in a principled way from their featural composition as given in (17), which instead predicts their semantics to be completely comparable. This formal complication, too, disappears once *chisso* is taken not to be used inclusively.

The asymmetric definition of *chisto* (exclusive or inclusive reading) as opposed to *chisso* (exclusive only) derives the lower frequency of the latter altogether, as *chisto* and *chisso* compete for the expression of  $u_\chi$  ('near you'). If a distinction is needed within the wider participant-related domain, *chisso* is selected: this can be thought of as a pragmatically marked condition, as, in common discourse settings, the hearer may be fairly close to the speaker and, as such, ultimately amenable to the speaker-oriented domain. *Chisto* is selected otherwise: in this second case, the relevant deictic domain is that related to both participants ( $iu_\chi$ , which still crucially includes  $u_\chi$ ), although it can be conceived as primarily centred on the speaker (and as such accounting for the speaker-oriented interpretation highlighted by [Ledgeway](#), in spite of the generally inclusive semantics). This follows from the in-built egocentricity of the person system adopted here, rather than from other factors. Note that, crucially, whenever *chisso* is used, *chisto* may only be used in its exclusively speaker-oriented function to refer to referents located in the deictic domain of the speaker as identified in contrast to that of the hearer: that is, there is a subtle but systematic distinction between the exclusive speaker-oriented semantics ( $i_{o_\chi}$ ) and the inclusive speaker-oriented semantics ( $iu_{o_\chi}$ ).

Thus, it can be concluded that the distribution of Old Neapolitan demonstratives is compatible with a person system that encodes a clusivity distinction (see quaternary systems in (14)), under the assumption that *chisto* syncretically spells out both the exclusive reading and the inclusive one, as proposed in (18):<sup>15</sup>

- (18) a. N:DEM.1EXCL (*chisto*)  $\leftrightarrow$  +author(−participant( $\pi_\chi$ )) =  $\{i_{o_\chi}\}$   
 b. N:DEM.1INCL (*chisto*)  $\leftrightarrow$  +author(+participant( $\pi_\chi$ )) =  $\{iu_{o_\chi}\}$   
 c. N:DEM.2 (*chisso*)  $\leftrightarrow$  −author(+participant( $\pi_\chi$ )) =  $\{u_{o_\chi}\}$   
 d. N:DEM.3 (*chillo*)  $\leftrightarrow$  −author(−participant( $\pi_\chi$ )) =  $\{o_{o_\chi}\}$

<sup>15</sup> To the best of my knowledge, 1INCL is always syncretic with another form across Romance demonstratives. Evidence that 1INCL is indeed syncretic with another form, and not conflated with 1EXCL as in ternary systems (where  $1 = \{i_o, iu_o\}$ ), comes from varieties in which 1INCL is syncretic with 2 (see (10)–(11) above and Section 5.2.2). As  $\{iu_o, u_o\}$  is not a set that may be expressed by natural languages (see [Harbour 2016](#) and contributions in [Filimonova 2005](#) for discussion), it cannot be maintained that 1INCL and 2 are conflated; the only way to derive the attested patterns, then, is to assume that they are syncretic. Also note that systematic syncretism of this type is ensured by the fact that 1INCL forms a natural class with either 1EXCL (by virtue of [+author]) or 2 (by virtue of [+participant]).



That is, and leaving *chillo* aside, *chisso* is used whenever the referent is located in the exclusively hearer-related domain ('near you':  $u_{o_x}$ , i.e. the domain occupied by the hearer  $u$  and possibly by others,  $o$ ), whereas *chisto* is used for either the deictic domain strictly related to the speaker ('near me':  $i_{o_x}$ ) or that related to both speaker and hearer, i.e. the inclusive domain ('near us':  $iu_{o_x}$ ), which are crucially syncretic but not conflated.

So far, demonstrative systems that display three different forms have been pre-theoretically referred to as ternary; in what follows, demonstrative systems that superficially display three forms but make frequency distinctions, as the one in (18), will be indicated as 'quaternary', while the label 'ternary' will be more precisely restricted to demonstrative systems that do not show similar distinctions. Further, whenever the distinction between the two types of systems is immaterial to the discussion, both systems are jointly referred to as '(qua)ternary'.

### 3.3 Capturing the reduction

Granting the discussion in the foregoing, the featural derivations for the different demonstrative systems seen so far and given in (16) can be revised as in (19):

(19) (Qua)ternary and binary demonstrative systems

System	Partitions/System			
	$i_{o_x}$	$iu_{o_x}$	$u_{o_x}$	$o_{o_x}$
2/P Neap.	$+P(\pi_x)$ <i>chisto</i>			$-P(\pi_x)$ <i>chillo</i>
2/A Sard.	$+A(\pi_x)$ <i>kústu</i>		$-A(\pi_x)$ <i>kúđđu</i>	
3 Span.	$+P(+A(\pi_x))$ <i>este</i>		$+P(-A(\pi_x))$ <i>ese</i>	$-P(-A(\pi_x))$ <i>aquel</i>
4 O.Neap.	$+A(-P(\pi_x))$ <i>chisto</i>	$+A(+P(\pi_x))$ <i>chisto</i>	$-A(+P(\pi_x))$ <i>chisso</i>	$-A(-P(\pi_x))$ <i>chillo</i>

Furthermore, it seems possible to establish a link between quaternary demonstrative systems and binary participant-based ones (see for instance [Ledgeway's](#) (2004) diachronic account for southern Italo-Romance participant-based binary demonstrative systems). Instead, no "exclusively" inclusive semantics seems to be recorded for the demonstrative systems that eventually

reduced to speaker-based binary systems: these can as such be described as strictly ternary systems. Thus, a diachronic generalisation can be proposed for the systems under consideration:

- (20) a. Ternary systems =  $\pm\text{participant}(\pm\text{author}(\pi_\chi)) >$   
           Speaker-based binary systems =  $\pm\text{author}(\pi_\chi)$   
       b. Quaternary systems =  $\pm\text{author}(\pm\text{participant}(\pi_\chi)) >$   
           Participant-based binary systems =  $\pm\text{participant}(\pi_\chi)$

