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Abstract

Old Persian shows a change of postconsonantal *y*, *w* to *ẏ*, *ẇ*, respectively. However, if one applies (pre-)Middle Persian sound changes to the Old Persian forms, the result is at variance with certain Middle Persian forms. If one were to assume a syncope reversing the Old Persian change of *y*, *w* to *ẏ*, *ẇ*, this would also affect old cases of *ẏ*, *ẇ* and likewise yield incorrect results for Middle Persian. The Old Persian change can thus not have operated in the prehistory of Middle Persian, and there is a dialectal difference between attested Old Persian and the later stages of the language, which is to be added to those already noted. The paper also discusses some sound changes that are connected to the Old Persian change in one way or the other. Cases in point are the processes called Epenthesis and Umlaut in previous scholarship, which this article suggests to interpret as occurring in different contexts and in different periods. The former is limited to V*ry*, which yields V*ir* and feeds into a monophthongisation that, as shown by some late Old Persian word forms, occurred within Achaemenid times, giving *ēr* and *īr* from *ary* and *əry*. Epenthesis did not occur in the prehistory of Parthian, whereas the monophthongisation did. The Appendix presents a tentative sequence of the processes discussed in this article, which is intended as a contribution to the relative chronology of Persian historical phonology.

Keywords

Persian – Old Persian – Middle Persian – sound change – Iranian linguistics

Introduction

As argued by Hoffmann (1976: 636–38), Old Persian (OP) shows a change of postconsonantal *y*, *w* to *iy*, *uw*, respectively. The present article discusses evidence that this change did not operate in the dialect(s) on which Middle Persian is based; this difference between Middle Persian (MP) and attested Old Persian is thus to be added to those already identified.

This article is part of ongoing research on the chronology of Persian sound changes, which intends to proceed differently from what has been done so far: Traditionally, a "black box" method has been applied in studies on the historical phonology of Iranian, i.e., apart from isolated notes that a certain change X has to be earlier than change Y, they have limited themselves to contrasting an input—Proto-Iranian (Ir.), or even Proto-Indo-European (PIE)—with an output (Old, Middle, or New Persian) without examining what happens in between. Conversely, the "glass box" approach tries to determine in what sequence the various processes take place, while at the same time also taking into account how they interact.[1] This article will show examples of sound changes that yield incorrect results if one disregards how they interact.

The present attempt at presenting a relative chronology of some Persian sound changes is hypothetical in many details—necessarily so for lack of data in some parts—and awaits further refinement in others. It does try to establish what seems reasonably certain, and to offer additional points for subsequent discussion, laying out at each step the evidence (or lack of the same) on which the proposal is based. The suggestions systematically attempt to follow the principle of economy in terms of hypotheses: where two explanations seem equally viable, the approach which explains the data in the most straightforward way will be preferred. The Appendix (Section 5.) lists a preliminary tentative chronology of the sound changes suggested here; the numbers cited throughout the article refer to the items on this list, which, however, will be limited to changes discussed in this article. In the formulaic form of the sound changes, asterisks are omitted.

Dialectal differences between Old, Middle, and New Persian (NP) are of central importance to this article. I will use the terms "Proto-Old Persian", "Proto-Middle Persian", and "Proto-New Persian" to refer to the dialect(s) from which attested Old, Middle, and New Persian, respectively, derive.[2] For rea-

1 I owe the terms "black box" vs. "glass box" to the teachings of Heiner Eichner, who has applied the latter principle, e.g., in Eichner (1992).

2 Obviously matters are in principle even more complicated since Middle and New Persian are not dialectally homogenous.

sons of economy and also to avoid *ex nihilo* arguments, the assumption will be that Proto-MP is identical to attested Old Persian unless there is evidence to assume a difference (and similarly for Proto-NP). Similarly, I will assume that Elamite renderings of Ir. word forms reflect Old Persian unless they show features implying a dialectal difference, and that Armenian has borrowed from Middle Persian and Parthian (Pth.) unless there is evidence to the contrary.[3]

The term "Classical Old Persian" will be used to refer to what seems to be the "normal" form of attested Old Persian, differentiating it from other dialects and from late stages of Old Persian.[4]

As in any discussion of Middle Iranian phonology, the evidence of Ir. loanwords in Armenian (Arm.) is of crucial importance. Expressions such as "Armenian shows …" are meant to refer to the Ir. items found in the Arm. lexicon, more precisely the older layer of (Proto-)Middle Iranian loanwords (showing inherited *p*, *t*, *k* in postvocalic position),[5] which is most relevant for the present discussion.[6]

3 Some Armenian forms require the assumption of a third Western Iranian language as source, see Korn & Olsen (2012).

4 Brust (2018: 1) uses the term "Achaemenid Old Persian", but this has the unfortunate consequence that variations within the extant inscriptions such as *ahmiy* 'I am' in Xerxes' inscription in Persepolis instead of OP *amiy* elsewhere (see **1.8**) would qualify the former inscription as "non-Achaemenid".

5 See, e.g., Hübschmann (1897: 12–14) on this matter.

6 In the transliteration of Old Persian, I follow Schmitt (2009) and others by noting the potentially *a*-inherent signs as C (e.g., ⟨t⟩ instead of ⟨ta⟩ or ⟨t^{a}⟩) and the signs with inherent *i* and *u* as ⟨C^{i}⟩, ⟨C^{u}⟩. I transliterate ⟨c⟩, ⟨j⟩, ⟨v⟩ following the tradition, but prefer *č*, *ǰ*, and *w* for the transcription; the latter seems a more likely pronunciation, as also shown by the processes to be discussed in this article. For practical purposes, I also use *y*, *w* instead of *i̯*, *u̯* for Proto-Iranian. I follow Werba (1993: 142–43) in noting the diphthongs as *ai*, *au* (see also n. 8), and Hoffmann, Mayrhofer, etc. in noting the Proto-Ir. outputs of PIE **ḱ*, **ǵ$^{(h)}$* as **ś*, **ź*, respectively (Proto-Indo-Ir. **ć*, **ǰ$^{(h)}$*). For discussion of Ir. **r̥* > OP *ər* (which other authors transcribe *ar* or *ar̥*), see **1.4**.

Unless otherwise specified, forms with asterisk (*) refer to Proto-Iranian and/or the forms underlying Old Iranian, abstracting from the specificities of Old Persian and Avestan (Av.). A list of abbreviations is in the Appendix.

The spellings of OP words are cited from Brust (2018), with the adaptations just mentioned. Middle Persian is quoted from MacKenzie (1986) and/or Durkin-Meisterernst (2004) unless otherwise noted, while (classical) New Persian follows Steingass (1892) for the vowels. Quotes from works in languages other than English are my translations.

1 Old Persian

Before discussing the Middle Persian non-change which is the topic of this paper, it is necessary to review a number of Old Persian changes in some detail. The argument chiefly follows Hoffmann (1976), whose argument (revising much of previous scholarship) seems convincing to me so far as Classical Old Persian is concerned.

Old Persian y > iy, w > uw

1.1 In his comprehensive article on the Old Persian script, Hoffmann (1976: 636–38) argues that OP spellings such as ⟨h-r^{u}-u-v-⟩ 'all', ⟨a-n-i-y-⟩ 'other', ⟨θ-u-v-a-m⟩ 'you (ACC.SG)' stand for *haruwa-*, *aniya-*, *θuwām*, respectively, implying a change of postconsonantal *y* and *w* to *iy* and *uw*,[7] and opposing the forms just mentioned to Proto- Iranian **harwa-*, **anya-*, **θwām*.

Hoffmann thus argues against other authors' assumptions that spellings such as ⟨a-n-i-y-⟩ and ⟨h-r^{u}-u-v-⟩ represent *anya-, harwa-*, etc., with the additional *i, u* being merely orthographic.[8] For instance, Meillet & Benveniste (1931: 87–89, §144, 146)[9] had considered it improbable that an old *šyāti-* 'joy' would become *šiyāti-* and then change back to the *šyāt-* that is required to yield MP *šād* since the change *šy* to MP *š* appears to presuppose the absence of *i, u*.[10] A similar argument would hold for Ir. **dw-* > (Middle Persian) *d-*, which appears to speak against an intermediary stage *duw-*.[11]

However, as pointed out by Risch (1954: 151, followed by Hoffmann 1976: 636), reversals of *iy*, *uw* to postconsonantal *y*, *w* are in fact not uncommon. For instance, the development of PIE **méd^{h}i̯os* 'middle' (OInd. *mádʰya-*) to Latin *medius* (trisyllabic) implies **d^{h}i̯* > *dii̯*, which then reverted to **di̯-* to yield Italian *mezzo*. Moreover, says Hoffmann (1976: 637), had the OP form been /harwa-/,

7 The development of *hy* need not be an exception, see **1.8**. See **2.5** for further discussion of *aniya-* and *haruwa-*.

8 The account by Brust (2018: 22–24) is inconclusive and based on a misunderstanding regarding Sievers' Law. Schmitt (e.g., 1989: 64–65) considers as "orthographic rules" much of what Hoffmann considers a real phenomenon; his transcription is a "regrettable step backwards" (Werba 1993: 141–42) compared to Hoffmann (1976).

9 In contrast to Meillet & Benveniste (1931), Meillet (1915: 75 §144, 77 §147) does not appear to doubt "real" *iy, uw*; he notes that this *i/u* is of recent date and specific to Old Persian (implying, I assume, that it is absent from Avestan), and mentions the difference between OP **huw-* and MP *xw-* from Ir. *hw-*.

10 See **2.3** and **3.4** for further discussion of this word.

11 See **2.1**–**2.3** for further discussion of this change.

TABLE 1 Examples of postconsonantal *y*, *w* in Old and Middle Persian

Old Indic (OInd.)		**OP spelling**	**OP form**		**MP**
			Hoffmann[a]	**Meillet & Benveniste**[b]	
sárva-	'all'	⟨h-r^{u}-u-v-⟩	*haruwa-*	*harwa-*	*harw*
tvā́m	'you (ACC.SG)'	⟨θ-u-v-a-m⟩	*θuwām*	*θwām*	
dvā́r-	'door'	⟨d^{u}-u-v-r-⟩	*duwara-*	*dwara-*	*dar*
√*cyu*	'move'	⟨š-i-y-v-⟩	*šiyaw-*	*šyaw-*	*šaw-*
**čyāti-* (Latin *quiēs*)	'joy'	⟨š-i-y-a-t-i-⟩	*šiyāti-*	*šyāti-*	*šād*
satyá-	'truth'	⟨h-š-i-y-⟩	*hašiya-*	*hašya-*	
anyá-	'other'	⟨a-n-i-y-⟩	*aniya-*	*anya-*	*any*

a Hoffmann (1976: 636–38).
b Meillet & Benveniste (1931: 88–89, § 144, 146).

TABLE 2 Proposals for the development of some Ir. consonant clusters in Old and Middle Persian

	Proto-Ir.		**Proto-OP**		**OP**		**Proto-MP**		**MP**
Meillet & Benveniste:	**čy*, **θy* **dw-*	>			*šy* *dw-*			>	*š* *d-*
Hoffmann:	**čy*, **θy* **dw-*	>	**šy* **dw-*	>	*šiy* *duw-*	>	**šy* **dw-*	>	*š* *d-*

one would expect it to be written †⟨h-r-v-⟩; one would hardly write ⟨h-r^{u}-u-v-⟩ with a ⟨C^{u}-u⟩ "representing a phonetic nothing"; the same argument could be made about ⟨d^{u}-u-v-r-⟩, which could just as well be written †⟨d-v-r-⟩ (or †⟨d^{u}-v-r-⟩) if a form /dwara-/ was meant.[12]

12 One might be tempted to compare the Avestan *ii* and *uu* which render **y* and **w* in intervocalic and postconsonantal position. Hoffmann & Forssman (1996: 84) suggest that this orthography might be due to the influence of Old Persian and thus belongs to the transmission of the Av. texts, not to the Av. language while it was spoken. At any rate, metrical and other details show that the difference between historic *iy* vs. *y* (both written *ii*) and *uw*

Hoffmann (1976: 638) further argues that both inherited *-iya-* and the output of Ir. **ya* are written ⟨Ci-ya-⟩ in Elamite, and old and secondary *uwa* are both rendered by ⟨Cu-ma-⟩ or ⟨ma-⟩ (cf. Mayrhofer 1973: 33, 85, 93).[13] Moreover, both inherited and secondary *iya* are contracted in later Old Persian according to Schmitt (1989: 71, see **1.7**, **2.1**). Potential examples are OP *marīkā* (VOC.SG) ⟨m-r-i-k-a-⟩[14] 'lower-rank / younger man'[15] from **maryaka-* (cf. OInd. *maryaká-*) via **mariyaka-*[16] and several possible cases of *-y-a-* > *-iy-a-* > *-ī-* where the contraction seems to operate across the morpheme boundary of the preverbs *ni-*, *abi-* and the augment *a-* (**niy-a-* > *nī-*; **abiy-a-* > *abī-* from **ny-a-*, **aby-a-* as seen in OInd. parallel forms):

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vs. *w* (both written *uu*) is preserved in Avestan (Hoffmann & Narten 1989: 39–49). We can conclude that there are the Av. phonemes /y/ and /w/, which have word-initial allophones written with the signs transcribed ⟨y⟩, ⟨v⟩ and word-internal allophones written *ii, uu*.— See also n. 53.

