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Morphosyntactic Microvariation in Hamadan Lori: An Isogloss-Based and Dialectometric Account

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ABSTRACT

The Lori dialects of Hamadan Province lie at the northwestern edge of the Southwest Iranian area, in contact with Laki and Southern Kurdish. Standard descriptions, going back to MacKinnon's work on Khorramābādi, treat their morphosyntax as fully Persian-aligned, but that picture rests on single-site studies and has never been tested against a dense sample. We examine eleven variables at 54 Lori-speaking sites in Malayer, Nahavand, Tuyserkan, and Asadabad, comprising six morphosyntactic variables (exponents of case, definiteness, agreement, and tense-aspect) and five grammatical-lexical variables (lexical alternations tied to a closed set of morphological exponents). Across the four counties, the past and perfect are accusative: S and A are indexed by the same verbal agreement affixes as in the present, while O is indexed by a pronominal clitic. Asadabad and Nahavand-fringe depart from this pattern in the present perfect: when the agent alone is indexed, A is realized by an oblique clitic rather than an affix, while S stays affixal; once an object is also indexed, the agent reverts to an affix and the clitic indexes the object. We read this alternation as a residual, transitional reflex of ergativity, not a stable alignment type. Dialectometry recovers four clusters that track geography only moderately (Mantel $r = 0.54$, $p < .001$, 3,000 permutations). Hamadan Lori is predominantly accusative, but a small set of Northwest-leaning features survives at its western and northern margins, decreasing in frequency with distance from the Laki and Southern Kurdish contact zone.

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Introduction

Lori is one of the larger but less thoroughly described languages of the Iranian family. Anonby (2003) treats it as a cluster of three related languages, Northern Lori (Luristāni), Bakhtiari, and Southern Lori, strung along a continuum between Kurdish and Persian (see also Anonby & Asadi, 2014). The Lori dialects of Hamadan Province belong to the Northern Lori branch and occupy a particularly exposed position. Their speakers live alongside Azeri Turkic to the north, Laki and Southern Kurdish to the west, and Persian-influenced varieties to the east. Hamadan Lori is thus the Northern Lori variety furthest from the Lurish heartland and closest to the northwestern margin of the Iranian Southwest.

The phonology of these varieties has begun to receive serious attention. Alongside the morphosyntactic variables that are our focus here, we also coded, as a secondary comparison, six phonological isoglosses across the same 54 sites: (i) lenition of the labial stop in *sib* ‘apple’; (ii) lenition of the velar stop in *sag* ‘dog’; (iii) vowel raising in *xun* ‘blood’; (iv) diphthongization in *gāv* ‘cow’; (v) vowel nasalization in *ostoxān* ‘bone’; and (vi) syllable structure in *kolox* ‘clod’. Each of these six variables was coded categorically, in exactly the same way as the morphosyntactic variables, and the resulting site-by-variable matrix was converted into a pairwise phonological distance matrix using the same categorical (RIV) measure defined in the Method section. That matrix is used at one point below, where it is correlated with the morphosyntactic distance matrix. The retention of the fricative ʒ, discussed later in connection with the form *jaʒen* ‘rainbow’, is not one of these six variables: it is an observation drawn from the lexical variable ‘rainbow’ and is reported separately.

This consensus is plausible, and in the end we largely confirm it. It has never been tested, however, against a dense and geographically systematic sample of the area where residual northwestern features might be expected to survive if they survive anywhere, namely the Hamadan Lori zone, whose dialects sit immediately adjacent to Harsini Laki, Kakavandi Laki, and Southern Kurdish varieties. The standard descriptions are based on point studies of single sites (Khorramābād, Giō, parts of Borujerd) and say nothing about internal variation across the Hamadan Lori area itself. They tell us what Northern Lori looks like at one site; they do not tell us whether all Northern Lori sites look alike.

We examine the morphosyntactic structure of Hamadan Lori from two complementary angles. The first is descriptive and isogloss-based: we take eleven morphosyntactic and grammatical-lexical variables across 54 Lori-speaking sites in four counties and ask whether their isoglosses bundle and how the picture relates to the Northwest–Southwest cline. The works cited here as the descriptive and theoretical background for that cline (Paul, 1998; Haig, 2008; Korn, 2019) frame the question we ask; they are not the source of the findings reported below, which rest entirely on our own fieldwork data. The second is dialectometric: we compute

This study examines three issues. It investigates whether the morphosyntactic isoglosses form discrete zones or instead remain independently distributed, as expected under a continuum model of Lori. It also assesses whether the overall pattern aligns closely with

the Persian end of the cline, as suggested by MacKinnon (1977, 2002, 2011) and Anonby (2003), or whether pockets remain in which Northwest-leaning features are retained. Finally, it considers whether morphosyntactic differentiation patterns with phonological differentiation or diverges from it. These issues are addressed through two complementary components of the study. The descriptive analysis presents the variants site by site, while the dialectometric analysis examines, in aggregate and without reference to the proposed zone labels, whether the variants cluster and whether those clusters follow geography. Where the two analyses converge, the resulting pattern is treated as more robust than either analysis alone.

The remainder of this introduction places the study in context; the Method section describes the sample, variables, and pipeline; the Results section presents the isogloss analysis and the dialectometry, including the four-cluster structure and the linguistic-geographic relationship; and the final section brings the two together and asks what they imply for the position of Hamadan Lori on the cline.

The Northwest–Southwest Cline and the Position of Lori

The standard typological frame for Western Iranian, from Tedesco (1921) and reformulated by Paul (1998), treats the family as organized along a Northwest–Southwest cline rather than a branching tree, with Kurdish, Zazaki, Hawrami, Balochi, Laki, and the Caspian languages at the Northwest pole and Persian, Tajik, Lori, Bakhtiari, and the Fars dialects at the Southwest. The classic diagnostics include the reflex of Proto-Iranian initial *dw- (Northwest b- against Southwest d-, as in *bar* ~ *dar* ‘door’) and, most relevantly here, a cluster of morphosyntactic features: the survival or loss of tense-split ergativity, the form and function of pronominal clitics, and the marking of definite and specific direct objects (Bossong, 1985; Stilo, 2018).