This generalisation descriptively captures the reduction process: the two resulting binary systems, in fact, are derived by one active feature only, while their input systems were yielded by the activation of both person features. More specifically, the one feature that remains active after the reduction process is the one that composed directly with  $\pi_\chi$  in the original system, rather than the one that entered the derivation later on to combine with the result of a preceding featural composition with  $\pi_\chi$ . This latter feature is lost, or delinked from the functional spine:

- (21) a. Ternary  $>$  speaker-based binary:  $\pm\text{P}(\pm\text{A}(\pi_\chi))$   
       b. Quaternary  $>$  participant-based binary:  $\pm\text{A}(\pm\text{P}(\pi_\chi))$

As (21) shows, the availability of two orderings of composition naturally captures the semantic variation attested in the reduced demonstrative systems. Besides, the assumed featural inventory does not include a dedicated feature for the hearer (see again discussion in Section 3.1): the hearer-related semantics is only derived by the interactions between the two features. Therefore, the loss of one feature straightforwardly implies the loss of the hearer-related semantics, which was pointed out to be systematically true for any reduction into binary systems (Section 2). Finally, the intuition that the reduced binary demonstrative systems result from the loss of the last feature to enter into the derivation for the original (qua)ternary systems will be shown to capture the gaps in (12) and to be fully compatible with the different patterns of formal reduction illustrated in Section 2 (see Section 5.2).

Of course, however, the intuition that the attested patterns of change are derived by the loss of the last feature to enter into the derivation of a given demonstrative form begs the question as to why one feature is lost at all. In the next section, the answer is shown to lie in the featural derivation of (qua)ternary systems, which can be regarded as computationally complex on different counts. Section 5, instead, explores in more detail the structural generalisation whereby only the latest feature to enter into the derivation un-

dergoes loss.<sup>16</sup>

#### 4 ACCOUNTING FOR CHANGE: FEATURAL COMPLEXITY

This section proposes that feature loss is contingent on featural complexity, for which two different, but convergent, metrics are put forth: length of the derivation (Section 4.1) and (non-)monotonicity of the derivation (Section 4.2). If the conditions on featural complexity are met, that is: if the derivation is relatively long and, concurrently, some categories of the system are non-monotonically derived, then one feature may be lost to reduce the overall level of complexity.

Before proceeding, it should be noted that feature loss does not apply of necessity: as the current (micro-)variation in Romance demonstratives attests (see [Ledgeway & Smith 2016](#) for an overview and (1) above for a quantitative review), (qua)ternary systems may remain stable. In what follows, the actualisation of feature loss is taken to be subject to a stipulated language-specific complexity tolerance threshold, which rules in the attested variation in this respect. For a concrete proposal concerning the formalisation of (featural) complexity, see below; how to formalise the tolerance threshold is left however for further research.<sup>17</sup> Moreover, (qua)ternary systems can be reinstated in the diachronic evolution of a language (see again [Ledgeway & Smith 2016](#), and [Stavinschi 2012](#) for an analysis): these cases are likewise to be regarded as resulting from changes in the posited complexity tolerance threshold for a given language.

##### 4.1 *Complexity as a function of description length*

This section argues that complexity is inherent to the description length of a system, that is: to the length of the featural derivation of its forms; as such, (qua)ternary demonstrative systems are taken to display an inherently higher complexity level than binary demonstrative systems.

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<sup>16</sup> Note that the patterns described in Section 2 are not straightforwardly accounted for by frequency considerations, as frequency does not seem to necessarily correlate with the loss of a given form (see the discussion about the hearer-oriented adverb *lloco* in Neapolitan in [Ledgeway 2004](#): 99 ff.; and the formal mismatches across nominal and adverbial demonstratives mentioned in Section 2); besides, post-syntactic mechanisms, such as impoverishment, do not account for the patterns of reduction either, as the types of reduction discussed here have a clear semantic import.

<sup>17</sup> Several factors may contribute to shifts in the level of complexity that is tolerated, perhaps including, in this case, phonetic and (at least in part) frequency considerations. Statistical modelling of the factors at play here might contribute to shed light on their relative weight in this specific instance of change.

(Minimum) description length is one of the ways in which reference to Kolmogorov complexity is made (Kolmogorov 1968; for a comprehensive overview, see Li & Vitányi 2019). A description can be defined as a binary string that generates a system: Kolmogorov complexity substantially relates to the length of that description, and to how much information it should contain to successfully describe a given system. In other words, Kolmogorov complexity provides a measure for the regularity inside a string: the higher the string-internal regularity, the more it will be possible to compress the string, yielding a shorter description. Consider for instance the following sequences:

- (22) a. 1010101010  
b. 0011101001

Although both sequences consist of 10 characters, the first one can be regarded as simpler than the second one, because it can be described as ‘5 times 10’. The second sequence, instead, can only be described as ‘0011101001’, i.e. itself, and cannot be compressed.

In linguistics, Kolmogorov complexity has been regarded as a metric for syntactic complexity (see e.g. Biberauer 2019). Following this rationale, here the complexity of featural descriptions for person categories is pinned down to the amount of operations needed to derive those categories. As per the discussion in Section 3, the definition of (qua)ternary systems is more complex (because longer) than that of binary systems:

(23)	[±A] takes precedence	[±P] takes precedence
	2 operations    3: ±P(±A( $\pi_\chi$ ))	4: ±A(±P( $\pi_\chi$ ))
	1 operation    2/A: ±A( $\pi_\chi$ )	2/P: ±P( $\pi_\chi$ )

As an aside, it should be noted that, by virtue of their description length, (qua)ternary systems logically imply the binary systems into which they eventually evolve. In fact, the two operations needed to yield (qua)ternary systems are a superset of the single operation needed to yield the two binary ones. The activation of an additional feature in (qua)ternary systems still makes those systems sufficient to derive the smaller set of contrasts, as encoded in the systems that lack that feature, following Harbour’s (2011) reasoning line (see also Terenghi 2023: 5.3 for a more detailed discussion). Importantly, the additional feature in (qua)ternary systems allows for the derivation of categories for which no primitive is given in the system and which may only result from non-trivial interactions between the active fea-

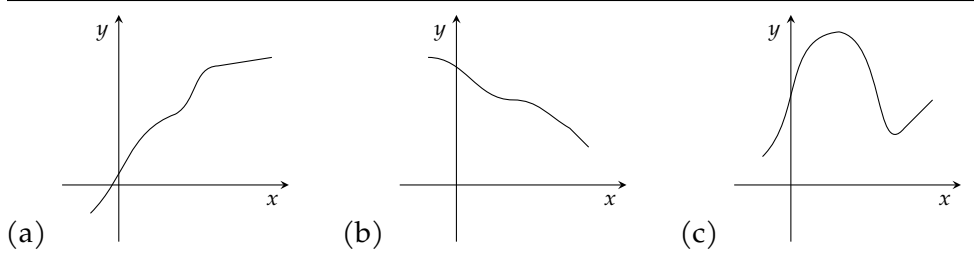
tures: 2nd person and 1EXCL. These may instead not be derived under a binary system, hence their loss in the reduction process.