13 ⟨m⟩ is the regular Elamite rendering of any OP *w* in any position of the word (see the list in Mayrhofer 1973: 85–87).

14 None of the three instances (DNb 50, 55, 57) is fully preserved; the fact that the text is structured in parallel sentences may confirm the restorations. The rock shows both old cracks that seem to antedate the inscription and later ones, which does not facilitate the interpretation (see also the details in Schweiger 1998/I: 74 and II: 215–21). The comparatively best instance is the one in line 50. Schmitt (2000: 34) reads ⟨m-r-i-●-k-a⟩, which has a lacuna in the middle (cf. the photo in Plate 18 of Schmitt 2000). It seems to me that the crack is old, and that no sign is lost (which is what Schmitt's ⟨●⟩ implies; thus also Sims-Williams 1981b: 3); also, the ⟨k⟩ is rather narrow, as if compensating for the space lost by the crack, and in the lines below, the crack continues in a way coherent with line 50, and no signs appear to be lost. As for the individual signs, I think that ⟨k-a⟩ are beyond doubt, ⟨m⟩ and ⟨i⟩ fairly certain, while ⟨r⟩ is not.

15 Schmitt (1999b: 129–31) argues in favour of *marīka-* meaning 'young man' (cf. MP *mērag* 'young man, husband') rather than 'servant' (which is the meaning of Bactrian μαρηγο). For cognates from other IE languages meaning 'boy / girl' and pointing to a possible root **mer(H)* 'young', see Milanova (2021: Section II. 2.3.1). In the Aramaic version (cf. Sims-Williams 1981b), the equivalent passages are not preserved.

16 The argument by Brust (2018: 25–26, 187, 283) is circular: According to him, the middle signs in OP *marīka-* are not readable (this is not entirely accurate, see n. 14), from which he concludes that there is no change *iya* > *ī* in Old Persian. From the supposed absence of this change he concludes (p. 187) that ⟨a-b-i-j-a-v-y-m⟩ cannot be an imperfect *abī-ǰāwayam* < **abiy-a-ǰāwayam* (according to him, ⟨n-i-š-t-a-y⟩, ⟨n-i-š-t-a-y-m⟩ and ⟨n-i-š-a-d-y-m⟩, are injunctives as well). While ⟨a-b-i-j-a-v-y-m⟩ might indeed be an injunctive (*abi-ǰāwayam*), even if it would be the only injunctive in this inscription (among many imperfects and some aorist forms), a lack of readability of *marīka-* would not prove that there is no change *iya* > *ī*. Also, and independent from the details of *marīka-* and the interpretation of the cited verb forms, the change *iya* > *ī* clearly did take place at some point in the prehistory of Middle Persian and also in numerous other Ir. languages (see 1.7, **2.1**); it thus seems to have occurred rather early.

TABLE 3 Possible cases of OP *-iya-* vs. *-ī-*[a]

Uncontracted form		Contracted form		Meaning
	**mariyaka-*	⟨m-r-i-k-a⟩ DNb	*marīkā*	'young man' (VOC)
⟨n-i-y-š-t-a-y⟩	*niy-a-štāya*	⟨n-i-š-t-a-y⟩ XPh	*nīštāya*	'he established'
⟨n-i-y-š-a-d-y-m⟩	*niy-a-šādayam*	⟨n-i-š-a-d-y-m⟩ XPh	*nīšādayam*	'I placed down'
⟨a-b-i-y-j-a-v-y-m⟩	*abiy-a-ǰāwayam*	⟨a-b-i-j-a-v-y-m⟩ XPf	*abīǰāwayam*	'I added'

a Readings from Schmitt (2014: 63, 246 and 45, 183, respectively).

1.2 Postconsonantal *y*, *w* yielding OP *iy*, *uw* recalls *iy*, *uw* arising from *i/ī*, *u/ū* (including *ai*, *au*) in word-final position. Examples include *paruw* ⟨p-r^{u}-u-v⟩ 'much' (OInd. adverb *purú*); the 3rd SG imperative ending *-tuw* (⟨-t^{u}-u-v⟩, OInd. *-tu*); *naiy* ⟨n-i-y⟩ 'not' < **nait*; *=čiy* ⟨-c-i-y⟩ (particle, etymologically 'any') < **čit* (OInd. *čid*); and the 3rd SG ending active *-tiy*, middle *-taiy* (OInd. *-ti*, *-te*, respectively) are both written ⟨-t-i-y⟩ in spite of the ambiguity this creates since there is no sign ⟨t^{i}⟩ (cf. Schmitt 1989: 64). Again, Hoffmann (1976: 635, 643) argues that this is a real change, not a quirk on the part of the scribes ("Schreibermarotte").

I suggest that this change and the one discussed in **1.1** are in fact a single process, which can be interpreted as a general tendency for both *i, u* and *y, w* to be excluded from certain positions in the word. Note that interconsonantal *i*, *u* (including *i, u* occurring in the diphthongs *ai*, *au*) are not affected.[17]

Change (9) Ir. $\begin{bmatrix} i, y \\ u, w \end{bmatrix}$ > OP $\begin{bmatrix} iy \\ uw \end{bmatrix}$ $\begin{Bmatrix} /C\_V \\ /\_\# \end{Bmatrix}$

Similar processes sporadically operate in other contexts. While *y* and *w* mostly appear as such between vowels (V_V), there are cases of a change to *iy*, *uw* even in this position, e.g., *adāra(i)ya* ⟨a-d-a-r-(i-)y⟩ 'he held' (OInd. *ad^{h}ārayat*), *ba(u)watiy* ⟨b-(u-)v-t-i-y⟩ 'becomes' (OInd. *b^{h}ávati*), etc.[18] However, these sporadic cases are not on the same level as the systematic ("regelmäßig", Schmitt 1989: 69) change of postvocalic *y*, *w* to *iy*, *uw*.

Likewise apparently related is, according to Hoffmann (1976: 635), the phenomenon of ⟨u-v⟩ for expected *ū*, but it needs to be kept in mind that this

17 Word-internal *i* and *u* are normally written ⟨C^{i}-i⟩, ⟨C^{u}-u⟩ where a C$^{i/u}$ character is available (⟨C$^{i/u}$⟩ alone is also found), otherwise ⟨C-i/u-⟩, thus identical to *ai*, *au*. Word-initial *ai* and *au* are written ⟨a-i/u-⟩, and *i-*, *u-* ⟨i-⟩, ⟨u-⟩ (Kent 1953: 13–14).

18 Examples from Hoffmann (1976: 635^{24}). Cf. also Kent (1953: 21).

is limited to isolated cases, it is thus different from the systematic change in (9). Relevant cases include GEN.PL *dahyuwnām* ⟨d-h-y-u-v-n-a-m⟩ beside *dahyūnām* ⟨d-h-y-u-n-a-m⟩ 'countries' (OInd. *dásyūnām*) and *uwnara-* ⟨u-v-n-r-⟩ 'skill' (OInd. *sūnára-*). The analysis on the part of Old Persian scribes of *ū* as a combination of *u+w* is noteworthy from a phonological point of view (Hoffmann 1976: 636).[19]

***Some changes preceding OP* y > iy, w > uw**

The OP change (9) can be used as point of reference for a relative chronology of some other changes.

1.3 As pointed out by Meillet (1915: 75 § 144, 77 § 147),[20] the change of **čy* and **ϑy* to **šy*, yielding instances such as ⟨š-i-y-v-⟩ *šiyaw-* 'move, proceed' (OInd. √*cyu*); ⟨š-i-y-a-t-i-⟩ *šiyāti-* 'joy' (Latin *quiēs*); ⟨h-š-i-y-⟩ *hašiya-* 'true' (Av. *haⁱϑiia-*, OInd. *satyá-*), presupposes contact of the two consonants; it thus predates the change of C*y/w* to C*i*̯ / C*u*̯*w*.

It may be noted in passing that Avestan shows *šii* for **čy* as well (but not for **ϑy*). However, the agreement of the two Old Ir. languages should not be taken to imply that **čy* > *šy* is a Proto-Iranian change. Some later Ir. languages have an affricate in the relevant words (Khotanese *ts*, Ossetic *c*, Kurdish *č*),[21] so it is more likely that the change **čy* > *šy* occurred independently in those Ir. languages that show it (in fact, most Ir. languages)—aided perhaps by contact among some of them, but not as part of a common inheritance.

If, then, the OP change **čy* > *šy* is independent of the parallel change in Avestan, this offers the possibility to assume (as is generally done), if only for reasons of economy, that the specifically Persian change **ϑy* > *šy* occurred together with the parallel change **čy* > *šy*.

Change (3) Ir. *čy*, *ϑy* > OP *šy*

It would be interesting for the purposes of relative chronology if the fact that OP *ϑ* is of several origins—PIE **t* preceding a consonant, **th₂* and **ḱ* (> Ir. **ś*)—

19 See Werba (1993: 142–43) for an alternative interpretation: He suggest that there was a neutralisation of vowel quantity in word-final *i*, *u* in the same way as there clearly is in the case of *-a/ā*, which both yield OP *-ā* (see **1.5**); he interprets ⟨-i-y⟩ [ij] as an allophone of /ī/, implying a lengthening of *-i*, *-u* > OP *-ī*, *-ū*.

20 Note the change in opinion by Meillet; Meillet & Benveniste (1931: 87) consider as "sûrement graphique" the *i* and *u* in OP C*y/w* (see n. 9).

21 Thus also the argument by Cheung (2007: 41) for the root **čyaw*, cf. also MacKenzie (1961: 71–72).

provided an element of relative chronology for the subsequent processes, but unfortunately there is no good example nor a compelling counterexample of whether or not OP *ϑ* deriving from PIE **ḱ* is included in the change **ϑy* > *šy*. It has generally been assumed that it is (Brandenstein & Mayrhofer 1964: 135, following Kent 1953: 34a).[22] If this is so, **ϑy* > *šy* would postdate the OP merger of the output of Ir. **ś* with Ir. *ϑ* from **t* in preconsonantal position (and, by extension, the merger of Ir. **ź* with **d*).

Change (2) Ir. **ś, ź* > OP *ϑ, d*

It is obvious that (3) equally presupposes the change of stops to fricatives when another consonant follows, so that **ty* yields Ir. **ϑy* and then OP *šy* (⟨h-š-i-y-⟩ *hašiya-* 'true', Av. *haⁱϑiia-* vs. OInd. *satyá-*). Since this change is likely to be Common Iranian (or Proto-Iranian) and not specific to Old Persian, it also precedes (2).[23]

Change (1) Indo-Ir. K > Ir. X /_C

1.4 Another change (occurring, in my view, systematically) preceding that of C*y/w* > C*i̯* / C*uw* is that of **r̥* to *ər*. This is shown by OP ⟨k-r-i-y-⟩ 'be done', ⟨m-r-i-y-⟩ 'die' from Proto-Ir. **kr̥ya-* and **mr̥ya-*: Had the OP forms still been **kr̥ya-*, **mr̥ya-* (i.e., if *r* preceding *-ya-* behaved like a vowel), the change C*y/w* > C*i̯* / C*uw* would not have taken place in these forms, and they would be written †⟨k-r-y-⟩ and †⟨m-r-y-⟩. As the change *-ya-* > *-i̯a-* is operating, the element preceding it is behaving like a consonant. ⟨k-r-i-y-⟩ and ⟨m-r-i-y-⟩ thus must contain a consonantal *r*, and encode *kəri̯a-*, *məri̯a-* which arose from **kərya-*, **mərya-* with consonantal *r* providing the context for the change to the forms with *-i̯-* (cf. Gippert 2001: 15).