Korn (2019) has complicated this picture, arguing on philological grounds that few supposed Northwest–Southwest isoglosses are genuine shared innovations, many being independent retentions or parallel developments, so the bipolar typology is weaker than it appears (see also Cathcart, 2022). We take this skepticism as a theoretical foil: a clean bundling of isoglosses along a single line would provide evidence for a robust cline, while a diffuse picture of crossing isoglosses and area-defined clusters would support her view. What follows comes closer to the second, though with a structured residual signal Korn’s account does not predict.

Lori is consistently classified as Southwest Iranian. MacKinnon’s descriptions of Giō (1977) and Khorramābād (2002) and his Encyclopædia Iranica synthesis (2011) treat Northern Lori as showing the full Southwest set: nominative-accusative alignment in all tenses, the past taking the same personal endings as the present; a single set of pronominal clitics confined to object and possessor uses; a definite/specific-object marker *=ne* ~ *=na* parallel to Persian *rā*; and an analytic perfect on the past stem plus enclitic copula. On this account Lori marks past-tense objects exactly as Persian does and shows no ergativity. Anonby (2003) reports a more graded picture across the Lori continuum, but on the features that matter here his data agree with MacKinnon’s for Northern Lori.

Hamadan Lori and the Adjacent Northwest Varieties

Where Hamadan Lori is unusual is in its immediate neighbors. To the west and northwest lie the Laki varieties of Lorestan and Kermanshah, several preserving tense-split ergativity robustly: Mohammadirad (2020) shows that Kakavandi and core Aleshtari Laki retain the full ergative function of past-tense Agent indexing through clitics, described in detail by Belelli (2021) for Harsini Laki. Peripheral Hamadan-area Laki, including the Češin variety described by Rasekh-Mahand (2024), has already lost this function, where the pronominal clitics mark objects irrespective of whether a full object noun phrase is also present. The ergative function thus erodes gradiently from west to east: full preservation in core Laki, partial in Aleshtari, loss with object-clitic retention in peripheral Hamadan Laki, and, if MacKinnon (2011) is right, no trace in the Lori dialects examined here.

This near-frontier position makes Hamadan Lori the right test case. If residual Northwest features survive anywhere in Northern Lori, they will survive at sites in immediate contact with Laki and Kurdish: northwestern Nahavand, Asadabad (bordering Kurdish-speaking Kermanshah), and the western fringes of Tuyserkan. If the standard description holds in full strength, even these margins should look like the Lori-Persian heartland, the only variation being graded distance from Persian rather than residual Northwest character.

Recent Dialectometric Work on the Region

Two recent studies form the direct methodological background to ours. Rostambeyk Tafreshi (2016) examined 15 villages across five Hamadan counties, using a 149-word Swadesh list and hierarchical clustering to identify nine dialect clusters. Her work establishes internal Hamadan dialect structure and shows the largest within-province distances running east–west, but it does not isolate the Lori sites from the Turkic-speaking north and works only with lexical data.

Piryaee et al. (2024), at a larger scale, compute Levenshtein distances across 80 sites from southern Hamadan through Lorestan to northern Khuzestan (Kleiweg & Nerbonne, 2013), identifying three clusters (Laki, Lori Lorestani, Lori Bakhtiari) with r = 0.88 between linguistic and geographic distance. Their study confirms the continuum character of the broader area and places Hamadan Lori in the Lori Lorestani macro-cluster, but at their scale the internal structure of Hamadan Lori is not resolved.

Our study sits in a third niche: we restrict ourselves to the Lori-speaking sites of Hamadan Province, a denser sample in a smaller area, and take morphosyntactic rather than lexical or phonological variables as the primary data. We apply the same pipeline (categorical and Levenshtein distance, Ward clustering, Mantel test) to a morphosyntactic feature set, asking whether the cline organizing the broader transect of Piryaee et al. (2024) has a microvariational counterpart inside the Lori area.

Method

Terminology and Measures

Because the analysis draws on both dialectological and quantitative vocabulary, the central terms are defined here at the outset. An *isogloss* is a line on a map separating the

areas in which two variants of a single variable are used; isoglosses are said to bundle when several of them run along approximately the same line, which is the classical evidence for a dialect boundary rather than a gradual transition. *Dialectometry* is the quantitative study of such variation; instead of examining isoglosses one at a time, it aggregates many variables into a numerical measure of distance between every pair of sites, and then looks for structure in the resulting matrix.

Four measures are used below. The categorical distance, known in the dialectometric tradition as the *Relative Identity Value* (RIV), is simply the proportion of variables on which two sites have different variants, so that 0 means complete identity and 1 complete disagreement. The *Levenshtein distance* counts the minimum number of single-character insertions, deletions, and substitutions needed to turn one string into another, normalized by string length; it is a string-based rather than category-based measure, and we use it only as a check on the categorical one. *Ward hierarchical clustering* is a procedure that repeatedly joins the two most similar sites or groups of sites, producing a branching tree (a dendrogram) whose structure reveals how the sites fall into groups; the cophenetic correlation coefficient measures how faithfully that tree reproduces the original distance matrix, with values near 1 indicating a good fit. *Cronbach's α* is a reliability coefficient, borrowed from psychometrics and standard in dialectometry. It measures whether a set of variables behaves consistently as indicators of one underlying dimension of distance; a high value licenses aggregating them into a single matrix but says nothing about whether they are linguistically interchangeable. The *Mantel test* assesses the correlation between two distance matrices computed over the same objects, here linguistic and geographic distance, and evaluates its significance by repeatedly permuting the rows and columns of one matrix; a *medoid*, finally, is the member of a cluster whose average distance to the other members is smallest, and thus serves as that cluster's most representative site[1].

Sites and Sampling Procedures

The data come from a field survey within the broader Atlas of Lori in Hamadan Province project, which covers 79 settlements in the southern half of the province and follows the model of large-scale geolinguistic documentation in Iran (Anonby, Taheri-Ardali, & Hayes, 2019). Of these, 54 are Lori-speaking, the rest Azeri Turkic (12), Laki (9), Kurdish (2), or mixed (2). We work only with the 54 Lori sites: 22 in Malayer, 15 in Nahavand, 14 in Tuyserkan, and 3 in Asadabad. The non-Lori sites, useful for delimiting the Lori boundary, lie as Laki to the southwest along the Nahavand–Lorestan border, Turkic to the north, and Kurdish to the west of Asadabad.