To conclude, (qua)ternary demonstrative systems are complex because of their featural definition, where complexity is conceived in terms of description length. Their complexity is tightly linked to the additional feature (that is: an extra operation) needed to derive the categories that will eventually be lost (2 and, where available, 1EXCL); that very feature would be unnecessary to the system if those terms were not there. As such, (qua)ternary systems logically imply the less complex binary demonstrative systems in which they evolve: the reduction process can then be thought of as driven by the lowering of the language-specific complexity tolerance threshold (in line with general tendencies towards complexity reduction).

#### 4.2 *Feature values and monotonicity*

As per the foregoing discussion, the complexity (length) of the featural derivation for (qua)ternary systems can be seen as related to the 2nd person semantics (including DEM.2, ‘near you’), and the 1EXCL person semantics (including DEM.1EXCL, ‘near me only’). This suggests that 2 and 1EXCL might themselves be complex: in what follows, an additional argument is adduced in support of this hypothesis, which rests on independent third factor considerations. Concretely, it is advanced that the derivations for 2 and 1EXCL involve a non-monotonic sequence of functions, because of their non-uniform features values (sequences of + and –, or the reverse). This section argues that non-monotonic sequences are generally dispreferred with respect to monotonic ones, because of a general monotonicity bias.

Monotonicity is a (mathematical) property: taken an interval of values for a function, those values may be entirely non-decreasing (monotonically increasing function; Figure 1a) or entirely non-increasing (monotonically decreasing function; Figure 1b). If the values are instead partly increasing and partly decreasing, the function is non-monotonic (Figure 1c). Monotonicity is however not only relevant at a mathematical level, but also applies in other cognitive domains. Importantly here, the grammar’s sensitivity to (non-)monotonicity and its preference for monotonic computation have been extensively documented for a wide array of linguistic phenomena (consider, at least, quantifiers: Barwise & Cooper 1981; van Benthem 1986: 208–209; Geurts & van der Slik 2005); besides, comparable remarks hold beyond the language faculty, for instance in the logic one (Gottlob 1992). Hence, a bias towards monotonic sequences can be identified: given its domain-general nature, the monotonicity bias is cognitive. As such, it is regarded here as third factor.



**Figure 1** Monotonic increasing (a), monotonic decreasing (b), and non-monotonic (c) functions.

As already discussed in the foregoing, the derivation of (qua)ternary demonstrative systems hinges on the activation of both [author] and [participant]: given the action on lattice nature of person features, whereby feature values denote different functions, it is possible to recast the different person(-related) categories can be defined as being derived by a monotonic sequence of operations, or by a non-monotonic one, as summarised in (24):

(24)	Monotonic		Non-monotonic	
T.	1 +P(+A( $\pi_\chi$ ))	3 -P(-A( $\pi_\chi$ ))	2 +P(-A( $\pi_\chi$ ))	3 -P(+A( $\pi_\chi$ ))
Q.	1INCL +A(+P( $\pi_\chi$ ))	3 -A(-P( $\pi_\chi$ ))	1EXCL +A(-P( $\pi_\chi$ ))	2 -A(+P( $\pi_\chi$ ))

In monotonic sequences of operations, one and the same operation is reiterated (respectively, consistent disjoint addition,  $+/+$ , or consistent joint subtraction,  $-/-$ ; see Section 3.1 and Harbour 2016); in non-monotonic ones, instead, two different operations must be performed (disjoint addition and joint subtraction, in either order:  $+/-$  or  $-/+$ ). Importantly, (non-)monotonicity in the person domain correlates with the subset-superset relations instantiated by the three lattices:

$$(25) \llbracket \text{author} \rrbracket \subseteq \llbracket \text{participant} \rrbracket \subseteq \llbracket \pi \rrbracket \quad (\text{based on Harbour 2016: 74})$$

Whenever disjoint addition applies to  $\pi_\chi$  (i.e.  $[+F]$ ), this subset-superset relation is ultimately preserved (e.g.  $\llbracket \text{author} \rrbracket \subseteq \llbracket +A(\pi) \rrbracket$ ); whenever joint subtraction applies (i.e.  $[-F]$ ), the relation is instead obliterated (e.g.  $\llbracket \text{author} \rrbracket \not\subseteq \llbracket -A(\pi) \rrbracket$ ). Monotonic sequences of features preserve these relations fur-

ther (e.g.  $\llbracket \text{author} \rrbracket \subseteq \llbracket +P(+A(\pi)) \rrbracket$ ;  $\llbracket \text{author} \rrbracket \not\subseteq \llbracket -P(-A(\pi)) \rrbracket$ ), while non-monotonic ones reverse them (e.g., despite  $\llbracket \text{author} \rrbracket \subseteq \llbracket +P(\pi) \rrbracket$ ,  $\llbracket \text{author} \rrbracket \not\subseteq \llbracket -A(+P(\pi)) \rrbracket$ ). A more comprehensive discussion of the subset-superset relations across lattices and how they relate to monotonicity exceeds the scope of this work, but it can be found in [Terenghi 2023: 5.4.2](#).<sup>18</sup>

Taking the monotonicity bias to be active in the person domain, it can be proposed that monotonic and non-monotonic person categories correlate with different complexity levels: non-monotonic derivations (2 and, whenever available, 1<sub>EXCL</sub>: crucially, the categories whose definition requires the application of a second person feature) are to be conceived as more computationally complex than monotonic ones (1<sub>INCL</sub> and 3) and, therefore, as generally disfavoured on third factor grounds. As regards the non-monotonic derivation for 3rd persons in ternary systems (boxed in (24)), one note is here in order: [Harbour \(2016: 92\)](#) speculated that the derivation of 3rd persons in ternary systems could be considered in terms of (non-)monotonicity, leading to the two derivations in (24) (see also (14)), and argued that the specific value of [author] is immaterial to the result of the derivation.<sup>19</sup> However, as per the identification of a general monotonicity bias in the person domain, the status of 3rd person in ternary systems should be reviewed: the non-monotonic derivation for 3rd person in ternary systems, while being in principle set-theoretically possible, is ultimately bled out by third factor considerations, whereby the competing monotonic derivation is favoured.