The statement just made differs from the scenario suggested by Schmitt (1967: 61–62, similarly in subsequent works), who argues that the Old Persian passive shows full grade throughout (thus *kari̯a-*, *mari̯a-*, where the *ar* contains the consonantal *r* triggering *-ya-* > *-i̯a-*). He further holds that ⟨c-x-r-i-y-a⟩ *ča-xr-i̯ā* (3SG.PRF.OPT)—with the consonantal *r* effecting **kr* > Ir. *xr*—establishes a sequence of changes **ča-kr̥-yā-t* > **čakri̯āt* > *čaxri̯ā*, i.e., there would have been a resyllabification of **r̥y* > OP *ri̯*; the passive should thus be †*xri̯a-* (not ⟨k-r-i-y-⟩) had this category had zero grade.

22 The question merits a separate study, which is beyond the scope of this article.

23 See Tremblay (2005: 674–85) for an argument that the change is "Common Iranian", i.e., shared by the individual Ir. languages, but not necessarily dating back to Proto-Iranian.

TABLE 4 Development of **r̥y* in Old Persian

Input	OP form	Schmitt	My reading	MP form	Meaning
**kr̥-ya-*	⟨k-r-i-y-⟩	*kariya-*	*kəriya-*	⟨k(y)l-⟩, ⟨qyryh-⟩	do-PASS
**mr̥-ya-*	⟨m-r-i-y-⟩	*mariya-*	*məriya-*	⟨myr-⟩ (NP *mīr-*)	'die'
**čakr̥-yā-t*	⟨c-x-r-i-y-a⟩	*čaxriyā-*			do.PRF-OPT-3SG

While at least the latter seems a valid point considering cf. OInd. *kriyá-*, *mriyá-*, it is difficult chronologically: since *k* changing to *x* (in fact, the change of any stop to fricative) in pre-consonantal position (1) surely is Proto-Iranian (see **1.3**), this would date **kr̥y* > **kriy* > **xriy-* to Proto-Iranian. However, the corresponding Avestan forms are unambiguous and demonstrate that this scenario is unlikely: the perfect stem is *čāxr-* and the passive *kiriia-*; the latter is obviously not the full grade, but from **kr̥ya-* and does not yield ***xriya-*. Pointing in the same direction is Manichean MP (MPM) ⟨qyryh-⟩ 'be done' and inscriptional MP (MPI) ⟨kylyt, klyty⟩ 'is being done', according to Skjærvø (1997: 161) "the direct descendant" of the OP form,[24] thus militating against Schmitt's assumption of a full-grade passive in Old Persian. *čaxriyā* is then likely to contain the prevocalic variant *ča-xr-*V- which was generalised as the only perfect stem, including in the position preceding *-y-*, thus showing the same process as Avestan *čāxr-*.

Similarly, as pointed out by Gippert (2001: 15), Av. *miriia-* and MP/NP *mīr-* 'die' speak against Schmitt's assumption of a full-grade OP passive /mariya-/ replacing the expected **mr̥ya-*, and in favour of an OP form **mərya-* with consonantal *r* necessary here as well to yield *məriya-*.[25]

In fact, in view of the rigorous method otherwise applied by these authors, it is surprising that Brandenstein & Mayrhofer (1964: 33, 35), Mayrhofer (1989: 10), Hoffmann (1976: 631), Schmitt (various works), and Brust (2018: 13) are somewhat unclear on the status of **r̥*; assuming that there was "a phoneme *r̥* that was pronounced [ər]", as it were (thus explicitly Schmitt 1989: 69). However, "it is difficult to motivate the development in OP if one assumes a real *r̥*" (Gippert

24 See **2.1, 2.4** for the further development of *kərya-*.

25 NB that a scenario Proto-OP **marya-* > PMP **maira-* (by the change discussed in **2.1, 2.5**) > MP †*mēr-* > NP *mīr-* is impossible: except for the position preceding a nasal, the merger of MP *ē* and *ī* is limited to postclassical standard New Persian, while the two vowels are kept distinct in the classical literature and in dialects and varieties such as Afghan Persian (see Korn & Olsen 2012: 209–10[34]); the vocalism of *mīr-* for classical NP (and by extension for MP) is thus beyond doubt. See also **2.4** for further discussion of *mərya-*.

2001: 15), and the idea that the question of the phonemic and phonetic reality does not matter (thus explicitly, e.g., Brust (2018: 13), following others) is linguistically odd. One cannot help but feel that the approach aims at "explaining away" evidence against the preservation of **r̥* in Old Persian, and at positing a maximum of regularity for the OP verbal system (thus also Schmitt's argument for other verbal categories in his 1967 article).

Concerning the vocalism of the OP output of **r̥*, the OP orthography does not distinguish *ar* and the output of **r̥* (both are written ⟨a-r⟩ word-initially and ⟨C-r⟩ word-internally), but the Elamite rendering of **r̥* is *ir*, e.g., *ir-ta-* for OP ⟨a-r-t-⟩ *ərta-* 'justice' and *Birdiya-* (personal name) for OP ⟨b-r-d^{i}-i-ya-⟩ (cf. Mayrhofer 1973: 25). Conversely, had **r̥* given OP *ir* generally as Elamite might suggest, one would not expect both *ir* and *ur* as MP/NP outputs of **r̥* (cf. MP *burd* 'carried'). Taken together, this makes a pronunciation *ər* for the OP result of **r̥* likely[26] and establishes *ə* as a phoneme for Old Persian.[27]

While OP provides direct evidence for **r̥* yielding a vowel plus consonantal *r* (*ər*) only for **r̥* preceding *y* (**r̥y* yielding **əry* being shown by OP *əriy*), the Elamite rendering of **r̥* as *ir* shows that **r̥* > *ər* was a general process.

Change (8) **r̥* > *ər*

As for relative chronology, **r̥* > **ər* (8) needs to precede *y* > *iy*, *w* > *uw* (9) as argued above. I am grouping **r̥* > **ər* next to *y*, *w* > *iy*, *uw* (thus after **ϑy* > *šy* (3) discussed in **1.3**), assuming that they follow the same tendency of insertion of anaptyctic vowels, although there is no direct evidence for this specific relative chronology.[28]

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26 Thus also Gippert (2001: 15). Bartholomae (1925: 48) states: "The opinion I voiced earlier (…) about Proto-Indo-Iranian *r̥* being still pronounced as a sonant [i.e. vocalic **r̥*] in Proto-Iranian is wrong." He also points out (1925: 17–19) that the vowel can neither have been *a* nor *i* or *u*. He thus notes *„r* for Old Persian and (54) *ᵊr* for Proto-Iranian.

27 See also Werba (1993: 142), who postulates (for slightly different reasons) that the OP output of **r̥* was a biphonemic combination of a reduced vowel and *r*, and that the former is thus to be added to the inventory of OP vowels. He follows Hoffmann (1976) in transcribing "*ar*", but interprets it as /ər/.

28 Some authors (e.g., Werba 1993: 142) have dated **r̥* > *ər* to Proto-Iranian (see also n. 26). While the question surely needs more research, I am sceptical of such an early date, seeing that the result of **r̥* is treated differently from combinations of vowels with *r* in Sogdian: It is lost between voiceless consonants (e.g., as in **kr̥taka-* > *kte* 'done', Schwartz 2005: 165) and otherwise yields a "light syllable" (Sims-Williams 1984: 210). For an argument along similar lines, see Tremblay (2005: 680–81). See also n. 97.

1.5 The change *i*, *u* > *iy*, *uw* also needs to postdate the loss of word-final *t/d*, as shown by **čit* > *=čiy* and **nait* > *naiy* (see **1.2**). The change is usually formulated as affecting word-final *t*, but in fact this includes *-d*, because there is no voice opposition of word-final stops in PIE and Proto-Iranian, and the voice feature depends on that of the initial sound of the next word (thus, e.g., **čit/d*).[29]

It may safely be assumed that the loss of other word-final consonants is part of the same change, so that the only consonants permitted in word-final position are *y*, *w*, *m*, *r*, and *š* (Brandenstein & Mayrhofer 1964: 45). This produces the coalescence of many verbal and nominal endings in *-a* (< Ir. **-ah*, *-an*(*h*), *-a*(*n*)*t/d*, *-ats*).[30]

Change (7) *t/d*, *ts*, *n*(*h*), *nd/t*, *h* > OP ∅ /_#

As pointed out by Hoffmann (1976: 633–34), this *-a* does not coalesce with inherited word-final **-a* because the latter was lengthened at a previous stage. That this lengthening was likewise a real (not only graphic) phenomenon is shown by the consistent spellings as well as by the absence of the lengthening if a clitic follows (e.g. *manā* I.GEN/DAT vs. *mana=čā* with *=čā* 'and'). The change is shared by Proto-Middle Persian, as shown by some MPM fossilised phrases where *-ā* became phrase-internal later on and thus treated as one word with the following item, cf. MPM ⟨ps'c⟩ *pasāz* (cf. OP *pasā* 'afterwards') with the MP clitic *=*(*i*)*z* 'also' (see **1.6**), MPM ⟨gw'm⟩ < **gaubā=mai* 'tell me!' and several such instances in the Psalter (Sims-Williams 1981a: 174).

Change (6) *a* > OP *ā* /_#

1.6 As likewise noted by Sims-Williams (1981a: 175), Manichean Middle Persian shows another peculiarity which is relevant here. The words *kas* 'someone' and *tis* 'something', which are usually derived from **kas=čid* and **čis=čid*, are written with a final ⟨w⟩ when the clitic *=*(*i*)*z* 'also' is attached, thus ⟨qswc⟩ *kasuz* and ⟨tyswc⟩ *tisuz*.[31] Now, *kasčid* and **čisčid* would hardly yield *kasu, čisu*. More probably, the inherited **čid*, showing the pronominal NOM/ACC neuter ending *-d*, was adjusted to **čim* (a process that also yields Av. *čim*), i.e., took the much more frequent nominal NOM/ACC ending. The *-m* then caused a labialisation of

29 Cf. Fortson (2010: 70) for the PIE sandhi and EWAia (I: 542) for the OInd. form.

30 Cf. Brandenstein & Mayrhofer (1964: 45–46). Kent (1953: 32, 39) assumes the loss is only graphic (except for *d/t* following *i*).

31 Needless to say, MP *kas* and *tis* may also be combined with the freely available clitic *=iz*, thus *tis=iz* noted by Durkin-Meisterernst (2004: 333).

the vowel: **čum*, and the nasal was later lost, yielding **ču* (as it did in Sogdian *cu* and Khotanese *ju*), thus PMP **kasčim* > **kasu* and **čisčim* > **čisu*.

Conversely, Classical Old Persian shows *=čiy*, which can only be from **čid*, not from **čim*, because *-m* is not among the word-final consonants which were lost (cf. (7)). The substitution **čid* → **čim* is another dialectal contrast between Classical Old Persian and Proto-Middle Persian.

If one assumes that the OP loss of word-final *t/d* etc. in (7) also operated in Proto-Middle Persian, the substitution of **čim* for **čid* needs to precede this change: the element **=či(y)* probably no longer functioned as an independent element and was not perceived as a pronominal NOM/ACC anymore; it thus was not a candidate for being replaced by **čim*.

Change (4)		**=čid*	→ **=čim*	(operates in PMP, but not in OP)	
i.e.:	PMP:	**kas=čid*	→ **kas=čim*	> **kasim*	→ **kasu*
	OP:	**kas=čid*	> *kas=čiy*		

The substitution **čid* → **čim* probably also precedes the change **sč* > *s* (seen, e.g., in **pas-ča* > OP *pasā*, MP/NP *pas* 'after'):[32] Had the latter change happened first, **kas=čid* and **čis=čid* would have yielded †*kasid* and †*čisid*, arguably morphologically obscure and unlikely to be replaced by †*kasim*, †*čisim*. This yields a relative chronology **kas/čis=čid* → **kas/čis=čim* > **kasim*, **čisim* > **kasu*, **čisu*.

I do not see particular evidence for a relative chronology of this change and of the loss of word-final *t/d*, *n*, *h* and the changes in **1.3-1.4**. Perhaps both could be part of a tendency favouring open syllables that could be seen in **1.2**, so as a preliminary hypothesis, I place *sč* > *s* near *y*, *w* > *iy*, *uw* (9), but leave **r̥* > *ər* (8) and the loss of word-final consonants next to *y* > *iy*, *w* > *uw* as possibly even more closely related phenomena.

Change (5) Ir. *sč* > OP *s*

***Some changes following OP* y > iy, w > uw**

Conversely to the cases just discussed, the OP change of postconsonantal *y*, *w* to *iy*, *uw* is presupposed by some other changes.