At each site, fieldworkers conducted structured elicitation with two native speakers, using a questionnaire of 149 lexical and 44 sentential items covering phonological,

[1] The following abbreviations are used in the glosses and tables: A = agent (subject of a transitive verb); ACC = accusative; CL = clitic; COP = copula; DEF = definite; DOM = differential object marking; EZ = ezafe; IND = indefinite; LOC = locative; NEG = negation; O = object of a transitive verb; PL = plural; POSS = possessive; PST = past; PTCP = participle; RIV = Relative Identity Value; S = subject of an intransitive verb; SG = singular; 1, 2, 3 = first, second, third person.

morphological, and syntactic phenomena. The consultants were all male, aged 40 to 50, with educational backgrounds ranging from a high-school diploma to a bachelor's degree, and lifelong residents. We prioritized middle-aged, locally resident male speakers as the locally recognized norm bearers, a pragmatic choice given a 79-site survey; the sample is accordingly not designed to capture gender-based or generational variation, and we make no claims about either. The 54 Lori sites are not a pre-stratified subsample but simply all settlements whose speakers self-identified as Lori-speaking, the rest excluded on the same criterion. From the questionnaire we extracted eleven variables indexing morphosyntactic or grammatical-lexical contrasts relevant to the Northwest–Southwest cline. Coordinates were recorded for 50 of the 54 sites; the four sites lacking coordinates are retained in the cluster analysis but excluded from the geographic-distance computations. Two points about scope follow from this design. With two consultants per site, the data capture the dominant local variant rather than within-village variation, and with 54 sites the analysis speaks to the internal structure of Hamadan Lori, not to Lori as a whole or to the finer sociolinguistic grain of any one village. The claims below should be read at that resolution.

Variables

Two classes of variable are used here, and it is worth defining them before the groups are introduced. A morphosyntactic variable is one whose variants are exponents of a grammatical category, such as case, definiteness, agreement, or tense and aspect; the variants differ in grammatical function, not merely in lexical choice. A grammatical-lexical variable is one in which the choice of lexeme is itself tied to a closed set of morphological exponents, so that selecting one variant entails a particular morphological shape. The two classes are therefore not independent categories but points on a single continuum of grammaticalization, the second shading into the first; we keep them distinct in the exposition because the grammatical-lexical variables carry less theoretical weight, but they enter the dialectometric analysis on exactly the same footing. Where the text refers to morphosyntactic variables without qualification, both classes are intended. The variables fall into three groups. Group A is five core grammatical markers: the definite/object suffix on *sini* 'tray' (*n-a*, *n-a-ne*, *n-e*); the third-plural oblique clitic (*=šo* vs. *=šon*); the negative present perfect of 'see' (*na-i-dam*, *neydi-din*, *ni-yam*); the pluperfect auxiliary (*bīd*, *ū*, *Ø*, *vī*); and the locative preverb in 'give back' (*pas-dā-i* vs. *dūī-de-mā*). Group B is a single variable, the perfect of *bordan* 'take, carry' (*bordīm*, *bordīm-a*, *bord-i:-mān*, *bordeym*). Group C is five lexical-and-morphological variables where the lexical choice tracks a small set of morphological options; these are lexical as well as morphological, included because the choice is tightly coupled to a closed set of exponents and partitions the sites exactly as Group A does. They are 'tortoise' (*kisal* vs. *kāsapoš*), 'husband' (*mira*, *šiar*, *šuar*), 'which' (*komī*, *komīn*, *kāmi*, *kāmīn*), 'last child' (several forms), and 'rainbow' (several forms, including *jaʒen* with the Northwestern ʒ). Two variables were revised during data cleaning. The pluperfect auxiliary was originally coded together with the present perfect of 'see'; these are two distinct exponents, a periphrastic auxiliary (*bīd*/*ū*/*Ø*/*vī*) and the negated participial form, and we treat them

separately. The ‘give back’ item, first glossed as a causative, is more accurately a locative-preverb alternation (*pas* ‘back’ vs. Nahavand-fringe *du*). Neither revision changes the aggregate results, but both sharpen the zones.

A word is in order about how the illustrative forms below were chosen. For each variable we cite one representative form, but the coding itself rests on the full set of tokens elicited for that variable at each site, and a site was assigned a variant only where its tokens agreed. Where a variable is exemplified by a single lexeme (for instance the perfect of *bordan*), the paradigm was elicited for that verb at every site, and the parallel forms of *didan* ‘see’ and *xordan* ‘eat’ were checked at the sites carrying the marked variant, so that the pattern reported is not an artefact of one lexeme or of one phonological environment.

Group A is the heart of the analysis. The definite/object marker is the diagnostic exponent of differential object marking in Lori, the category described for Persian by Rasekh-Mahand and Sabouri (2018), its shape (notably the n-initial forms vs. the -e vowel) linked to the Northwest–Southwest cline by Stilo (2018) and Haig (2018). The third-plural oblique clitic is the form most likely to retain the ergative Agent-indexing function if any does; the *=šo*/*=šon* contrast is minor (loss of final n) but lets us ask whether sites preserving archaic phonology also preserve archaic morphology. The pluperfect auxiliary is the most sharply differentiating variable, distinguishing the eastern d-final *bīd*, the Tuyserkan zero, the Nahavand *ū*, and the Asadabad v-initial *vī*. The locative preverb separates the Nahavand-fringe directional *dūī-de-mā* ‘give back’ from the *pas-dā-i* used elsewhere. The perfect of *bordan* is similarly diagnostic, the Asadabad *bord-i:-mān* indexing A by an oblique clitic, a Northwestern pattern lost in Persian and most Lori.

Distance Measures and Analytical Pipeline

Following the dialectometric tradition on Iranian, we compute two parallel pairwise-distance matrices over the 54 sites and eleven variables. The first is the categorical distance, equivalent to Goebl’s Relative Identity Value (Goebl, 2010) and to Rostambeyk Tafreshi’s (2016) proportion of non-identical variants: for sites i and j, d(i, j) = d/n, where n is the number of variables compared and d the number on which they differ. The second is the Levenshtein distance (Levenshtein, 1966; Heeringa, 2004) on the variant strings, length-normalized and averaged across variables. We include Levenshtein not because edit distance is ideal for morphosyntactic contrasts (it counts character edits, not structural differences) but as an independent check: where the categorical metric records only same or different, Levenshtein registers how far apart two variants are in string shape, so agreement between them shows the categorical partition is not an artifact of how variant boundaries were drawn. Its role is corroborative, and all substantive results below use the categorical matrix.