Hence, the monotonicity bias singles out 2 and 1<sub>EXCL</sub> as relatively complex person categories: this can be identified as the main factor in driving feature loss and, in turn, the reduction of (qua)ternary systems to binary ones, as will be detailed in what follows. Additionally, it can be entertained that monotonicity considerations play a role in shaping the formal realisation of the new binary systems, as monotonically derived forms are fairly consistently favoured over non-monotonically derived ones (see Section 5.2).

## 5 ACCOUNTING FOR CHANGE: LAST IN, FIRST OUT

The last section argued that feature loss depends on featural complexity; this section proposes that, if those conditions on featural complexity are met (de-

<sup>18</sup> The same holds for a full exploration of monotonicity effects in the person domain. Importantly, independent evidence for the (non-)monotonic natural classes is given by the order of acquisition of person categories (non-monotonic categories are harder to acquire than monotonic ones, and follow them; see [Harley & Ritter 2002: 499](#), who account for this pattern by means of their feature geometry) and by otherwise poorly explained patterns of syncretism (see [Terenghi 2021b](#)).

<sup>19</sup> Recall that [author] is not conceived predicatively, but lattice-theoretically: the identity of results across different feature values is contingent on this semantic difference.

scription length, Section 4.1; and concurrent monotonicity considerations, Section 4.2), one feature may be dropped from the functional sequence, so as to reduce the overall level of complexity.

However, feature loss is not indiscriminate, as per the generalisation in Section 3.3: rather, it only affects the last action-on-lattice feature to enter into the derivation. In this section, it is argued that this structural generalisation can be shaped as a constraint on feature loss, called the Last in, first out principle, which naturally accounts for all and only the patterns of semantic and formal reduction attested across Romance languages.

More precisely, subsection 5.1 motivates the intuition that a structural factor constrains feature loss and shows how the Last in, first out principle accounts for the semantic variation between speaker- and participant-based binary systems. Building on this, subsection 5.2 provides a detailed account for the patterns of formal variation attested across Romance demonstrative systems: the Last in, first out principle determines both the different patterns of reduction and the gaps uncovered in Section 2 and summarised in (12). Differences in the frequency of different systems (formally conservative *vs* formally innovative systems; see again (2)–(7)), instead, may be brought back to monotonicity considerations, in line with the remarks in Section 4.2. Finally, Section 5.3 briefly discusses the diachronic asymmetry between pronominal and demonstrative systems already noted at the outset and reduces it to differences concerning the functional spine underlying personal pronouns as opposed to demonstrative forms.

### 5.1 *Last in, first out and semantic variation*

Building on the generalisation presented in (21) above, whereby feature loss was suggested to be constrained such that it may only target the last action-on-lattice feature to compose with  $\pi_\chi$ , this section proposes that this pattern is not coincidental, but follows from a general structural constraint on feature loss, the Last in, first out principle, which can be stated as follows:

(26) *Last in, first out principle*

A feature can only be lost if it is the last to enter into the derivation.

Here, this constraint is taken to hinge on the very nature of action-on-lattice features. Under this approach, in fact, the ordering of person features in the derivation is fully meaningful and derives the semantic difference across ternary and quaternary systems, derived by the precedence of [author] and by the precedence of [participant] respectively (see again Section 3.1). Following Harbour (2016), the ordering of compositions is further subject to



parametric variation: as such, the loss of the first feature to enter into the derivation would bring about a more general parametric change that would however be unaccounted for. Further, such change would not be supported by the behaviour of other person(-related) indexical categories, which are overly stable, as noted at the outset (see [Nichols 1992](#) for a typological examination of stability in pronominal systems). Hence, only the second and last feature to enter into the derivation may be omitted from the featural sequence.

As per the 1 Feature–1 Head architecture adopted here, the last feature to compose with  $\pi_\chi$  is to be construed, structurally, as the last head to merge within the relevant functional sequence. Thus, ultimately, featural (in)stability is contingent on a syntactic condition: the merge position of the relevant feature. Note that the idea that (in)stability and structure might be related has been explored by [Polinsky \(2018: 63–65\)](#) with respect to heritage languages. Specifically, [Polinsky](#) proposed that stable elements are encoded in the top layer of the relevant domains (e.g. tense is encoded high in the IP domain, and is stable, unlike aspect, which is low and unstable). Here, however, a reversal of [Polinsky's](#) idea is proposed: namely, unstable features, rather than stable ones, are merged higher up in their functional sequence. This reversal may be explained, mirror-theoretically, by the difference in domains of investigation: [Polinsky](#) refers mostly to the word-level and beyond, while the present account holds word-internally.