1.7 As pointed out by Hoffmann (1976: 637), instances of the contraction *iya* > *ī* occurring within Old Persian show that both the inherited sequence *iya* as well

32 The change **sč* > *s* is not seen in the OP compounds containing **=čid*, which have the "Median" form with *šč* (e.g., *kaščiy* "someone"); see Korn (2013: 83) for further discussion.

as *iya* arising from C*y* undergo this change (see **1.1**). One obvious effect is that the frequent suffix combinations **-iya-ka-* and **-ya-ka-* both yield *-īka-*. Indeed, a contraction *iya* > *ī* is widespread in Iranian, and **-iya-ka-* yields *-īk/g* in much of Middle and New Iranian, which makes it likely that the change is rather old.[33] In the Arm. Bible, *-ik* occurs in "adjectives of appurtenance, mostly of Iranian origin" and reflects both Ir. **-(i)yaka-* and **-ika-* according to Olsen (1999: 454–55); obviously the suffix was borrowed into Armenian before the change of postvocalic Ir. *p, t, k* (for which see **2.7**).—As I will argue in **2.1**, however, the merger of **-iya-ka-* and **-ya-ka-* is a specifically Old Persian phenomenon, and **-ya-ka-* does not necessarily yield *-īg* in Middle Persian.

Quite probably there was a parallel change **uwa* > *ū* (Schmitt 1990: 18–20). This appears likely a priori, and is also suggested by some Elamite evidence: It seems that a certain OP place name is rendered both by *Si-qa-hu-ut-ti-iš* /Θikayūtiš/ and *Ši-ik-ki-ú-ma-ti-iš* reflecting Ir. /Sikayuwatiš/ (also showing the dialectal difference OP *ϑ* vs. other Ir. *s*).[34] There are also some rather convincing MP examples: *xūb* 'good' may be derived from **hu-Hapah-* (via **huwapah-*, cf. Av. *huuapah-*)[35] and *d*(*u*)*rūd* 'health' reflects Ir. **druwat-* (cf. Arm. *druat-ik'* 'praise').[36]

However, there are also cases of *uwa* yielding MP *ō* rather than *ū*, e.g., *padrōd* 'farewell'.[36] The change *uwa* > MP *ō* could be comparatively late, which would mean that some cases of *uwa* escaped the change to *ū*. The contrast of *d*(*u*)*rūd* vs. *padrōd*, both containing a cognate of Av. *druuatāt-* 'health', makes it unlikely that the phonetic context plays a role. It is likewise unclear whether the accent might play a role. One might assume that *úwa* could have yielded *ū* while *uwá* (and/or unstressed *uwa*) changed to *ō* only later,[37] but this assumption is rendered difficult by the accent of OInd. *s_uv-ápas-* (EWAia I: 84) vs. NP *xūb*. While

33 Rastorgueva & Molčanova (1981: 53, 69), Durkin-Meisterernst (2014: 160). A similar change is seen in Bactrian (-ιγο, Sims-Williams 2007: 217) and Sogdian (*-yk* /-īk/, Gershevitch 1954: 31 § 202, 148 § 977).

34 Schmitt (1990: 18–20). For Elamite *uma* rendering OP *uwa* see **1.1**.

35 A derivation from **hu-Hpah-* seems less likely because of the Av. and OInd. forms, both pointing to Proto-Indo-Ir. **s_uw-ápas-*. Also, Ir. compounds with *hu-* are productive and transparent in Old Iranian (hence one expects the independent form of the word as second member). As pointed out by de Vaan (2003: 565–68, 575), *hu-* is even frequently restored in front of vowels in Avestan rather than changed to *x^v-* as would be regular for inherited **hw*V-.

36 Hübschmann (1895: 169) has *drōd* (thus also read in other sources) and *padrūd*, but the rhymes speak in favour of the reverse distribution of vowels in the Shāhnāma (Horn 1899: 182–84) and also elsewhere (Chams Bernard, p.c.).

37 This is what I thought at some point (noted in Bernard 2019: 48).

the details of these changes are not quite clear at present, the development of *uwa* does not seem to be entirely parallel to that of OP *iya*.

Change (11)	*iya*	>	*ī*		(only for cases of inherited *iya* in MP)
	uwa	>	*ū*	?	(conditions of change unclear)

1.8 Another change that needs to be later than C*y/w* > C*iy* / C*uw* is the OP loss of *h* preceding *u*, e.g., *ukāra-* ⟨u-k-a-r-⟩ 'having good people' < **hu-kara-*, *Aura-* ⟨a-u-r-⟩ < **ahura-* (god's name). Since *hu* > *u* includes *huw* that comes from **hw* (e.g., *uwaspa-* ⟨u-v-s-p-⟩ 'having good horses' < **hw-aspa-*, *Harauwati-* ⟨h-r-u-v-t-i-⟩ 'Arachosia' < **harahwati-*), it needs to postdate (9) *y* > *iy*, *w* > *uw* (Hoffmann 1976: 641–42).

That this is a real change in Classical Old Persian again (not only graphical) is shown by the consistent absence of *h* preceding *u*. Also, Elamite renderings mostly have *u* in OP words with **hu*, and this in spite of the fact that there is an Elamite sign *hu* available. This sign is of course used in Elamite words containing *hu*, and also in OP words containing *həyu*, which is changed to *yhu* in Elamite (thus Elamite *da-ay-hu-na-um* renders OP *dahəyūnām*). The fact that this sign is normally not used for cases of Ir. **hu* confirms the change **hu* > OP *u* (Hoffmann 1976: 639–42).

However, some Elamite words do show preserved Ir. **hu*, providing evidence for the existence of a dialect that preserved *hu* (Hoffmann 1976: 639, see also **2.1**, **2.2**). This dialect would agree with Middle Persian, where **h* preceding *u* and *w* was not lost, but yields *hu-/xu-* and *xw-*.[38]

It is generally assumed that the loss of *h* in other contexts is part of the same process. Hoffmann (1976: 639[33]) thus suggests that *hm* > *m* is regular for Old Persian, which means that *ahmiy* ⟨a-h-m^{i}-i-y⟩ 'I am' in XPl (several attestations) beside more common *amiy* ⟨a-m^{i}-i-y⟩ differs from Classical Old Persian just as regular *hu* > *u* vs. dialectal *hu* reflected in Elamite. Brandenstein & Mayrhofer (1964: 42–43) treat the OP loss of *h* preceding *r* (*rautah-*, NOM/ACC.SG ⟨r-u-t⟩ 'river' < Ir. **hrautah-*) as part of the same change, but whether this is really so is not quite clear.[39]

Synchronically, *y* following *h* is an exception to (9) in that it shows no trace of an *i*, i.e., **hy* does not appear to yield OP *hiy*. Werba (1993: 142), following

38 That Middle and New Persian differ from "the dialect of the [OP] cuneiform inscriptions" in the treatment of **hwa-* was already seen by Hübschmann (1895: 218).

39 Hoffmann (1976: 639[33]) appears to regard loss of *h* other than that preceding *u* and *m* as sporadic and due to OP *h* being "weakly articulated" in general. The loss of word-final *h* is part of the change (7) discussed in **1.5**.

TABLE 5 Development of word-initial **hu/w* in Old and Middle Persian

	Old Persian <	**Proto-Iranian**	> **Middle Persian**	
uw-aspa- 'with good horses'	*uw-* < **huw-* <	*hw*-V 'having a good …'	> *xw-*	
uwa- 'self'		*hwa-* 'self'		*xwad* 'self'
		hwar- 'swallow'		*xwar-* 'eat, drink'
u-kāra- 'with good people'	*u-* < **hu-* <	*hu*-C 'having a good …'	> *h/xu-*	*xunak* 'happy', *hušnūd* 'pleased'
		huška- 'dry'		*xušk* 'dry'

and summarising Hoffmann (1976: 642–43), suggests that *y* after *h* did yield *i̯y* together with all other instances of postconsonantal *y* and that **hi̯y* (including the output of word-final *-hi*) then changed to *həy* (i.e., OP ⟨h-y⟩ is to be read /həy/).[40] Sporadic cases of ⟨h-i-y⟩ *hi̯y* for ⟨h-y⟩ *həy* in Xerxes' inscriptions support the reality of a vowel in the OP result of **hy* (Hoffmann 1976: 643) and may reflect a memory of *hi̯y* being the older form. It seems possible to me that OP *h* at least in *hə* was pronounced in a specific way (e.g., like the German "ich"-fricative, IPA [ç]),[41] and that Elamite ⟨yh⟩ mentioned above might be an attempt to render this sound.

In view of proto-MP not sharing the OP loss of *h* preceding *u*, one might expect that it does not share the loss of *h* preceding consonants either. However, whether this is indeed so does not seem quite clear to me. It also seems possible that the loss of *h* preceding *m* is not on the same level as that of *hu* > *u*: cases of preserved *hm* are found in the OP corpus itself, while preserved *hu* is not found in the OP corpus and is reflected only in Elamite. For the time being, I prefer to separate the case of *hu*, for which the developments to OP *u* and to MP *xu* are equally well established, from other OP losses of *h*.[42]

Change (10) $h > \varnothing$ /_*u*, *m* (does not operate in PMP)

40 The OP spelling of the name of Anāhitā as ⟨a-n-h-t⟩ in A^{2}Sa (several copies) and A^{2}Ha (beside ⟨a-n-h-i-t⟩ in A^{2}Sd) might point in the same direction (see also **3.4**).

41 Thomas Jügel (p.c.). Note that Avestan *x́ii* likewise indicates a specific pronunciation of the result of **h*(*i*)*y*.

42 For the NP loss of *h* in word-initial *ha-*, see Hübschmann (1895: 215).

2 Proto-Middle Persian

Evidence against the* OP *change* y > iy, w > uw *in Middle Persian

As pointed out by Hoffmann and Risch (see **1.1**), it is a mistake to think that a change of postconsonantal *y*, *w* to OP *i̯y*, *uw* would be disfavoured by the MP developments presupposing *šy* and *dw*: *i̯y*, *uw* could have reverted to *y*, *w* in the same way as it demonstrably was in other languages.

Still, a process *y* > *i̯y*, *w* > *uw* being possible a priori is obviously no proof that it did take place in the dialect(s) on which MP is based. Indeed, I argue that there is evidence against C*y/w* > C*i̯y* / C*uw* having operated in Proto-Middle Persian, and that this difference to Classical Old Persian is to be added to the dialectal differences already established.

2.1 First, some OP input forms showing postconsonantal *i̯y, uw* would yield wrong results.

a. One of these is **maryaka-* > OP **mariyaka-* (see **1.2**) > *marīka-* (see **1.1**). From this form, one would expect MP †*marīg*, just as the common suffix combination **-i̯ya-ka-* yields the MP adjective suffix *-īg* (see **1.7**). However, the attested form is MPZ ⟨mylk'⟩ *mērag* 'young man' (cf. Bakhtiari *meyre* 'husband', Anonby & Asadi 2014: 168). This suggests **maryaka-* > **mairak-* without an intervening form containing *i̯ya*.[43]

The change seen in *mērag*, viz., **ary* > MP *ēr*,[44] is best known from **aryānām* > **airān-* > *Ērān* 'Iran' (MPM ⟨'yr'n⟩, MPZ ⟨'yl'n'⟩, MPI ⟨'yr'n⟩), crucially not via the OP form *ariyānām*, from which one would expect †*Aryān* or †*Arīn*.[45] Other instances of **ary* likewise seem to be best explained under the assumption that there was no sequence *i̯y* in their prehistory, e.g. MPM ⟨pyrwz⟩, MPZ ⟨pyrwc⟩ *pērōz* 'victorious' from **pari-au̯ah-* via **paryau̯ah-* (Bartholomae 1904: 862)[46] > **pairau̯ah*, while OP **pariyau̯ah* would perhaps have given †*paryūz*.[47]

As I will argue in **2.4**, the output of Ir. **r̥y* > **əry* (as established in **1.4**) shows a development parallel to that of **ary* > **air* and yields **əir* > *īr*.

43 Note that the problems with the attestation of OP *marīka-* (see **1.1**) are immaterial to this argument: even if neither OP **mariyaka-* nor *marīka-* were attested, this would not remove the problem that Proto-Indo-Ir. **maryaká-* should yield OP **mariyaka-* > **marīka-* > MP †*marīg*.