Reliability of the variable set is assessed with Cronbach’s α, computed with the 54-choose-2 pairwise comparisons as units and the eleven variables as items, following established dialectometric practice (Heeringa, 2004; Nerbonne & Kleiweg, 2007): each variable returns a same-or-different verdict per site pair, and α measures how far the items agree in ranking those pairs. A high α means not that the variables are linguistically interchangeable but that they are consistent indicators of a single dimension of aggregate

distance, the property one needs before aggregating them. The categorical–Levenshtein correspondence is assessed with a Mantel test (Mantel, 1967; 3,000 permutations). From the categorical matrix we derive (i) a Ward clustering solution, with the cophenetic correlation and a UPGMA cross-check, and (ii) a Mantel test against great-circle distances between the 50 sites with coordinates, the linguistic-to-geographic curve fitted with the Séguy form a + bx/(c + x). Computation used Python (scipy, scikit-learn); the pipeline replicates RuG/L04 (Kleiweg & Nerbonne, 2013), used by Piryaee et al. (2024), on a morphosyntactic rather than lexical-phonetic feature set.

Results

A word on terminology before the variables, since three kinds of label are in play. The four counties (Malayer, Nahavand, Tuyserkan, Asadabad) are administrative units; the dialectometric clusters are the groupings the distance analysis recovers; and the zones we name are our labels for those clusters. The two mostly coincide, with one wrinkle: Nahavand County splits into two zones. We take the variables in turn, the five core grammatical markers of Group A, then the perfect of *bordan*, then a selective look at the lexical-morphological variables of Group C, giving the per-zone distributions in tabular form. The zones, Malayer, Nahavand-fringe, Nahavand-core, Tuyserkan, and Asadabad, come from the cluster solution presented later in this section; the forward reference is unavoidable, since the county boundaries do not everywhere match the clusters. Nahavand-core is four sites, Nahavand town among them, in the north of the county that pattern with Malayer on most variables; the other eleven Nahavand sites, the rural belt, are the Nahavand-fringe.

The Five Core Grammatical Markers

Table 1 summarizes five grammatical markers across the zones, Nahavand shown as its two sub-zones: the definite/object marker on *sini* ‘tray’, the third-plural oblique clitic, the negative present perfect of ‘see’, the pluperfect auxiliary, and the locative preverb in ‘give back’.

Table 1. Distribution of five grammatical markers across zones (cell entries: dominant variant)

Zone (n)	DOM marker (*sini*)	3PL clitic	Pres. perf. ‘see’	Pluperf. auxiliary	Preverb ‘give back’
Malayer (22)	*n-a*	*=šon*	*neydi-dim*	*bīd*	*pas-dā-i*
Nahavand-core (4)	*n-a*	*=šon*	*neydi-dim*	*ū*	*pas-dā-i*
Nahavand-fringe (11)	*n-e*	*=šo*	*ni-yam*	*ū*	*dūī-de-mā*
Tuyserkan (14)	*n-a-ne*	*=šo*	*na-i-dam*	*Ø*	*pas-dā-i*
Asadabad (3)	*n-a-ne*	*=šo*	*na-i-dam*	*vī*	*pas-dā-i*

Most striking is that each zone is internally homogeneous on every variable: all 22 Malayer sites share the same five variants, all 14 Tuyserkan sites theirs, and so on, the single systematic exception being Nahavand, which splits into two blocks. No zone mixes the variants of any single variable. This homogeneity is the empirical core of the bundling

argument: at the resolution our data allow, the zones behave as discrete grammatical units, not as points on a smooth continuum.

Second, the Nahavand sample splits cleanly. The eleven Nahavand-fringe sites carry a distinctive profile (*n-e*, *=šo*, *ni-yam*, auxiliary *ū*, preverb *dūī-de-mā*), while the four Nahavand-core sites nearest Malayer follow the Malayer pattern on the object marker, clitic, present perfect, and preverb, sharing only the auxiliary *ū*, and show Malayer-type phonology on our secondary coding. We read the eleven-site fringe as the conservative rural belt of Nahavand and the four northern core sites, Nahavand town among them, as a transitional belt into which the Malayer grammar has spread, rather than a true four-way split of Nahavand.

Third, and most consequentially, the pluperfect auxiliary is the variable on which the zones are maximally differentiated: Malayer has *bīd*, Tuyserkan a zero auxiliary, Nahavand (both sub-zones) *ū*, and Asadabad alone *vī*. The Asadabad *vī* is a reflex of the older *baw-/*bū- auxiliary, surfacing as a distinct v-initial perfect auxiliary in Northwest varieties such as Laki and Southern Kurdish, whereas Malayer *bīd* is the innovative Persian-aligned d-final form. Its pluperfect thus preserves the same Northwest-leaning archaism we meet again in its perfect of *bordan* and its retention of ʒ. On the object marker, clitic, and present perfect, Asadabad patterns with Tuyserkan, the two forming a central-and-northern conservative type against the innovative eastern majority (Malayer plus the four Nahavand-core sites) and the idiosyncratic Nahavand-fringe; on the pluperfect auxiliary alone it stands apart, which is why the dialectometry resolves it as its own cluster.