Finally, the Last in, first out principle naturally follows from the featural considerations introduced in Section 4. Assuming that multiple functional applications induce an overall higher level of complexity and that the presence of complex non-monotonically derived person(-related) categories in (qua)ternary systems (namely,  $\text{DEM.2}$  and  $\text{DEM.1EXCL}$ ) is ultimately the trigger for feature loss, it can in fact be submitted that the last feature to enter into the derivation is lost to bring about a complexity reduction. This proposal hinges on the principle of Input Generalisation ([Roberts 2007: 275](#); [Biberauer & Roberts 2012](#); *et seq.*) and on the idea that language acquisition closely adheres to the structure of the tree moving bottom-up (see e.g. [Rizzi's 1993/4](#) truncation model and [Friedmann, Belletti & Rizzi's 2021](#) Growing Trees).<sup>20</sup> Granted these, it can be proposed that, by learning hypothesis, non-monotonic derivations are converted into monotonic ones, when the second and last active person feature is acquired: the generalisation of the value of the first feature to compose with  $\pi_\chi$  throughout the functional sequence is

<sup>20</sup> The Growing Trees view in particular predicts that no two non-contiguous portions of the tree can be acquired, if the one structurally between them has not been acquired yet (i.e. gaps in the structure are banned). Similarly, the Last in, first out principle may be defined in implicational terms. This is relevant for the derivation of the diachronic asymmetry between pronominal and demonstrative systems, as briefly discussed in Section 5.3.

in line with the principle of Input Generalisation.

However, this preliminary (monotonic) derivation cannot derive the semantic distinctions between originally non-monotonic and monotonic person categories in (qua)ternary systems. If the input provides consistent positive evidence for the reset of the second feature value in the feature sequence, the monotonicity bias can be disregarded, leading to a more computationally demanding derivation but also to a full semantic differentiation in the system. Otherwise, as the monotonic derivations necessarily involve systematically co-varying features, one of the two features in the derivation becomes fully redundant and is as such not postulated by subsequent generations of acquirers: that could only be the second and last feature, if acquisition proceeds bottom-up. As such, feature loss leads to less burdensome computations and can then be fully explained as third-factor-driven: the optimised computation bans non-monotonic derivations while yielding shorter sequences of functions at the same time.<sup>21</sup>

Besides, the semantic variation between speaker- and participant-based binary systems naturally falls out from the availability of two different input systems (ternary *vs* quaternary demonstrative systems, derived by two different orderings of operations). In fact, the loss of the last feature to enter into the derivation in tripartitions, namely [ $\pm$ participant], leaves [ $\pm$ author] to define a speaker-based bipartition; the loss of the last feature to enter into the derivation in quadripartitions, namely [ $\pm$ author], leaves instead [ $\pm$ participant] to define a participant-based bipartition. This is neatly summarised in (21).

Thus, the semantic variation in the patterns of reduction attested across demonstrative systems in Romance is to be traced back to parametric variation in the input systems. As seen in Section 2, the other major source of variation across Romance demonstratives lies in their formal realisation, which is discussed in the next section.

## 5.2 *Patterns of formal reduction*

The loss of the last feature to enter into the derivation leaves one or two pairs of forms from the original (qua)ternary systems with identical featural content: evidence for this state of affairs comes from diachronic stages in which a language showed optionality between two forms, such as the cases of “con-

<sup>21</sup> Note that, by virtue of the computationally-driven featural complexity that underlies feature loss, the present proposal exclusively applies to action-on-lattice features; no claims are made as to other types of features. This implies that it should be possible to extend this rationale to the syntax of any form that is derived by means of action-on-lattice features, but not beyond those; the wider investigation of this issue is left to further research (see Terenghi 2023: 6.5.2.2 for initial remarks on number systems).

fusion” reported by 19th century grammars of some southern Italo-Romance varieties (as mentioned in Section 3.2). Variation amounts to which of these (new) synonyms is preserved. This section reviews each new system from a featural standpoint: the discussion is organised by reduction patterns (as listed in (12)). Additionally, the gaps in (12) will be shown to be correctly ruled out by the Last in, first out principle.

### 5.2.1 Ternary systems > binary speaker-based systems

Let us first consider the reduction of (proper) ternary demonstrative systems to speaker-based binary systems in Romance languages (as illustrated in Section 2.1 above). As per the discussion in Section 3, the two systems involved can be featurally represented as follows, where the shading indicates the last feature to merge, [ $\pm$ participant], which is lost in the transition from ternary to speaker-based binary systems.<sup>22</sup>

(27)	DEM.1	DEM.2	DEM.3
	1	2	3
	$+P(+A(\pi_\chi))$	$+P(-A(\pi_\chi))$	$-P(-A(\pi_\chi))$

The formal variation attested across the resulting systems is discussed in what follows.

**Speaker-based: Pattern I** Pattern I speaker-based binary demonstrative systems have the shape 1–3–3, as illustrated in (3)–(4) in Section 2.1.

These systems are straightforwardly derived from the input one by the loss of [ $\pm$ participant], which yields the following reduced system:

- (28)
- a.  $1 \leftrightarrow +P(+A(\pi_\chi))$
  - b.  $2 \leftrightarrow +P(-A(\pi_\chi))$
  - c.  $3 \leftrightarrow -P(-A(\pi_\chi))$

As a result of feature loss, the original hearer-oriented term (‘2’) and the original non-participant-oriented term (‘3’) are derived by the same feature, [ $-$ author]; hence, all else being equal, they compete to spell out the same chunk of structure. In Pattern I systems, the competition is eventually won by ‘3’. Note that this formal type is the most widely attested for speaker-based

<sup>22</sup> Note that the derivation for DEM.3 does not include the ambiguous [ $\pm$ author] feature (see (14)), following the discussion relative to the monotonicity bias in Section 4.2.

binary systems, as remarked in Section 2.1: it can be speculated that this state of affairs derives from the original monotonic derivation of ‘3’, which could make it the preferred form with respect to originally non-monotonic ‘2’.

At any rate, in the resulting binary systems, the original speaker-oriented form (‘1’) retains its original speaker-oriented semantics, [+author], and is thus used to refer to the speaker-related deictic domain; the original non-participant-oriented form (‘3’), instead, is used to refer to the undifferentiated non-speaker-related deictic domain, [−author], substantially in continuity with its previous function.

**Speaker-based: Pattern II** Pattern II speaker-based binary demonstrative systems have the shape 1–2–2, as exemplified in (5)–(6) in Section 2.1.

They are likewise derived from the input system through the loss of the [±participant] feature. Also in this case, the resulting reduced system is:

- (29) a.  $1 \leftrightarrow +P(+A(\pi_\chi))$   
 b.  $2 \leftrightarrow +P(-A(\pi_\chi))$   
 c.  $3 \leftrightarrow -P(-A(\pi_\chi))$

After feature loss, as seen for Pattern I, the original hearer-oriented term (‘2’) and the original non-participant-oriented one (‘3’) are uniformly derived by [−author]. In Pattern II, however, the competition is resolved in favour of ‘2’ and with the loss of ‘3’: that is, the originally non-monotonically derived form is preserved, which might explain why Pattern II systems are overall rare in the Romance domain, as already mentioned in Section 2.1.