44 For this change, see Hübschmann (1895: 131).

45 See **2.6**–**2.7** for further discussion of this word.

46 Cf. Av. *paⁱriiaoi̯as-tara-*.

47 See Hübschmann (1895: 131) for further examples.

TABLE 6 Word-initial **duw* and **huw* in Old and Middle Persian

6.a Development with OP as input

	Input	>	Old Persian	>	Outcome
dw-	**dwara-* 'door'		*duwara-*		†*dūr* / *dōr*
hw-	**hwat-* 'self'		**huwat-* (> *uwa-*)		†*xūd*

6.b Development with Proto-Iranian as input

Old Persian	<	Iranian	>	Middle Persian
duwara-		**dwara-*		*dar* 'door'
uwa- < **huwat-*		**hwat-*		*xwad* 'self'

Change (14) **ary* > **air* > *ēr* (MP, not operating in OP)
**əry* **əir* *īr*

b. Similar to OP **mariyaka-* > *marīka-*, OP *məriya-* 'die' and *kəriya-* 'is done' cannot have been the input forms for Middle Persian as they would have yielded †*mirī-*, †*kirī-*, crucially with a short *i* in the first syllable, which is at variance with NP *mīr-* (see also **2.4** and **Table 8** below). Middle Persian thus treats **iya* and **ya* differently while both yield *iya* in Old Persian.

c. There are parallel cases with postconsonantal *w* (> OP *uw*): Input forms such as OP *duwara-* 'door' and **huwat-* 'self'[48] would yield †*dūr* / *dōr* (see **1.7**) and †*xūd* (cf. the parallel case of **huwapah-* > MP *xūb* 'good'), respectively, whereas the existing forms are *dar* and *xwad*.

2.2 Having seen that the OP forms with *iy, uw* cannot be the input for Middle Persian, the alternative would be to follow Hoffmann and Risch and assume a syncope to revert *šiy*, *duw*, etc. to *šy*, *dw*, etc. to yield MP *šād* 'joy', *dar* 'door' from Ir. **šyāta-*, **dwara-*, etc. (see **1.1** and **2.3**). However, this would likewise produce wrong results in some cases.

For instance, a syncope of C*uw* would yield Ir. **hu-Hapah* > OP **huwapah* > **hwapa-* > MP †*xwab* (cf. **hwat-* 'self' > MP *xwad*) instead of the attested

48 This form would be from an OP dialect that conserved word-initial *hu-* (see **1.8**).

TABLE 7 Word-initial **dw* and **hw* in Old and Middle Persian

7.a Development with OP as input

	Input	>	**Old Persian**	**Syncope**	>	**Outcome**
duw-	**duwā*		**duwā*	**dwā*		†*dā*
huw-	**hu-Hapah-* ‘good’		**huwapah-* (> **uwapah-*)	**hwapah*		†*xwab*

7.b Development with Proto-Iranian as input

Old Persian	<	**Iranian**	>	**Middle Persian**
**duwā*		**duwā*		*dō* ‘two’
**uwapah-* < **huwapah-*		**hu-Hapah-*		*xūb* ‘good’

xūb ‘good’ (cf. **1.8**). Similarly, Ir. **duwā* ‘two’ would yield **dwā*, which, with the change *dw* > *d*, would give †*dā* rather than the attested MP *dō*.

The syncope assumed by Hoffmann and Risch can thus not have taken place. As shown in **2.1**, the OP unsyncopated forms do not work either as inputs for Middle Persian.

This can only mean that the contrast between Ir. word-initial C*i̯*y / C*u̯*w vs. C*y/w* was preserved in Proto-Middle Persian, whereas the distinction was lost in Old Persian. In view of all this, the conclusion seems unavoidable that Proto-Middle Persian goes back to a dialect that, differently from attested Old Persian, did not show C*y/w* > C*i̯*y / C*u̯*w.

2.3 The change of word-initial *dw-* to *d-* mentioned in **1.1** and **2.1**–**2.2** and seen in examples such as *dar* ‘door’[49] has generally been discussed together with the cluster simplification of *šy* to *š*, which suggests that the two changes are contemporary. It is not clear to me whether this really is so, since **dw-* > *d-* is specifically Persian (in Parthian, the result of **dw-* is *b-*) while **šy* > *š* also happened in other Ir. languages such as Parthian and Balochi and **šy* yields *ś* in Young Avestan. On the other hand, **šy* > *š* is surely natural

49 For this change, see Hübschmann (1895: 116², 166).

enough (a palatal pronunciation of *š* "absorbing" a following *y*, as it were) for it to occur in several languages independently.

There is evidence of **šy* to *š* happening in late Old Persian times, since A^{3}Pa shows ⟨š-a-y-t-a-m⟩ (apparent *šāyatām*) for expected (and attested) ⟨š-i-y-a-t-i-m⟩ *šiyātim* 'joy', which appears to imply a pronunciation *š-* rather than *šiy-*. Given that ⟨š-a-y-t-a-m⟩ also shows the effects of vowel-neutralisation in word-final syllables (see **3.4**), I tentatively place the change *šy* > *š* next to these processes. Elamite and Greek forms likewise reflect *šāt-* (Schmitt 1999: 96–98). On the other hand, Armenian *dahlič* 'chamber' (NP *dihlīz*, MPM ⟨dhryz⟩[50] vs. OP *duwarϑi-* 'hall, portico') shows that **dw-* > *d-* precedes the change of postvocalic *č* to *z* (26) discussed in **2.7** and seen in examples such as MP *rōz* 'day' (OP *raučah-*) and *=čim* > *=(i)z* 'also' (see **1.6**).

Change (19)	*šy*	>	*š*
	dw-	>	*d-*

The Middle Persian Epenthesis

2.4 Hübschmann (1895: 131) treats MP/NP *īr* resulting from Ir. **r̥y* as part of the same process that yields MP *ēr* resulting from Ir. **ary* (calling it, as does Henning 1934: 205, "Epenthesis").[51] This suggestion seems attractive to me, and its reformulation in the present framework (aimed as it is at a detailed account) would be Ir. **r̥y* > **əry* > **əir* > *īr* ((14) and (15)) parallel to **ary* > *air* > *ēr* (see **2.1**),[52] rather than a development of **r̥y* > *iry* > *īr* as suggested by Hübschmann (1895: 131, 145–46; see also **3.3**).[53]

Differently from the argument just made, Skjærvø (1997: 161, followed by Durkin-Meisterernst 2014: 229) suggests *kirīh-* for the MPM passive ⟨qyryh-⟩ 'is done' (apparently for reasons of the MPI variants). However, New Persian forms deriving from **r̥y* unambiguously show *īr*, not only in *mīr-* mentioned in **1.4**,

50 See Korn (2009: 205) for discussion of the MP word.

51 Note, however, that they include under Epenthesis also forms that in my view rather show Umlaut, see **2.5**, **3.1**. I use Epenthesis and Umlaut with initial capitals to refer to the MP sound changes under discussion here, differentiating them from similar processes in other languages whose conditions may be different.

52 Cf. Bartholomae (1925: 36[2]), who notes "*ˌrī*" changing to *īr*.

53 The Avestan forms that Hübschmann cites at various points, showing "*airii*" or "*irii*", should not be held to imply that we are looking at the same phenomenon; these orthographies probably indicate a palatal pronunciation of the consonant (Martínez & de Vaan 2004: 17–18), parallel to, e.g., the orthography of Irish, and might even be only a feature of the transmission of the Avestan text, whereas the PMP change **ary* > **air* is a phonological process, leading as it does to a long vowel *ēr*.

but also in NP *guzīr-*, MPZ *wizīr-* 'avoid' (**wi-tr̥-ya-*, the full grade is seen in NP *guzar-* 'pass by' < **wi-tara-*), cf. also MPM *parzīr-* 'keep away' (< **para-čr̥-ya-*), *wistīr-* 'spread (itr.), be successful' (full grade in NP *gustardan* 'spread (tr.)').[54] On the strength of the NP evidence, Henning (1934: 205–06) follows Hübschmann (1893: 131) in reading MPI ⟨kylyt, klyty⟩ *kīr-ēδ*, and explains MPM ⟨qyryh-⟩ *kīrīh-* as showing the passive suffix *-īh-* secondarily added to the (already passive) stem *kīr-* (205, 210, 212).[55] For reasons of the NP data, the readings advocated by Hübschmann and Henning seem compelling to me both in the sense of **r̥ya* yielding NP *īr* and in the sense that, had the MP output been *irī* as suggested by Skjærvø for MPM ⟨qyryh-⟩, the same process should have given †*mirī-* 'die', etc., instead of the forms just cited.

As in the case of a possible change *uwa* > *ū* parallel to OP *iya* > *ī*, one might wonder whether there was an epenthesis **arw* > **aur* > *ōr* parallel to **ary* > **air* > *ēr*, but Bartholomae (1925: 5) points out that potential examples are rare, and some of them might be loanwords from other Ir. languages or from Avestan, and that no Epenthesis takes place in MP *harw* (see **1.1** and n. 59).

2.5 Conversely, I think that Hübschmann (1895: 131) is wrong in assuming that there was a parallel Epenthesis of Ir. **any* producing MP *ēn*. His (only) examples are MP *mēnōg* 'spirit' (MPM ⟨mynwg⟩, MPZ ⟨mynwk̲⟩, cf. Av. *maⁱniiu-*, OInd. *manyú-*),[56] which seems to imply **manyawaka-* > **mainawak-*,[57] and MP "*mēn-*" (MPZ ⟨myn-⟩, MPM ⟨m(y)n-⟩) 'think' (OInd. *mán-ya-*). He is followed by Henning (1934: 205–06), who adds "*framēn-*" (MPM ⟨f/prmyn-⟩) 'rejoice' and (Pth.) "*viyēn-*" (< **wi-kan-ya-*).[58]

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54 Examples from Henning (1934: 206).

55 The suffix must have originated in verbs whose root ends in a consonant other than *-r*. The origin of the *-h* is not clear to me; perhaps it originated as a hiatus-avoiding consonant in the past stem, which is *-īh-ist* for all the attested MPM passives (see Henning 1934: 221). The explanation of *-īh-* by Skjærvø (1997: 177–79) seems unlikely to me. He suggests that *-īh-* was abstracted from roots in *-h* (from **ϑ* and dialectal **ϑ* < **d*), e.g. **siϑ-ya-* > **sid-ya-* > *abē-sīh-* 'cut off (passive)'. However, I find it difficult to imagine that a form such as **sīh-* would have been reanalysed as **s-īh-*, for which there is no model. It also seems important to me that, as noted by Henning (1934: 210, 222), Pazend *-ih-* and Early Judeo-Persian *-əh-* rather suggest a short vowel for this suffix.

The passive suffix ⟨-yd⟩ in the Psalter is likely to be a hyperarchaic orthography (Henning 134: 211), probably standing for *-īy-* as suggested by Skjærvø (1997: 177–78), potentially confirming that *-y-, -h-* are hiatus-deleting consonants.

56 Cf. EWAia (II: 313–14) for the etymology and cognates.

57 Note that if inherited, MP *mēnōg* would be another counterexample to the OP change (9) *y, w* > *iy, uw* /C_ operating in Proto-Middle Persian: **manyawaka-* should yield OP **maniyawaka-* and result in MP †*manīwag* (cf. *marīka-* in **2.1**).

58 Henning (1934: 172) derives MP "*man-*", i.e., the variants written without ⟨y⟩, from a stem

However, there is solid counter-evidence of several types. First, the MPM spelling of Henning's "*mēn-*" and derivatives is ⟨mn-⟩ beside ⟨myn-⟩ and Pth. "*viγēn-*" is spelt ⟨wyg(y)n-⟩, both rather indicating a short vowel, and the same applies to MPZ/MPM ⟨dwšm(y)n⟩ 'enemy' (Ir. **duš-man-yu-*). Also, Ir. **anya-* 'other' yields *any* (MPM ⟨ʾn(y)⟩, MPZ ⟨zkʾy⟩),[59] not †⟨ʾyn⟩ †*ēn*,[60] contrasting with MPI ⟨ʾyrʾn⟩, MPM ⟨ʿyrʾn⟩ *Ērān* 'Iran' with *ēr* from **ary*.

In the light of this evidence, it seems preferable to regard MP *mēnōg/y* as an Avestan loanword, which is particularly likely for a Zoroastrian concept.[61] The other items are better explained as containing a (short) *-e-* arising from the Middle Persian "Umlaut" discussed in **3.1** as suggested by MacKenzie (1986). Crucially, Ir. **any* > MP *en* yields *an*, e.g. in NP *dušman* 'enemy' (not †*dušmēn*), without any epenthesis and monophthongisation that would give a long vowel.

2.6 As cautiously suggested by Hübschmann (1895: 131, 146), PMP **r̥rwy* does seem to be treated in the same way as **r̥y*, both giving MP *īr*. Examples for the former include *pīr* 'old' (Ir. **pr̥wya-*[62] > **pərwya-* > **pərya-*) as well as *gīr-* 'seize' and MP *padīr-*, NP *pazīr-* 'accept' from **(pati-)gr̥bya-*; for the latter there is *mīr-* 'die' (see **1.4**) and the examples discussed in **2.4**. Whether or not one should assume that the PMP forms of *gīr-* and *padīr-* contained Old Ir. **b* (thus **gr̥b-ya-*)[63] or rather a lenited sound as in Av. *gəᵘruuaiia-* is not clear to me. In the former case, Ir. **b* > PMP **β* could have coalesced with Ir. **w* at least in this context.[64]

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without **-ya-*, but the Ir. data rather point to a present stem **man-ya-* with the possible exception of some Avestan forms (see Cheung 2007: 262–63).