A methodological caveat concerns the present-perfect variable. Its elicitation prompt, *tā hālā čenīn māšīnī nadīde-am/nadīde būdam* ‘I have not / had not seen such a car’, is pragmatically ambiguous between present-perfect and pluperfect readings, since the adverbial *tā hālā* ‘up to now’ biases speakers toward the present perfect regardless of copula, and a minority resolved it inconsistently. Where a response was ambiguous, we coded the variant on the form actually produced rather than the intended reading, and the inconsistent minority did not fall along zone lines. We keep the variable for two reasons: its zone-level distribution is internally consistent and it bundles with the other four Group A markers, so whatever noise the prompt introduces does not disturb the partition. Still, the individual forms should be read with the ambiguity in mind, and a follow-up elicitation with a past-anchored frame is planned. In the simple past and the wider non-perfect domain, the ergativity question is straightforward: no zone places an agent-indexing clitic on a simple-past transitive verb, past agreement uses the same affixes as the present, and pronominal clitics appear only in the object and possessor roles. For the simple past, then, Northern Lori has lost tense-split ergativity, exactly as MacKinnon (2002, 2011) maintained. The present perfect is a different matter: at Asadabad and Nahavand-fringe it preserves an agent clitic in the agent-only construction, a restricted and residual reflex that qualifies MacKinnon’s (2011) generalization for the perfect domain specifically. We take this up in the section on contact-induced ergativity below, where the relevant paradigms are analysed in full.

The Perfect of bordan

The perfect of *bordan* 'take, carry' is the most direct morphosyntactic diagnostic in our data, standing at the intersection of the analytic-vs-synthetic perfect, the form of the personal endings, and the possibility of clitic Agent indexing. Across the 54 sites we attest four variants (Table 2).

Table 2. The 1PL perfect of bordan 'take' across zones

Zone (n)	Variant	Comment
Malayer (22)	*bordīm*	Persian-type, affixal ending *-īm*
Tuyserkan (14)	*bordīm*	Persian-type
Nahavand-core (4)	*bordīm-a*	Persian-type stem + affixal *-īm* + copula *-a* 'be'
Nahavand-fringe (11)	*bord-i:-mon-a*	Participle *-i:* + 1PL agent clitic *=mon* + copula *-a*
Asadabad (3)	*bord-i:-mān*	Participle *-i:* + 1PL agent clitic *=mān* indexing A

The four variants split into two morphological types along a line that matters for alignment. In Malayer, Tuyserkan, and Nahavand-core the perfect is Persian-type, a past stem followed by the affixal ending *-īm*; the Nahavand-core *bordīm-a* adds only the reduced present copula *-a* 'be' that closes the perfect in the Nahavand varieties, and is not structurally a different type of perfect. These three zones are accusative, and the agreement here is unambiguously affixal. The Asadabad *bord-i:-mān* and the Nahavand-fringe *bord-i:-mon-a* are of a different type. Each segments as a past stem plus the participle *-i:* plus a first-plural exponent, *=mān* at Asadabad and *=mon* at Nahavand-fringe, which indexes the transitive subject (A). Because the agent is indexed alone here, with no object clitic in the complex, this exponent is the oblique agent clitic rather than the affix, and it is the reflex of the inherited Northwestern perfect that survives in core Laki and Southern Kurdish (Mohammadirad, 2020). Its survival at Asadabad and Nahavand-fringe has not, so far as we know, been reported for Lori before, and it is the strongest single piece of morphosyntactic evidence for residual Northwest character in Hamadan Lori. We return to the alignment significance of this A-indexing clitic, and to the parallel forms of *didan* 'see' and *xordan* 'eat', in the section on contact-induced ergativity below.

The small Asadabad and Nahavand-fringe samples cannot establish a stable dialect type, and *bord-i:-mān* could in principle be a relic confined to particular speakers. We therefore treat the Asadabad findings as hypothesis-generating and the historical interpretation in the Discussion as a motivated conjecture. What the concordant Northwest-leaning features do establish is narrower but real: such features are attested in Northern Lori at all, which is enough to qualify MacKinnon's (2011) blanket statement that Northern Lori shows no Northwest morphosyntax. At the margin bordering Kurdish-speaking Kermanshah, exactly the archaism his account predicts to be absent is attested.

Selected Lexical-Morphological Variables

Two of the five Group C variables are worth a closer look. 'Rainbow' has five variants, and the form *jaʒen*, attested exclusively at the three Asadabad sites, is striking for its fricative ʒ. On our secondary phonological coding, ʒ is retained exactly at the

northwestern margin (Asadabad in the north, Nahavand-fringe in the south) and lost elsewhere, the strongest single phonological diagnostic of Northwest affiliation in our data. Its survival in *jaʒen* reinforces the pattern seen with *bord-i:-mān*: Asadabad is where the Northwest features cluster and the Lori–Northwest interface is most clearly visible in the morphosyntax.

The word for 'last child' shows the same zonation with more interesting variants: Malayer and Tuyserkan use a shared root (*ta-ta-qārī, tateqārī*); Nahavand-fringe uses *āxerzā*, a transparent 'last-born' compound parallel to Kurdish; Nahavand-core the Persian-influenced *betʃe āxer*; and Asadabad the untraceable *kerker*. The variation is partly lexical but tracks the same zonation, so the isogloss bundling extends beyond grammar into the lexicon.

The other three Group C variables behave the same way, each partitioning the sites along the four-way zonation. 'Husband' is *mira* in Nahavand-fringe (core using the Malayer form), *šiar* in Malayer, *šuar* in Tuyserkan and Asadabad; 'which' is *komī* (fringe), *komīn* (Malayer), *kāmi* (Tuyserkan and core), *kāmīn* (Asadabad); 'tortoise' is conservative *kisal* (Tuyserkan, Asadabad, fringe) against Persian-aligned *kāsapoš* (Malayer, core). None cross-cuts the zonation; all reinforce it.

Distance Matrices and Reliability

The descriptive picture can be sharpened quantitatively. Cronbach's α on the eleven variables across the 54-choose-2 = 1,431 pairwise comparisons is 0.967, indicating very high internal consistency of the variable set as a measurement instrument. The categorical and Levenshtein distance matrices are highly correlated (Mantel $r = 0.976$, $p < .001$ on 3,000 permutations), giving strong convergent validity: the categorical RIV approach and the Levenshtein approach agree on the structure of distances across the 54 sites. We therefore present the categorical matrix hereafter, the Levenshtein matrix giving substantively identical results.

A second check, with a caveat. The morphosyntactic distance matrix correlates with the phonological matrix, computed from our secondary coding of six phonological isoglosses on the same 54 sites, at Mantel $r = 0.983$ ($p < .001$): the same areal partition is visible in both domains. This does not show that one domain drives the other, or that both follow from a single mechanism, only that morphosyntactic and phonological isoglosses pick out the same zones. The figure itself should not be over-read, since both matrices are built from few categorical variables over the same sites, with the same localities (above all Nahavand-fringe and Asadabad) carrying the marked variants in both, so some of the agreement is built into the design.