Hence, in Pattern II, the original speaker-oriented form (‘1’) retains its original speaker-oriented semantics, while the former hearer-oriented one (‘2’) enlarges its deictic domain from its original hearer-related value to the general non-speaker-related semantics. This is fully compatible with its featural composition, which primarily includes [−author].

**Speaker-based: Pattern III (\*)** As shown in Section 2, speaker-based binary demonstrative systems do not display Pattern III, that is: loss of the erstwhile speaker-oriented form (‘1’) and definition of a speaker-based opposition between the original hearer-oriented and non-participant-oriented forms (2–3–3). Importantly, this gap can be shown to be not accidental, but to follow naturally from the Last in, first out principle: in fact, the loss of [±participant] derives an identical [−author] semantics for ‘2’ and ‘3’, as already shown for Patterns I and II above:

- (30) a.  $2 \leftrightarrow +P(-A(\pi_\chi))$   
 b.  $3 \leftrightarrow -P(-A(\pi_\chi))$

As feature loss makes the exponents for erstwhile DEM.2 and DEM.3 synonyms (they both denote the non-speaker-related semantics), a distinctive opposition cannot be established between them without extending the system's resources: as such, no two-way speaker-based system can be built from these two forms alone.

### 5.2.2 Quaternary systems > binary participant-based semantics

Let us now turn to the reduction of quaternary demonstrative systems to participant-based binary ones. Following the discussion in Section 3.2, the features of quaternary systems are given in (31), where, again, the shading indicates the last feature to be merged in the functional sequence (and, in turn the first to be eventually lost), namely [ $\pm$ author]:

(31)	DEM.1EXCL	DEM.1INCL	DEM.2	DEM.3
	1	1 <sub>1</sub> /2 <sub>1</sub>	2	3
	<span style="background-color: #e0e0e0;">+A</span> (-P( $\pi_\chi$ ))	<span style="background-color: #e0e0e0;">+A</span> (+P( $\pi_\chi$ ))	<span style="background-color: #e0e0e0;">-A</span> (+P( $\pi_\chi$ ))	<span style="background-color: #e0e0e0;">-A</span> (-P( $\pi_\chi$ ))

The availability of two alternative homophony patterns (the inclusive semantics may be realised by a homophone of the speaker-oriented term, '1<sub>1</sub>', or of the hearer-oriented one, '2<sub>1</sub>') will be shown to naturally derive two different formal patterns (Pattern I vs Pattern III, see below). The following discussion focuses on the formal variation attested across the resulting systems.

**Participant-based: Pattern I** Pattern I participant-based binary demonstrative systems apparently have the shape 1–1–3, as shown by (8)–(9) in Section 2.2.

Both systems are straightforwardly derived from the quaternary one through the loss of [ $\pm$ author], under the assumption that the inclusive demonstrative form is identical to the exclusively speaker-oriented one.<sup>23</sup> The resulting reduced system is:

<sup>23</sup> If DEM.1INCL were spelled out by a homophone of '2' (i.e. '2<sub>1</sub>', instead of '1<sub>1</sub>' in (32)), no two-way participant-based opposition could be derived, as both '1' and '3' carry a [ $-$ participant] feature.

- (32) a.  $1 \leftrightarrow +A(-P(\pi_\chi))$   
 b.  $1_1 \leftrightarrow +A(+P(\pi_\chi))$   
 c.  $2 \leftrightarrow -A(+P(\pi_\chi))$   
 d.  $3 \leftrightarrow -A(-P(\pi_\chi))$

After feature loss, the original inclusive and hearer-oriented terms ('1<sub>1</sub>' and '2') are derived by the [+participant] feature; and the original non-participant-oriented and exclusively speaker-oriented terms ('3' and '1') are derived by [-participant]. Note that, in each pair of synonyms, the first form was originally monotonically derived ('1<sub>1</sub>' and '3'), while the latter was originally non-monotonically derived ('1' and '2'). All else being equal, forms within these two pairs compete to spell out the (non-)participant-oriented deictic domain. In Pattern I systems, the competition was eventually won by originally monotonic '1<sub>1</sub>' and '3'.

Hence, in the resulting binary systems, the original exponent for the inclusive domain ('1<sub>1</sub>', i.e. a homophone of the original exclusively speaker-oriented form) is used to refer to the participant-related deictic domain, [+participant], in substantial continuity with its original function; the original non-participant-oriented form ('3'), instead, is preserved to refer to the non-participant-related deictic domain, [-participant]. As such, the abstract system for Pattern I may be rewritten as 1<sub>1</sub>-1<sub>1</sub>-3.

**Participant-based: Pattern II (\*)** As illustrated in Section 2, Pattern II is not attested in binary participant-based demonstrative systems. Here, Pattern II would amount to the loss of the form originally encoding the non-participant-related deictic domain ('3') and to the development of a two-way opposition between 1 (or '1<sub>1</sub>') and '2' (or '2<sub>1</sub>'). Also in this case, it can be shown that this Pattern is not derivable under the Last in, first out principle. Consider first the case in which what at face value looks like an exponent for DEM.1, i.e. '1', is, in fact, the originally inclusive homophone '1<sub>1</sub>'; as a consequence, '2' may only be the original DEM.2 exponent:

- (33) a.  $1 \leftrightarrow +A(-P(\pi_\chi))$   
 b.  $1_1 \leftrightarrow +A(+P(\pi_\chi))$   
 c.  $2 \leftrightarrow -A(+P(\pi_\chi))$   
 d.  $3 \leftrightarrow -A(-P(\pi_\chi))$

The loss of [ $\pm$ author] leaves the two pairs of synonyms already discussed for Pattern I above: '1<sub>1</sub>' and '2' for [+participant], '3' and '1' for [-participant].