59 Hoffmann (1976: 637[26], following Bartholomae 1906: 62–63, 113) takes this as another argument in favour of the OP change of postconsonantal **y, w* to *iy, uw* as being real, stating that the MP cognates of OP *aniya-* 'other' and *haruwa-* 'every' (see Table 1), MPM ⟨hrw⟩, MPZ ⟨hl⟩, "are hardly likely to have been pronounced *anį* and *harų*, but *anǐ* (…) and *harŭ*." He goes on to explain the difference in the development of *-iya-* in "*anǐ, harŭ*" vs. that of **martya-* > MP ⟨m(y)rd⟩ (not †⟨mrdy⟩ *mardǐ*) as being due to the light syllable of the former (see also n. 91 for this word). However, this approach has not been upheld in recent scholarship; MacKenzie 1986 reads *har(w)* for MPZ, Durkin-Meisterernst 2004 *harw* for MPM (NP *har*), both read *any*. NP *nīz* 'also' can also be derived from the combination of MP *any* and the clitic *=(i)z* mentioned in **1.6**. Hübschmann (1895: 104) suggests a derivation from **anid=čid* (OP **aniščiy*), thus likewise assuming the presence of the same element that gives MP *=(i)z*.

60 This problem was already seen by Bartholomae (1906: 62–63[3]), who adduces unlikely analogies to account for the form, which he reads *anī*.

61 Thus also the suggestion by Skjærvø (2002: 30[7]).

62 There seems to be no trace of the laryngeal seen in Av. *paoⁱriia-*, OP *paruwiya-(ta)* and OInd. *pūrvyá-*, all from **pr̥Hwya-* (cf. Fischer 1998).

63 Old Persian has a different present stem for this verb, viz. *gərbāya-* (corresponding to OInd. *gr̥bʰāyá-*).

64 For PMP **β, δ, γ* as results of Ir. postvocalic **b, d, g*, see **2.8**.

It is possible that **d* is lost in the same context as well, as suggested by Bartholomae (1925: 35–37). A possible example is MPM ⟨syr-⟩ 'to become angry (?)' if it is to be read *sīr-* and if it derives from **sṛd-ya-* as suggested by Henning (1934: 205, following Bartholomae 1925: 36–37, who compares Av. *sarədanā-* 'contempt'). However, an alternative derivation is likewise possible, viz., a reading *sēr-* and an interpretation as a denominative of *sēr* 'full, content',[65] thus 'be full' > 'be fed up, have enough of …'.[66] Henning's (1932: 5$0^3$) argument against this explanation is in my view not compelling. He states that since the MP Psalter has ⟨sgl⟩ for 'full' (cf. MPZ ⟨sgl⟩), this word must go back to **sagr-* (Bartholomae 1925: 14, 35),[67] which should yield MPM †⟨sgr-⟩ (vs. attested ⟨syrq⟩ *sēr-ag*). However, what one in fact expects is a variation of MPM ⟨yr⟩ / ⟨gr⟩ as seen in other instances of MP *ēr* < **agr* (see **2.8**), and since there is only one attestation each of the verbal noun ⟨syr-yšn⟩, the finite verb ⟨syr-yd⟩, and ⟨syrq⟩, the variant ⟨sgr-⟩ might be unattested by coincidence.

Bartholomae (1925: 14, 35–37) posits a general (early) loss of **b*, *d*, *g*[68] > *β*, *δ*, *γ* preceding *y*.[69] While some of his examples are in my view not instances of *β*, *δ*, *γ* plus *y* (see **2.8**), it seems plausible to me (and perhaps even a priori likely) that at least complex clusters such as *rδy* were reduced in the same way as **rwy* (and **rβy*?). For the present purposes, my tentative formulation is:

Change (13) *rwy* (and *rβy*, *rδy*, *rγy*?) > *ry*

As noted by Bartholomae (1925: 3$6^2$), this change feeds into Epenthesis (14) (**2.1**, **2.4**), i.e., *ry* from the clusters just mentioned is treated in the same way as inherited **ry* > *ir*. Indeed, a loss of *w* appears most likely at a time when there was a consonant cluster such as **ərwy* that emerged from **ṛwy* in (8) (**1.4**), i.e., **rwy* > *ry* postdates **ṛ* > *ər*; perhaps it also postdates (as Bartholomae assumes) the change **b*, *d*, *g* > *β*, *δ*, *γ*.

65 This suggestion appears to go back to Salemann (Henning 1932: 215) and seems to underly the reading *sēr-* in Durkin-Meisterernst (2004: 312), following Colditz (2000: 18$3^{83}$), who follows Boyce (1977: 83).

66 I am grateful to Iris Colditz for discussion of this word.

67 This means that the etymology of Hübschmann (1895: 78, 131, following Müller 1893: 376)—deriving *sēr* from **sarya-* and comparing Greek κόρος 'satiety'—is impossible.

68 As he points out (Bartholomae 1925: 1$4^4$), any case of **g* preceding *y* has to be secondary (analogical), since inherited cases of **g*$^{(u)(h)}$ followed by a palatal vowel, etc. yield **ǰ* already in Proto-Indo-Iranian.

69 One of his arguments is that (contrary to the argument made by Hübschmann 1895: 200), a group *δy* cannot feed into the general change **d* > ** δ* > MP *y* since this would yield **maδyāna-* > **mayyāna-* > †*mēyān* instead of NP *miyān* 'middle'.

TABLE 8 Development of **ary*, **əry* and **ərwy* in Persian, Balochi and Parthian

Old Persian	<	Input form	>	Parthian		Balochi		Middle Persian	
arịy		**ary* (*aryānām*)		*ary*	(*aryān*)	?		*air* > *ēr*	(*Ērān*)
ərịy		**əry* (**mərya-*)		*ir*	(*mir-*)	*ir*	(*mir-*)	*əir* > *īr*	(*mīr-*)
**əruwịy*		**ərwy* (**gərwya-*)		*irw*	(*girw-*)		(*gir-*)		(*gīr-*)

It is noteworthy that the loss of (**b* > *β* >) *w* does not happen in Parthian (cf. ⟨gyrw-⟩ 'seize', ⟨pdgyrw-⟩ 'accept'). The change **ary* > *ēr* did not happen in Parthian either: Sasanian inscriptions (3rd c. AD) have ⟨'ry'n⟩ in the Pth. version corresponding to ⟨'yr'n⟩ in the MP one. This is echoed by Armenian, which shows the Pth. forms *Arikʿ* (*ew Anarikʿ*) beside the MP forms *Eran* (*ew Aneran*) 'Aryans (and non-Aryans)' (Schmitt 1986: 447).

These facts suggest that Parthian does not share the Epenthesis of **ary* > **air*, and that, by extension, **əry* does not change to **əir* either. We therefore do not expect a long vowel in Pth. ⟨myr-⟩, ⟨(pd)gyrw-⟩. The Pth. output of (**r̥y*, **r̥rwy* >) **əry*, *ərwy* could thus be read *ir*, *irw*.[70] This in turn might mean that Balochi, which shows short vowels in these words (*mir-*, *gir-*), might not have experienced Epenthesis either, in which case any instance of *ēr* from **ary* would be a Persian loanword.

The OP monophthongisation

2.7 It seems obvious that the result of (14) *ary* > *air* (see **2.1**) feeds into the well-known and amply evidenced monophthongisation of *ai* to MP *ē*, i.e., that *ai* in Ir. **air* from **ary* changes to *ē* at the same time as old *ai*. It is highly likely and has generally been assumed that the parallel monophthongisation of **au* to *ō* (as, e.g., in MP *pērōz* mentioned in **2.1**) is part of the same change.[71] As mentioned in **2.4**, I suggest that **əi* > *ī* is part of the monophthongisation of *ai* and *au*.

The OP inscriptions indicate that the monophthongisation occurred within Old Persian, and that it included **aya* and **awa* (as is probable in any case). One relevant example is ⟨p-r-d-y-d-a-m⟩ 'palace' (A^{2}Sd) for what would be **paridaidam* *⟨p-r-i-d-i-d-m⟩ in Classical Old Persian. By a hypercorrect application of the following logic: "Where we say *ē*, the older, i.e., better / more official forms have *aya*"—generalised from the (correct) observation that older forms with

70 Thus the suggestion in Korn & Durkin-Meisterernst (2009: 12) for reasons of the Balochi evidence.

71 For *ai*, *au* > MP *ē*, *ō* see Hübschmann (1895: 141–42).

aya and *ai* were pronounced with *ē* at the time of writing—, the scribe (and/or the author) "restored" an apparent *par*(*a*)*dayadām* from the contemporary pronunciation *pardēd-*.[72]

It is entirely possible, but not a necessary assumption for the purposes of this paper, that *aya*, *awa* were first "syncopated" to *ai*, *au*[73] which then yielded *ē*, *ō* generally, and that there was an intermediary stage *ei*, *ou*.[74]

Change (15)	*aya*, *ai*	>	*ē*
	awa, *au*	>	*ō*
	əi	>	*ī*

This sets a point of absolute chronology, as the inscription A²Sd is from the reign of Artaxerxes II (first half of the 4th c. BC), and the monophthongisation had happened by this date, but the scribe must still have remembered a register (or words from older inscriptions) that had *ai* / *aya* for their *ē*.[75] By extension, all preceding changes are from the Achaemenid period as well. Where we do not have direct evidence in the OP inscriptions for this being the case, this can be due to the limited size of the corpus. More crucially, any orthography tends to be stable once it is installed and to mask changes ongoing in the language—particularly in royal inscriptions, which will certainly aim at a formal and conservative standard. All the more remarkable are those instances that do deviate from the traditional spellings and thus demonstrate a change in the language.

The Armenian loanwords likewise reflect *ē* from Ir. **aya* and **ai* (yielding Arm. *ē*, later *e*), and *ō* from **awa* and **au* (Arm. *oi*, later *o*),[76] and this in combination with preserved postvocalic voiceless stops, e.g. *kapēnkʿ* 'dowry' (MP *kābēn*), *hro*(*r*)*t-icʿ* (GEN.PL, month name) < **frawarti-* (MP *Fraward-īn*), *kapoit*

72 Thus Schmitt (1999: 82–84, with in-depth discussion of the various interpretations of this word). For discussion of the final syllable, see **3.4**.

73 Cf. Werba (2006: 279–83) and Schmitt (2014: 225) about ⟨p-r-d-y-d-m⟩.

74 Thus Werba (2006: 283), adducing further evidence for *ai* > *ei*; he assumes that ⟨p-r-d-y-d-m⟩ reflects "an allegro form */pardeida/* that was on its way to monophthongisation" (281). Further evidence for *-ei-* comes from Elamite *ik-še-ir-ša* for Xerxes (OP ⟨x-š-y-a-r-š-⟩, cf. Schmitt 1999: 114) and from Greek renderings e.g. of Artaxerxes (cf. Korn frthc.). Werba's word-final *-a* seems unlikely to me, however (see **3.4**).

75 As pointed out by Hoffmann (1976: 643–45, contra Brandenstein & Mayrhofer 1964: 29 and others), the Elamite data militate against this change having happened already in Classical Old Persian, as they render the OP diphthongs as well as can be expected of a language that does not have diphthongs.

76 For the Arm. outputs, see Hübschmann (1897: 14). In nonfinal syllables, *ē*, *oi* yield *i*, *u*.

'blue' (MP *kabōd*).[77] This shows that late OP forms with *p*, *t*, *k*, *č* were not mere historical spellings, and that they were preserved at the time when the monophthongisation had already taken place.