Hierarchical Clustering

Figure 1 shows the Ward solution as a dendrogram, leaf labels coded by county. Four clusters emerge cleanly, matching the zones used above; the cophenetic correlation is 0.968 (UPGMA cross-check: 0.991), so the tree faithfully summarizes the distance matrix.

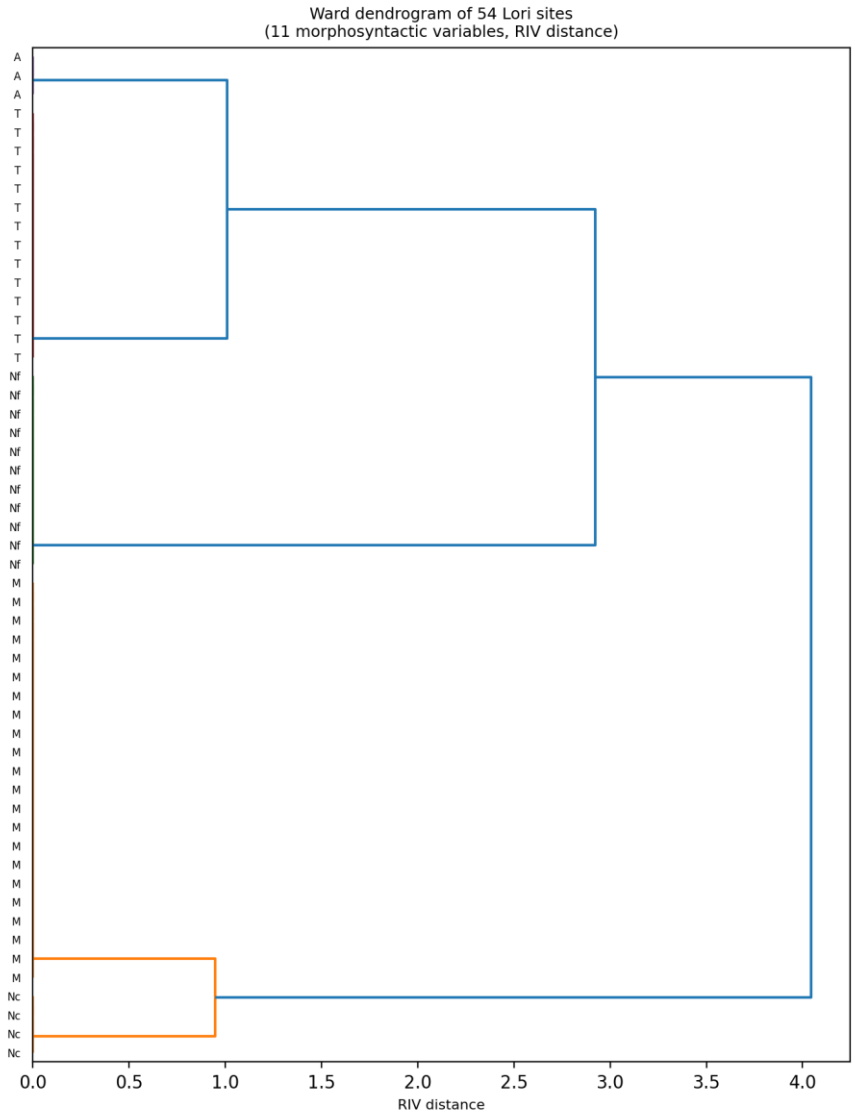

Figure 1. Ward dendrogram of 54 Lori sites on the 11 morphosyntactic variables (RIV distance). Leaf labels: M = Malayer, T = Tuyserkan, Nc = Nahavand-core, Nf = Nahavand-fringe, A = Asadabad.

The four clusters, in order of separation, are a Malayer cluster of 22 sites (absorbing the four Nahavand-core sites at a slightly larger distance), a Tuyserkan cluster of 14, a Nahavand-fringe cluster of 11, and an Asadabad cluster of 3. Unlike the phonological analysis, where Asadabad joins Tuyserkan, the morphosyntactic data place Asadabad as a fully independent cluster. This is interpretable: phonologically Asadabad and Tuyserkan share a central feature set, but morphosyntactically Asadabad's combination of the central markers (*n-a-ne*, *=šo*, *na-i-dam*, *pas-dā-i*) with the Northwest-archaic *bord-i:-mān* and the ʒ-bearing *jaʒen* is unique within Hamadan Lori. The morphosyntactic dialectometry recovers a distinction the phonological one obscured.

Linguistic Distance and Geography

The Mantel test between the linguistic and geographic matrices, on the 50 sites with coordinates, gives r = 0.54 ($p < .001$, 3,000 permutations), the Levenshtein matrix giving an essentially identical r = 0.51. This moderate positive correlation, more distant sites

tending to differ more but geography not being the whole story, we read as evidence for a mixed structure, partly gradient and partly organized by discrete areal bundles, rather than a precise partition of variance, since categorical data and few variables make any variance-explained figure suggestive rather than exact. The fitted Séguy curve (Figure 2; a = -0.13, b = 1.63, c = 40.6) shows the characteristic sub-linear growth Nerbonne (2010) documents for European areas: most differentiation accumulates within the first 40 km, and additional distance adds little.