However, a Pattern II system would only include '1<sub>1</sub>' and '2' (type: *chisto-chisso*), both of which carry a [+participant] feature. Thus, no participant-based binary opposition could be established between the two forms, as no [-participant] form is available.

Consider instead the case in which '1' does in fact realise the DEM.1 semantics (speaker-oriented term); then, '2' may either spell out the hearer-related semantics (DEM.2) or the inclusive one (DEM.1INCL), and be as such '2<sub>1</sub>':

- (34) a.  $1 \leftrightarrow +A(-P(\pi_\chi))$   
 b.  $2_1 \leftrightarrow +A(+P(\pi_\chi))$   
 c.  $2 \leftrightarrow -A(+P(\pi_\chi))$   
 d.  $3 \leftrightarrow -A(-P(\pi_\chi))$

Here, too, the loss of [ $\pm$ author] leaves two pairs (which will be reviewed for Pattern III below): '2<sub>1</sub>' and '2' for [+participant] (henceforth: '2<sub>(1)</sub>'), '3' and '1' for [-participant]. A Pattern II system would only include '1' and '2<sub>(1)</sub>' and have the shape 2<sub>(1)</sub>-2<sub>(1)</sub>-1 (type: *chisso-chisto*). Although '1' and '2<sub>(1)</sub>' do instantiate a two-way participant-based deictic contrast, in this case '1' carries the [-participant] feature, whereas '2<sub>(1)</sub>' carries the [+participant] one: that is, the original inclusive form ('2<sub>1</sub>') or its hearer-oriented homonym ('2') is employed for DEM.1/2 (participant-related deictic domain: 'near us'), while the original exclusively speaker-oriented exponent ('1') is employed for DEM.3 (non-participant-related deictic domain: 'far from us').

Despite this evolution is conceivable and, in strictly featural terms, derivable, it is not attested. Why that is the case (if the gap is not accidental), is left to further research; for the time being, it can be hypothesised that this might be due to an informal pragmatic principle: the system resulting from the reduction as sketched above would in fact use the original (exclusively) speaker-oriented form in the non-participant-related deictic domain. Given the general egocentricity of the featural system assumed here and forces such as subjectification (Traugott 1989: 35; subjectification is independently active in (re)shaping ternary systems, as argued by Stavinschi 2012), the relegation of the speaker-oriented term to the non-participant-related domain seems at best unlikely.

**Participant-based: Pattern III** Pattern III participant-based binary systems apparently have the shape 2-2-3, as illustrated in (10)–(11) in Section 2.2.

These systems are derived from quaternary systems through the loss of [ $\pm$ author] and by assuming that the inclusive demonstrative form is syncretic

with the hearer-oriented one. The resulting semantically reduced system is as follows:

- (35) a.  $1 \leftrightarrow +A(-P(\pi_\chi))$   
 b.  $2_1 \leftrightarrow +A(+P(\pi_\chi))$   
 c.  $2 \leftrightarrow -A(+P(\pi_\chi))$   
 d.  $3 \leftrightarrow -A(-P(\pi_\chi))$

As in the case of Pattern I, also here two pairs of new synonyms are created: in this case, however, [+participant] is expressed both by the originally monotonically derived inclusive term ('2<sub>1</sub>') and by the originally non-monotonically derived hearer-oriented term ('2'); [-participant] is instead expressed by the originally monotonically derived non-participant-oriented term ('3') and by the originally non-monotonically derived exclusive speaker-oriented term ('1'). In Pattern III systems, the competition is won by '2<sub>(1)</sub>' and '3'. This pattern is quite well attested across Romance participant-based binary system, on a par with Pattern I discussed above. In this case, too, the reduction might be construed as sensitive to the original (non-)monotonicity of the derivation, with originally monotonic forms being preserved and originally non-monotonic ones being lost. If this is the case, Pattern II would preserve '2<sub>1</sub>' over '2'.<sup>24</sup>

Either way, in the resulting binary systems, the original inclusive ('2<sub>1</sub>') or, possibly, the original hearer-oriented form ('2') is used in the general participant-oriented function, [+participant]; the original non-participant-oriented form ('3'), instead, is preserved in the non-participant-oriented function, [-participant]: as such, Pattern III participant-based binary systems may be abstractly rewritten as 2<sub>(1)</sub>-2<sub>(1)</sub>-3.

### 5.2.3 Last in, first out: Summary

The foregoing showed how the hypothesis that demonstrative systems across Romance varieties lose the last person feature to compose with  $\pi_\chi$  correctly derives the attested (and unattested) patterns of semantic reduction and formal variation and speculated that monotonicity considerations may be invoked to explain differences in frequency across different patterns.

The results of the pattern-by-pattern discussion for innovative demonstrative systems are summarised in (36), where the shaded cells indicate the patterns that are not attested.

<sup>24</sup> Note that, if this were not the case, then DEM.1INCL might just as well be expressed by '1<sub>1</sub>' (as in Pattern I above); in this case, a different account for the frequency of occurrence of the different formal systems across Romance should be found.



(36) Patterns of change: A featural and structural account

Input: DEM.1 vs DEM.2 vs DEM.3 = 1-2-3

	<u>Speaker-based</u>	<u>Participant-based</u>
	1 ↔ +P(+A( $\pi_\chi$ ))	1 ↔ +A(-P( $\pi_\chi$ ))
	2 ↔ +P(-A( $\pi_\chi$ ))	1 <sub>1</sub> /2 <sub>1</sub> ↔ +A(+P( $\pi_\chi$ ))
	3 ↔ -P(-A( $\pi_\chi$ ))	2 ↔ -A(+P( $\pi_\chi$ ))
		3 ↔ -A(-P( $\pi_\chi$ ))
I	1 <sub>+A(<math>\pi_\chi</math>)</sub> -3-3 <sub>-A(<math>\pi_\chi</math>)</sub>	1 <sub>1</sub> -1 <sub>1+P(<math>\pi_\chi</math>)</sub> -3 <sub>-P(<math>\pi_\chi</math>)</sub>
II	1 <sub>+A(<math>\pi_\chi</math>)</sub> -2-2 <sub>-A(<math>\pi_\chi</math>)</sub>	1 <sub>1</sub> -1 <sub>1+P(<math>\pi_\chi</math>)</sub> -*2 <sub>+P(<math>\pi_\chi</math>)</sub> / *2 <sub>(1)</sub> -2 <sub>(1)+P(<math>\pi_\chi</math>)</sub> -1 <sub>-P(<math>\pi_\chi</math>)</sub>
III	*2 <sub>-A(<math>\pi_\chi</math>)</sub> -3-3 <sub>-A(<math>\pi_\chi</math>)</sub>	2 <sub>(1)</sub> -2 <sub>(1)+P(<math>\pi_\chi</math>)</sub> -3 <sub>-P(<math>\pi_\chi</math>)</sub>