As likewise shown by Armenian (*ǰatuk* vs. Ir. **yātuka-* 'magic'; *zatik* vs. **ǰatika* 'sacrifice'), the voicing of the voiceless stops is also preceded by the change of Ir. **ǰ* to *z*, and by that of word-initial **y-* to *ǰ* (both specific to Persian), of which the former must precede the latter since otherwise the new *ǰ-* would also have yielded *z*. The use of etymologically unjustified ⟨c⟩ for Ir. **z* and **ǰ* in the early Sasanian inscriptions shows that *č* had coalesced with *z* from other sources (i.e. from postvocalic *č* and from non-Persian *z* < Ir. **ź*) by that time.[78]

Change (20) $\check{j} > z$

Change (21) $y > \check{j} \quad /\#\_$

Change (26) $\begin{bmatrix} p \\ t \\ k \\ č \end{bmatrix} > \begin{bmatrix} b \\ d \\ g \\ z \end{bmatrix} \quad /V\_$

2.8 In his discussion of *ary*, **ɣy* > *ēr*, *īr*, Hübschmann (1893: 131, cf. **2.4**) also mentions *dēr* 'late' < Ir. **darga-* (via **dayr*, Hübschmann 1893: 249), so that one might be tempted to assume that **dayr* > **dayr* > *dēr* feeds into the change (15) *ai* > *ē*. He did, however, add a question mark to indicate that this does not necessarily follow. In the meantime, his doubt proved justified since MP evidence now shows preserved ⟨g⟩: MPM ⟨dgr⟩, MPZ ⟨dgl⟩ *dayr* 'late' beside MPM ⟨dyr⟩ *dēr*,[79] and the same applies to *šēr* 'lion', for which there is MPM ⟨šgr⟩, MPZ ⟨šgl⟩ *šayr*.[80] The change **agr* > **ayr* > **ayr* thus cannot have happened before MP times; rather, the varying MPM spellings seem to date **ayr* > **ayr* right into MP times. The *ay* arising here therefore cannot have fed into the (Achaemenid, see **2.7**) monophthongisation. Given that monophthongisation is a highly com-

77 Examples from Hübschmann (1895: 141–42, 167, 169).

78 Cf. Korn (2009: 206, 2010: 423–24) for further discussion of these changes and Korn (2010) for the output of postvocalic *č* in Parthian. See also **2.3**.

79 Bartholomae (1925: 12–14, 36), who also discusses **ayr* > NP *ēr*, seems not to have known MPM ⟨dgr⟩ yet; he assumes a derivation from a comparative **darγ-yah-* (with analogical *γ*) and a loss of *γ* by his rule of **βy*, *δy*, *γy* > *y* (see **2.6**).

80 Note that the MPZ orthographies are not compelling because ⟨g⟩ and ⟨y⟩ are usually not distinguished. The words are not attested in the MP inscriptions.

mon phenomenon cross-linguistically, it is not surprising that there are several instances of *ai* > *ē* in the prehistory of Persian.

Again, there is a parallel development with vowels other than *a*, as the change **igr* > **iγr* > **iyr* > *īr* seen in NP *tīr* 'arrow' (Ir. **tigra-* 'sharp', cf. Hübschmann 1893: 249) had not yet occurred in Middle Persian (MPM ⟨tygr⟩, MPI ⟨tgl-⟩, MPZ ⟨tgl⟩). Another example is NP *sīr* 'garlic' (the MP form is not attested), which is likely to contain **iγr* because of the OP month name ⟨θ-a-i-g-r-c-i-⟩ *Θāigračī-*, a derivative from **ϑigra-ka-*[81] and probably referring to a garlic festival (Schmitt 2014: 256).

As in the case of *rβy*, *rδy*, *rγy* in **2.6**, it seems possible to me that *aδr* was treated in the same way as *aγr*. One possible case is MP *ēr* (MPM ⟨'yr⟩, ⟨'yr⟩) 'below, under' (in NP with the preposition (*a*)*z* 'from' as *z-ēr*) if it derives from **adari* (Av. *aδairi* via **aδr-* (cf. Horn 1983: 150–51, Korn 2005: 119, 199). Another possible instance might be MP *bēr* (MPM ⟨byr⟩), NP *bēl* (MPZ ⟨byl⟩) 'spade' if it goes back to **badra-* (>**baδra-*, cf. Balochi *bard*, Bashkardi *bahr*) instead of to the athematic form **badar-* (> **bayar-*) as suggested by Gershevitch (1962: 78–79); a form with metathesis would be seen in Balochi *bard* and in NP *bāl*.[82] In principle, one might then expect that *iδr* was treated like *iγr*, but I am not aware of an example.

Change (28)	*aγr*, *aδr* (?)	>	*ayr*
	iγr (and *iδr*?)		*iyr*

Change (29)	*ay*	>	*ē*
	iy		*ī*

For the words with *γr* just mentioned, MacKenzie (1986) and Durkin-Meisterernst (2004) read *-gr*, but postvocalic inherited voiced stops (**b*, *d*, *g*) must have yielded fricatives before the inherited voiceless stops (**p*, *t*, *k*) yielded voiced ones (26), else the two series would have coalesced.[83] Indeed, it seems possible that *b*, *d*, *g* had [β, ð, γ] as allophones either "generally or in some word-internal positions" (a fortiori in postvocalic position) already in Old Per-

81 Since it is NP *sīr* (not †*sēr*), this derivation seems indeed preferable to the alternative possibility **ϑaigra-ka-* also mentioned by Schmitt (2014: 256). See Lubotsky (2012: 102–04) for a suggestion that the OP word is borrowed from **tsigra-*, the Scythian cognate of **tigra-* 'sharp'.

82 Cf. Gershevitch (1962: 78–79), who further assumes that NP *bēl* shows a contamination of *bēr* and *bāl*.

83 One might say that at least in the case of ⟨dgr⟩, the postvocalic position of the ⟨g⟩ is secondary (**darga-*, cf. Av. *darəga-*), but this does not apply to ⟨tygr⟩.

sian (Hoffmann 1976: 628–29).[84] My situating the change of intervocalic **b, d, g* to *β, δ, γ* within the period of Classical Old Persian is a mere guess; it could also be earlier. Armenian agrees with this sequence of changes by showing voiceless stops preserved in postvocalic position, but fricatives for Ir. voiced stops, e.g., *aparankʿ* 'palace' (OP *apadāna-*) with Arm. *r* (regularly) rendering Ir. *δ*, and *ǰatagov* 'advocate' (OP *gaub* 'speak', cf. MP *ǰādag-gō(w)*) with *v* for Middle-Ir. *β* (the first member is from the same root as *ǰatuk* mentioned in **2.7** and shows the specifically Persian change *y-* > *ǰ* (21)).[85]

Change (12) $\begin{bmatrix} b \\ d \\ g \end{bmatrix} > \begin{bmatrix} \beta \\ \delta \\ \gamma \end{bmatrix} \quad / \text{V\_}$

3 Middle Persian

The Middle Persian vowel assimilation

3.1 I argue that the MP sound change called "Umlaut" by Hübschmann (1895: 129) and others is not part of the process called Epenthesis (14), although various authors have included some or all cases of Umlaut as Epenthesis. As argued in **2.1, 2.4**, the Middle Persian Epenthesis is rather early and yields long *ē, ī* that are preserved as such in Middle and New Persian. Conversely, Umlaut is later and appears to yield a short vowel (*e, o*) in Middle Persian, as indicated by the spellings, which oscillate between forms with and without ⟨y/w⟩ (see **2.5**).[86] Moreover, this vowel has frequently "reverted to /a/" in New Persian (MacKenzie 1967: 24),[87] which rather confirms that the vowel is short. An alternative interpretation would be that Umlaut did not happen in the MP variant(s) which is/are the predecessor of New Persian (Proto-New Persian); in this case as well, Umlaut would be different from Epenthesis since the latter did occur in Proto-New Persian.

Instances of Umlaut yielding MP *e* include MP *men-* 'think' (Ir. **man-ya-*) and *dušmen* 'enemy' (Ir. **duš-man-yu-*, NP *dušman*)[88] as well as MP *deh* 'land, vil-

84 Thus also Hübschmann (1893: 181, 198, 247). Old Persian thus would have resembled Spanish with respect to this feature.

85 Examples from Hübschmann (1895: 182, 201). There is no sound *γ* in Old Armenian, so that Middle Ir. *γ* is rendered by Arm. *g* (Hübschmann 1895: 247); Armenian thus does not provide evidence for *g* > *γ*.

86 See n. 51.

87 This statement refers to the MP vowel assimilation in general.

88 A derivation of the NP form from **duš-manyu-* (Av. *dušmaⁱniiu-*) has been assumed

lage' (MPM ⟨dyh⟩) < **dahyu-* (cf. OInd. *dásyu-* 'member of a "barbaric" tribe', OP *dahəyu-*[89]), *weh* 'better' (MPZ ⟨wyh⟩, MPM ⟨why⟩, ⟨wyh⟩) < **wahyah-* (cf. OInd. *vásyas-*, OP *wahəyah-*[90]), *merd* 'man' (MPM ⟨m(y)rd⟩) < **martya-* (cf. OInd. *mártya-*, OP *martiya-*). Examples for *o* include *dušox* 'hell' (MPZ ⟨dwšhw'⟩, MPM ⟨dwš(w)x⟩) < **duš-ahw-* and *passox* 'answer' (MPZ ⟨pshw'⟩, MPM ⟨pswx⟩) < *patisah-wan-* (Hübschmann 1895: 36, 218).[91]

In combination with the argument in **2.5**, this means that Epenthesis is limited to V*ry*, and that any other MP ⟨y⟩ in a syllable where one expects *a* is the effect of Umlaut.[92]

Change (22) *a* > *e* /_C*y*
o /_C*w*

Armenian shows that the vowel assimilation had taken place at a time when the voiceless stops were still preserved in postvocalic position, e.g. *pet* 'lord' (MPM ⟨-byd⟩, Ir. **pati-*, NP *-bad*, *-bud*), *Spandaramet* (Av. *spəṇtā- ārmaⁱti-*), etc.[93]

3.2 There is also an assimilation of Ir. **a* > MP *e*, *o* when certain consonants follow (MacKenzie 1967: 23–24, Durkin-Meisterernst 2014: 131–32). Predictably, *o* appears next to labial consonants, as in *abdom* 'last' (MPZ ⟨'p̄dwm⟩, MPM ⟨'bdwm⟩, Ir. **-tama-*). MP *e* is found before *nn* (< **nd*), *nd*, *h* (< **ϑ*)[94] and sibilant,

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because of the MP form; the second element is also contained in other compounds (Av. *aŋrō.maⁱniiu-* 'evil spirit', etc.) and attested independently in Avestan and Old Indic (*manyú-*), with several derivatives such as Av. *maⁱniiauua-*, which underlies MP *mēnōg* (see **2.5**). However, NP *dušman* could go back to the synonymous Ir. **duš-manah-* (likewise attested in Avestan) and thus does not need to show a reversal of Umlaut (this seems to be the suggestion of Bartholomae 1904: 754). See also **2.5**.

89 Cf. **1.2**.

90 Note that the *ə* in *dahəyu-*, *wahəyah-* is a product of the specifically OP changes **hy* > **hiy* > *həy* (see **1.8**), none of which occurred in PMP.

91 MP examples (except for *men-*) from MacKenzie (1967: 23–25). MacKenzie (1986: 54) reads MPZ ⟨mlt'⟩ *mard*; this form could go back to **marta-* (thus Bartholomae 1925: 55, comparing OInd. *márta-*). NP *mard* is ambiguous: it could go back to **marta-*, or, with reversal of Umlaut, to MP *merd* < **martya-* (OInd. *mártya-*, see n. 59). Bartholomae (1925: 55) assumes that MPM ⟨myrd⟩ is to be read *mērd* and has its vowel from *mērag* (for which see **2.1**), but this seems more complicated to me than an explanation by Umlaut.

92 This means that the derivation of MP *mēnōg* and the reading of MP *men-* and *dušmen* with long *ē* in EWAia etc. (cf. **2.5**) need to be revised.

93 Cf. the examples in Hübschmann (1895: 130), even if his interpretation differs from mine.

94 **ϑ* of any origin (i.e. PIE **ḱ*, **th₂* and **t* preceding a consonant) changes to MP *h* (ex. *dah* 'ten', *rāh* 'way', cf. Hübschmann 1895: 210–11).

e.g., *benn-* 'bind' (MPM ⟨byn⟩),[95] *-āwend* 'having …' (MPM ⟨-ʾw(y)nd⟩), *namehk* 'salt' (MPM ⟨nmyhk⟩, Ir. **namaδ-ka-*).[96] It is not entirely clear whether this assimilation is to be seen as part of the change called "Umlaut", but the two changes could at least be related processes.

3.3 It seems possible to me that the "colouring" of the OP vowel *ə*, which arises by the change (8) **r̥* > *ər* (see **1.4**), can likewise be considered vowel assimilation. As established by Hübschmann (1895: 143–50), Ir. **r̥* yields MP/NP *ur* in labial contexts, and *ir* otherwise.[97] Under the present approach, *ər* changes colour by assimilation to the respective contexts. Examples include NP *purs-* 'ask' (OP *pərsa-*, OInd. *pr̥cchá-*), *burd* (Av. *bərəta-*, OInd. *bʰr̥tá-*); *dil* 'heart' (OP **dərd-*, Av. *zərəd-*, OInd. *hr̥d*(*aya*)-), *kirm* 'worm' (OInd. *kŕ̥mi-*), MP *kird* 'done' (OInd. *kr̥tá-*), MP *tišn* 'thirst' (OInd. *tŕ̥ṣṇā-*).[98]

It seems a priori likely that *ə* arising from other processes is "coloured" at the same time. A possible candidate is **ə* in word-final **-əm*, which, as argued in Korn (2013) is the PMP result of Old Ir. *-am* and of other word-final syllables and then changes to **-um* (see **3.4**). Differently from MP *e*, *o*, the products of the PMP Umlaut, however, these coloured vowels are not changed to *a* in New Persian, but are treated like inherited *i*, *u*.