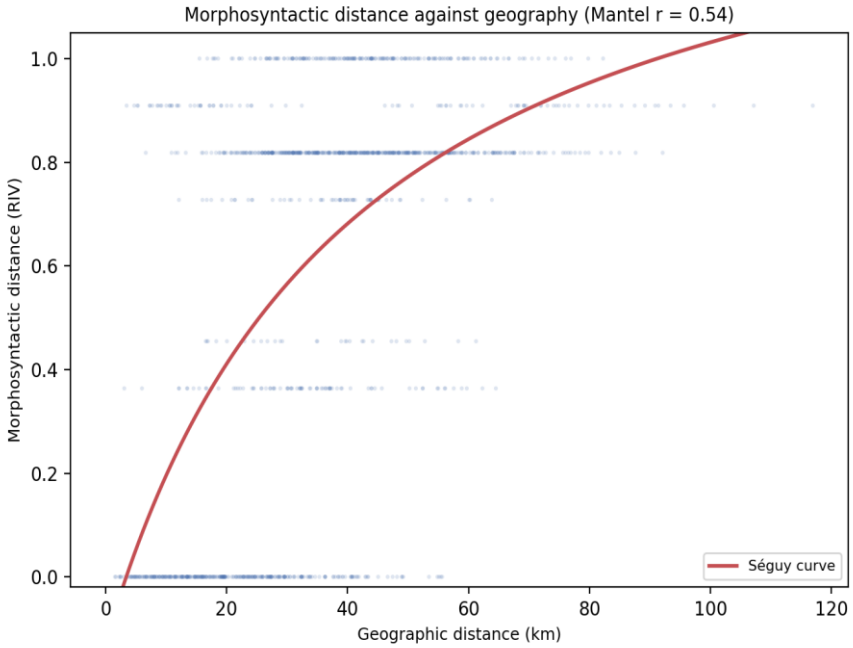

Figure 2. Morphosyntactic linguistic distance against great-circle geographic distance across the 50 sites with coordinates, with fitted Séguy curve.

The value r = 0.54 invites comparison with the r = 0.88 of Piryaee et al. (2024) for their three-province transect and with Nerbonne's (2010) cross-linguistic benchmark of 0.30-0.62. Our value sits within Nerbonne's range and well below Piryaee et al., a difference that is substantive rather than artifactual: their 80-site transect spans ~400 km across three provinces and includes the major Laki/Lori divide, where linguistic distance correlates strongly with geography, whereas our 54 sites span ~120 km within one province and are entirely Lori-speaking, where most linguistic distance is organized by discrete isogloss bundling rather than gradient separation. The lower r is therefore suggestive rather than decisive. It is consistent with the interpretation that within Hamadan Lori the dominant organizing principle is areal bundling rather than isolation by distance. This comparison should be read as illustrative rather than probative, since the two studies differ not only in geographic scale but also in the type of variable involved, lexical and phonetic in Piryaee et al. and morphosyntactic here, and the two feature types need not track geography to the same degree.

Discussion and Conclusion

Contact-Induced Ergativity

West Iranian alignment is standardly described as a trajectory from an inherited ergative system, in which the transitive subject (A) of the past or perfect is indexed by an oblique clitic while S and O are indexed by affixes, toward the accusative system of Persian, in which affixal agreement indexes S and A alike across all tenses (Haig, 2008; Karimi, 2010; Dabir-Moghaddam, 2023). Most of Hamadan Lori sits at the accusative end, with Persian and much of Southern Kurdish: across the great majority of our 54 sites the past and perfect take the same affixes as the present, and the clitics (*=šo* ~ *=šon*) index object or possessor, not agent.

Two zones break this pattern, and they are the point of the section. At Asadabad and Nahavand-fringe the present perfect is built on a fixed template, past stem plus participle *-i:* plus agent index plus copula, and the agent index alternates by construction. When the verb indexes the agent alone, the agent is an oblique clitic: the perfect of *bordan* 'carry' gives Asadabad *bord-i:-mān* and *bord-i:-tān*, and Nahavand-fringe *bord-i:-mon-a* (bord-PTCP-1PL.A-COP), with the oblique clitics *=mān*/*=mon*, *=tān*/*=ton* carrying A. Since the singular exponents do not distinguish clitic from affix, it is this agent-only distribution that identifies them as clitics. This clitic indexation of A, against an affixal S in the intransitive perfect (*rat* 'went', *rat-i:m*, *na-rase-vi:-n*), we interpret as a residual reflex of the old ergative A-marking. We put this as an interpretation rather than a demonstrated inheritance, since on the present data we cannot fully exclude a purely innovative source for the clitic, and the historical claim rests on the wider West Iranian pattern rather than on internal Lori evidence alone.

The system is in transition, and the direction of change shows up within the paradigm itself. When both agent and object are indexed, the agent is no longer a clitic: the clitic slot is taken by the object, and the agent is carried by the affixal series, distinct from the clitic series in the plural (*-im*, *-it* against *=mon*, *=ton*). The two-argument perfect thus surfaces as *bord-i:-me-šan* (carry-PTCP-1SG.A-3PL.O) and *borde-me-š* (carry-PTCP-1SG.A-3SG.O), agent affixal and object clitic, already the accusative pattern of the rest of Hamadan Lori. The alignment is therefore not a stable type but a conditioned split: agent clitic when indexed alone, preserving the ergative reflex, but agent affix once an object is co-indexed. It is not the double-oblique alignment of the Sanandaji-Ardalāni type, in which A and O are clitics simultaneously; in our data A and O are never both clitics.

The clitic indexation of A in the agent-only perfect, rather than any tense-based split, is what lets us speak of ergativity here at all, and even then only in a qualified sense. What survives is a single reflex of an ergative system, confined to the one construction where no object competes for the clitic slot; we read it as a residual, transitional pattern rather than a living alignment. Its origin we cannot settle. Given the position of these sites at the northwestern margin, in contact with Laki and Southern Kurdish, contact-induced retention is the most economical account, with the A-clitic held in place or reinforced by convergence with neighbours that still index A this way. But we cannot exclude simple inherited retention, and the three-site Asadabad sample is too small to tell the two apart. A decisive test would need comparable perfect paradigms from the adjacent Laki and

Kurdish localities, which we did not collect. We therefore offer the contact reading as an interpretation the data are consistent with, not one they establish.

Most Hamadan Lori is accusative in surface morphology, while a residual agent-clitic reflex survives at the northwestern margin in the agent-only perfect. This does not settle the typological position of Lori, and we resist a binary reading: the varieties retaining the A-clitic have lost most other ergative markers and already innovated the accusative pattern once an object is co-indexed, yet keep other Northwest-leaning traits (the auxiliary *vī*, the perfect *bord-i:-mān*, the ʒ of *jaʒen*, lost elsewhere) more or less independently. A single feature, even alignment, is thus a poor proxy for a variety's place on the cline. These traits are not ergativity but residues of the same Northwest-leaning type: the picture is accusativized Lori with a small but real Northwest residue at its margin. Our findings support a position intermediate between the classical bipolar typology and Korn's (2019) skepticism, the cline understood not as discrete typological packages, nor a strong continuum, nor a tree, but as a gradient of areal bundling that leaves relic residues at its margins even after the major Northwest features are lost.