Before concluding, it should be noted that a similar rationale accounts for the further reduction of binary demonstrative systems into unary ones. Unary systems, or demonstrative systems that only display one non-contrastive deictic form (e.g. French *ce*; see fn. 2), were left aside in this work for their marginal availability in Romance. Given their non-contrastive deictic content, unary demonstratives can be regarded as being derived by the inactivity of all person features (see again (14)). Diachronically, the reduction of binary systems to unary ones is then explained by the same featural and structural factors considered so far. The relevant complexity metric relates to description length alone (monotonicity considerations, instead, do not apply, as only one feature is active in the erstwhile binary systems); a postulated change in the complexity tolerance threshold leads to the loss of that one feature, which is the last (and only) to enter into the derivation. Moreover, it should be noted that also in this respect formal variation is attested: of the nine unary varieties recorded by [Ledgeway & Smith \(2016\)](#), five retain an originally speaker-oriented form ('1') while four retain an originally non-participant-oriented form ('3') in their current unary system.

### 5.3 A diachronic asymmetry across indexical systems

The present account, as is, seems to predict that personal pronouns should lose their 2nd person (and 1EXCL, when available): in fact, the featural and structural considerations advanced in the foregoing are general in nature and should naturally extend to any other system derived by action-on-

lattice person features, without extrinsic restrictions. However, the prediction is obviously not borne out; furthermore, as mentioned in Section 3.1, binary pronominal systems are exceptionally uncommon, unlike demonstrative ones.

Nonetheless, it can be proposed that this asymmetry across demonstrative and pronominal systems follows from the Last in, first out principle as well. Besides person features, in fact, pronominal forms typically include (action-on-lattice, see Harbour 2014) number features, too; these can be assumed to enter into the derivation *after* person features, i.e. to be merged in a higher position with respect to them, on both formal (Vanden Wyngaerd 2018) and semantic (Harbour 2016: chapter 6) grounds. Thus, the functional spine of a pronominal form that minimally encodes a two-way number opposition may be summarised as follows (where  $F_{\#}$  is a number feature and  $F_{\pi}$  a person one):

$$(37) F_{\#}(F_{\pi 2}(F_{\pi 1}(\pi)))$$

The presence of a number feature blocks the loss of the last person feature in the sequence, by the Last in, first out principle (which, as mentioned in fn. 17, is to be understood implicationaly). Thus, pronominal paradigms may only display a binary system if they are number-neutral, i.e. if no number feature is merged in the derivation of their internal structure. An initial investigation over a sample of 674 languages showed that this prediction is borne out (Terenghi 2022a).

Demonstrative systems, instead, do not commonly encode indexical number features: that is, despite possibly showing number agreement with their referent inside the DP, demonstrative forms do not contrastively encode contrasts such as ‘this near you.sg’ as opposed to ‘this near you.pl’. Given that no number feature is merged in the internal structure of demonstratives, the functional spine of a typical demonstrative form may be represented as follows:

$$(38) F_{\pi 2}(F_{\pi 1}(\pi_{\chi}))$$

In (38), the latest person feature to enter into the derivation is also the last available action-on-lattice feature: as such, this person feature is unstable and undergoes loss if the complexity level of the system is excessive, according to the relevant metrics. Only one exception should be mentioned here: Siwi Berber encodes an indexical number (and gender) distinction on hearer-oriented demonstratives (Souag 2014; see Terenghi 2021c for discussion). As such, it is predicted to be derived by the activation of both person features;

this prediction is borne out, as Siwi Berber presents a ternary demonstrative system.

## 6 CONCLUSIONS

This paper showed that (qua)ternary demonstrative systems across Romance varieties can lose one deictic opposition and undergo a general reorganisation in diachrony, differently from other indexical systems. The main empirical finding (as per Section 2) is that, despite semantic (speaker- *vs* participant-based systems) and formal (conservative *vs* innovative systems) variation, not all conceivable patterns of reduction are attested: rather, some gaps may be identified. Further, reduction was shown to systematically affect (at least) the contrastive encoding of the hearer-related domain. Assuming that demonstrative systems are formally derived by means of person features, a descriptive generalisation was put forth to capture the attested patterns of reduction (Section 3), as repeated here in (39):

- (39) a. Ternary > speaker-based binary:  $\pm P(\pm A(\pi_\chi))$   
 b. Quaternary > participant-based binary:  $\pm A(\pm P(\pi_\chi))$

This empirical generalisation was shown to follow from the interaction of featural and structural consideration. As regards the former (Section 4), whenever the derivation of a demonstrative form is relatively long (Kolmogorov complexity), and, concurrently, non-monotonic (i.e. the values across the two active features denote different operations; monotonicity bias), the resulting category (and, in turn, systems) are complex: if the complexity of the demonstrative forms (and systems) thus defined exceeds a language-specific threshold for complexity tolerance, one feature may be lost (i.e. not merged in the derivation) to reduce the level of complexity of the system.

Crucially, as per (39), feature loss is not indiscriminate, but constrained by a further structural factor, the Last in, first out principle, which is related to the action-on-lattice nature of features (Section 5). By the Last in, first out principle, the merge position of person features can be taken to correlate with different stability effects: concretely, it was proposed that feature loss is constrained in an implicational fashion, such that an action-on-lattice feature may only be lost if no other feature composes on top of it (i.e. if its loss does not affect a later function application). Finally, it was demonstrated that this structural constraint correctly derives the attested patterns of reduction, further showing that the attested gaps are not accidental, and the diachronic asymmetry between pronominal (stable) and demonstrative (unstable) indexical systems.

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