The Four-Cluster Zonation

The second finding is that morphosyntactic isoglosses do bundle. The variables sort the 54 sites into four discrete, internally homogeneous clusters, sharply enough that the boundaries are visible in the per-zone tables without any quantitative analysis; the dialectometry simply confirms in numbers what the tables suggest. The morphosyntactic structure of Hamadan Lori is one of discrete areas, not gradient continua.

This bears on how we model dialect variation. The continuum view (Anonby, 2003 for Lori; Chambers & Trudgill, 2004 generally) predicts gradient variation without sharp boundaries; the areal view (the traditional atlases and Goebl's dialectometric school, Goebl, 2010) predicts discrete bundling. Our data favour areal bundling, at least for morphosyntax within a compact Lori area. This does not falsify the continuum view generally: Piryaee et al.'s (2024) $r = 0.88$ for the broader Hamadan–Khuzestan transect shows a continuum emerging at the larger scale. Our result suggests that continuum is built out of discrete, internally homogeneous areal units rather than being a smooth gradient at all scales.

Asadabad-Tuyserkan Connection

The striking result, that Asadabad shares a grammatical type with Tuyserkan across the intervening and more innovative Malayer, invites a cautious historical explanation. The pattern is a textbook lateral or relic-area configuration (Bartoli's *areae laterales*; Bartoli, 1945; Chambers & Trudgill, 2004): when an innovation spreads through a central, well-connected area, the peripheries on either side are left sharing the older feature, not through mutual contact but because each independently escaped the innovation. Here the innovating center is Malayer, and the conservative peripheries are Tuyserkan to its west and Asadabad to its north.

Several things could produce this, none of them requiring direct contact between Asadabad and Tuyserkan. One is differential external contact. Malayer, the largest and

most urbanized county, sits on the corridor linking Hamadan to Arak and borders Persian- and Turkic-speaking districts, making it the county most exposed to the Persian koine and to levelling pressures. Tuyserkan, in a valley on the southern flank of Alvand, and Asadabad, beyond the Asadabad pass toward the Kurdish marches of Kermanshah, are both peripheral to that corridor and both in contact with Northwest Iranian varieties (Southern Kurdish and Laki) rather than the Persian-Turkic east. Their parallel conservatism is thus a parallel effect of similar contact ecologies, not a shared inheritance distinct from the rest of Hamadan Lori.

A second consideration is administrative and demographic history. The traditional grouping of Malayer, Nahavand, and Tuyserkan as the Salāsī ('the three districts'), a label that never included Asadabad, reflects a long-standing orientation of those three southern districts toward one another and the Lori heartland, whereas Asadabad has looked north and west toward Hamadan city and the Kurdish borderland. The label is administrative, not linguistic, and we do not claim it names a dialect group, but it proxies centuries of differential interaction consistent with Asadabad remaining apart from the southern innovations. There is also, simply, Asadabad's small size and border position: a small, peripheral community adjacent to a different language area is exactly where relic features (*vī*, *bord-i:-mān*, ʒ) are most likely to survive (Trudgill, 1986; Schreier, 2003; Trudgill, 2004).

We put these forward as motivated hypotheses. Testing them properly would require demographic and contact data, on settlement histories, tribal affiliations, road and market networks, and migration, that our survey was not designed to collect, and we flag it as future work. What our data establish is that the pattern is real and that a purely geographic account cannot explain it; the contact-and-relic account is the most economical explanation consistent with both the linguistic facts and the province's historical geography.

Morphosyntactic and Phonological Dialectometry

There is a methodological finding too. The morphosyntactic and phonological distance matrices correlate at r = 0.983 on the same 54 sites, near-identical structure. We read this cautiously. It shows that the same areal partition is visible in both domains, so the zonation is not an artifact of one feature set; it does not show that the two are driven by a single cause, and the high figure is partly built into a design that reuses the same sites and concentrates the marked variants in the same few localities. The feature sets are, in any case, complementary. It is the morphosyntax, not the phonology, that pulls Asadabad away from Tuyserkan, and that matters because Asadabad is where the Northwest residues gather. The two distance measures also agree closely (categorical vs. Levenshtein, r = 0.976), but this is a fact about our data rather than a general property: the shifts that separate the zones (*bīd* vs. *vī*, *bordīm* vs. *bord-i:-mān*) happen to involve large changes in string shape, so both metrics catch the same breaks. Levenshtein is not, in general, well suited to morphosyntax.

Concluding Remarks

This article has examined morphosyntactic microvariation in Hamadan Lori at two levels, an isogloss-based analysis of eleven variables across 54 sites and a dialectometric analysis using categorical and Levenshtein distances, hierarchical clustering, and a Mantel test against geography. What comes out of it is, first, that Hamadan Lori is accusative almost everywhere, which qualifies MacKinnon (2002, 2011) in just one place: at Asadabad and Nahavand-fringe the present perfect keeps an oblique agent clitic when the agent alone is indexed, S stays affixal, and once an object is co-indexed the agent shifts to an affix. We read that alternation as a residual, possibly contact-induced reflex of ergativity, though with only three Asadabad sites and a single construction involved, that reading remains tentative. It belongs to a wider if faint Northwest signal at the same two margins, where features like *bord-i:-mān* and the ʒ of *jaʒen* have held on. And the isoglosses themselves bundle sharply into four clusters, with the morphosyntactic and phonological partitions coming out nearly identical, so the descriptive and quantitative analyses point the same way.

Several lines of further work suggest themselves. Most obviously, the 54-site sample, though dense for Hamadan Province, is modest by the standards of larger Iranian dialectometric studies; extending it to the adjacent Laki and Southern Kurdish areas would test where the Lori–Laki boundary falls and whether the Asadabad residues are continuous with the neighbouring Kurdish villages or isolated relics. A fuller study of clausal syntax, particularly clitic placement, negation, and complex predicates, would refine the picture. Finally, the dialectometric pipeline applied here has, to our knowledge, not been used elsewhere for morphosyntactic variables in Iranian; the demonstration that it works, and that the distance matrices behave consistently across feature sets within one dialect area, will we hope encourage similar work on other Iranian micro-areas.

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