Change (23)	*a*	>	*e*	/_*nn*, *nd*, *h*, sibilant
			o	/_*m*, *w*
	ə	>	*u*	/_*m*
			u	/*p*, *b*, *m*, *w*_
			i	elsewhere

95 The change **nd* > *nn* does not occur in MPZ and NP (*band-*).

96 Examples from MacKenzie (1967: 23–25).

97 See also Bartholomae (1925) for detailed discussion. Note that statements to the effect of "The syllabic **r̥* of Old Iranian [sic] yields a consonant *r* with accompanying vowel in Western Middle Iranian. The vowel depends on the preceding consonant: *ur* after labials, *ir* after all other consonants" (Durkin-Meisterernst 2014: 138) should not be taken to refer to Western Middle Iranian in general, but only to attested Middle Persian and Parthian, since other Western Ir. languages show different developments. In Balochi, the result is *ir* in palatal contexts, but *ur* elsewhere (Korn 2005: 143–48), and Zazaki and Taleshi might show *ar*. These data cannot be accommodated in a view that holds the MP and Pth. result of **r̥* to be valid for Western Middle Iranian in general (see Korn 2016: 409–12 for the significance of this change as an isogloss).

98 Examples from Hübschmann (1895: 144–45). The *-a-* in the NP past stem *kard* is surely analogical to the infinitive, cf. OP *čartanaiy* (Bartholomae 1925: 76).

Note that this more detailed account removes a problem that would arise if one were to posit a development of MP *ur/ir* from **r̥* directly: Had **r̥* yielded *ur* in labial environments and *ir* elsewhere, instances such as **mr̥ya-* 'die' and **gr̥wya-* 'seize' could be expected to show *ur* as well. Under the present account, *w* in the latter example is lost at an early stage (13), and Epenthesis and the subsequent monophthongisation **əry* > *əir* (14) > *īr* (15) likewise took place quite early (in Achaemenid times, see **2.7**). The relevant examples thus get their *ī* from changes independent of the phonetic contexts long before the context-dependent colouring takes place.

Word-final phenomena again

3.4 The argument just made adds some perspective to the sequence of changes in OP/MP word-finals discussed in Korn (2013): Certain OP word forms show that OP vowels in final syllables experienced a "Quantitätenkollaps" ("collapse of [vowel] quantities")[99] by which *-ām* and *-am* (the accusative of the most frequent f. and m. stem classes, and the nominative/accusative of the most common neuter class) would have coalesced; similarly, *-im*, *-īm* and *-um*, *-ūm* would have coalesced to *-im* and *-um*, respectively. This was followed by a neutralisation of the vowel, the just mentioned word-finals thus all yielding **-əm*. The assimilation of **-əm* > **-um* (cf. 3.3) could be part of the MP vowel assimilation; **-um* < *-am* etc. is thus parallel to *-dom* < **-tama-* etc. mentioned in **3.2**.

If this account is on the right track, it would refine the relative chronology suggested in Korn (2013: 85) in dating the merger of final nominal syllables to **əm* before Umlaut. Since OP ⟨p-r-d-y-d-a-m⟩ 'palace' (implying *-ām* instead of expected *-am*) in an inscription from the reign of Artaxerxes II (see **2.7**) reflects both monophthongisation and the neutralisation of vowel quantity, I tentatively place the "Quantitätenkollaps" next to the OP monophthongisation ((15), see **2.7**).[100]

The neutralisation of vowel quality is likely to have been later than the neutralisation of vowel quantity because a neutralisation of vowel quality seems more probable in a short vowel. This sequence may be confirmed by the fact

99 I borrow the term "Quantitätenkollaps" from Romance linguistics, where it refers to the loss of vowel length distinctions in popular / late Latin, which is followed by a loss of some distinctions of vowel quality depending on the individual Romance language (see, e.g., Lausberg 1969: 144 for the term and Banfi 1996 for a survey, specifically p. 166).

100 As pointed out in Korn (2013: 85), a weakening in successive stages seems more likely to me a priori than a loss without trace of word-final syllables. The MP and Arm. data as well as the MP elements mentioned in **1.6** likewise militate in favour of intermediary stages.

that OP ⟨š-a-y-t-a-m⟩ 'joy' (from *šiyāti-*, see **2.3**) is from the reign of Artaxerxes III (reigned mid-4th c. BC) and shows (apparent) *-ām* instead of *-im* (*šiyātim*, see **2.3**).[101]

There is also evidence for a neutralisation of quantity of word-final vowels (or at least word-final *a*) in instances such as (see Schmitt 1999: 112–13) apparent NOM.SG *puçā* ⟨p-u-ç-a⟩ for *puça* ⟨p-u-ç⟩ attested elsewhere (i.e., ⟨-C-a⟩ instead of expected ⟨-C⟩) and *Anāhi/ət(a)*.[102] Furthermore, word-final *ai* not being written in several instances (Schmitt 1999: 113) might imply a change *-ai* > *-ē* > *-e* > *-ə*.[103]

Change (16) $\bar{V} > \check{V} \quad /\_(m)\#$

Change (17) $V > ə \quad /\_(m)\#$

Clearly later, but still in Proto-MP times, is the loss of final *-m*. The word-end of most stem classes would thus have ended in **-u*, which explains a number of Ir. *a*- and *ā*-stems (discussed in Korn 2013) being found in the *u*- and *o*-stem class in Armenian despite the marginal status of these classes, and also the MPM forms reflecting **kasu* and **čisu* mentioned in **1.6**. This loss of *-m* must, I think, precede the change (26) of postvocalic *p*, *t*, *k*, *č* to *b*, *d*, *g*, *z* (see **2.7**) because there is no trace of the word-final *-m* in Armenian or in any MP spelling, while Armenian as well as the archaising MPI and MPZ orthographies reflect Old Ir. postvocalic *p*, *t*, *k*, *č*.[104]

Change (24) *-m* > ∅

3.5 Several items discussed in the preceding sections show the loss of a short vowel: *parzīr-* 'keep away' (**2.4**) and probably also OP ⟨p-r-d-y-d-a-m⟩ *par(?)dēd-*

101 The inscription also shows the same treatment of *i*-stems in other lexemes, see Korn (2013: 84). Cf. Werba (2006: 283), whose observation is set in different terms, but also amounts to stating that inflectional classes were no longer distinguished, so that any stem received the same accusative ending.

102 See n. 40 for the spellings of Ardashir II's inscriptions.

103 This neutralisation of vowel quantity is not to be confused with the one mentioned in **1.5**: The latter operates in a period preceding Old Persian, neutralising inherited (Ir. and Indo-Ir.) word-final *-a* and *-ā* (6), while the process discussed here concerns vowels that came to be in word-final position by the OP loss of word final consonants (7).

104 Unfortunately, none of the Arm. instances of unexpected *u*- or *o*-class shows a postvocalic stop which would allow us to establish a relative chronology with the change of postvocalic *p*, *t*, *k*, *č* to *b*, *d*, *g*, *z*.

'palace' (**2.7**), both containing **pari-*, as well as MP *ēr* 'below' if this derives from Ir. **adari* > PMP **aδr-* (**2.8**), suggesting a syncope (at least) in open middle syllables. However, we also find unsyncopated forms such as Arm. *aparankʿ* 'palace' (**2.8**) and *Spandaramet* (**3.1**).

It seems possible that there are several types of syncope in the prehistory of New Persian,[105] one of them possibly in Achaemenid times for reasons of the missing ⟨-i-⟩ in ⟨p-r-d-y-d-a-m⟩, and (as shown by the Arm. examples just mentioned) earlier than the voicing of postvocalic voiceless stops, possibly close to the OP monophthongisation (15) and to the neutralisation of vowel quantity in word-final syllables (16) as potentially related processes of vowel reduction. Their study is reserved for future research.

4 Conclusion

While one cannot help but be amazed at the insights obtained by the pioneers of Iranian historical linguistics such as those mentioned throughout this paper, it is clear that the data available today permit a refinement of their research results. This is not only a question of the quantity of data and results, but also one of method. I argue that it is possible to go beyond the "black box" approach applied until now, which compared an input (such as Proto-Iranian or Proto-Indo-European) with an output (Middle or New Persian), largely resulting in an unsorted list of sound changes, as it were, disregarding their sequence and the ways in which they interact.

The present contribution attempts to demonstrate the results at which one arrives by putting into practice the converse approach called "glass box". This implies the study of a given sound change (such as postconsonantal *y* to *i̯y* and *w* to *u̯w*) within the context of somehow connected processes. In our case, this concerns, on the one hand, other phenomena affecting syllable structure such as the change of vocalic *r* (**r̥*) to *ər*, by which some instances of *y* come to be in postconsonantal position, as well as processes in which *y* and *w* are involved. Examples of the latter are changes affecting vowel quality, called Epenthesis and Umlaut in previous scholarship. The present approach permits us to view them as two distinct processes, which moreover took place in different periods.

The output is, I think, twofold. On the one hand, the study of these sound changes yields the relative chronology presented in the Appendix below (Sec-

105 One type of PMP syncope is described by Klingenschmitt (2000: 210–15), which results in the loss of certain short unaccented vowels in (Old Ir.) penultimate syllables (e.g., Ir. **paθana-* > MP *pahn* 'wide', **zarita-* > *zard* 'yellow', **wīsati* > *wīst*).

tion 5), which is a sorted list resulting from the application of the glass box approach. An absolute chronology is possible to some extent since certain word forms in Old Persian inscriptions attest a *terminus ante quem*, i.e., they show that a given change must have happened by the date the inscription was composed. All this also contributes to the philological interpretation of Old and Middle Persian word forms by suggesting, e.g., that the present stem of 'die' and the identically structured passive of 'do' are to be read MP *mīr-* (as always assumed), MP *kīr-* and OP *məriya-*, *kəriya-*, respectively.

At the same time, the "glass box" approach highlights an element of dialectology by showing that the OP sound changes under study cannot be brought into line with the Middle Persian varieties that have come down to us. The OP change of postconsonantal *y* and *w*, which, as I argue, did not happen in Proto-Middle Persian, thus constitutes a dialectal difference between Old and Middle Persian to be added to those already noted. I am sure that more such cases can be found where a look into the "glass box" allows to refine both the sequence of changes and their dialectal status.

5 Appendix

The following list contains the changes discussed in this article, with references to the sections where they are discussed. The list does not pretend to be the only possible solution, but is meant to encourage further studies on the relative chronology of sound changes in the prehistory of Persian. Changes that seem to be more closely connected chronologically or directly depend on one another are presented together and separated from the next set by an empty line.

While the list might seem somewhat bold, the intention is to submit some preliminary results for improvement and refinement through subsequent research.

Signs used (see also the list of abbreviations preceding the bibliography):

‡ specific to some subdialect(s) of Persian, not shared by others

⁂ surely / probably / potentially also shared by non-Persian languages (e.g. Parthian)

Common Iranian:

(1) ⁂ • Indo-Ir. *K* > Ir. *X* /_C (**1.3**)
(**tvām* > Ir. **θwām*; **satya-* > **haθya-*)

Proto-Old Persian:

(protoforms in this part are Proto-Iranian)
‣ *terminus ante quem*: inscription DB (**521 BC**)

(2) • **ś, *ź* > OP *θ, d* (**1.3**)
(**źr̥daya-* > **dr̥daya-*)

(3) ⁂ • **čy, *θy* > OP **šy* (**1.3**)
(**čyāti-* > *šyāti-*; **haθya-* > **hašya-*)

(4) ‡ • Analogical replacement of **čid* by **čim* (**1.6**)
(**kas=čid* → PMP **kasčim*)
‡ operates in Proto-Middle Persian, does not operate in Proto-Old Persian

(5) • *sč* > OP *s* (**1.6**)
(**kas-čim* > PMP **kasim*; **pas-ča* > OP *pasā*)

(6) • Neutralisation of vowel quantity 1
a > *ā* /_# (**1.5**)
(*manā* vs. *mana=ča*)

(7) ⁂ • Loss of word-final consonants (**1.5**)
t/d, ts, n(*h*)*, nt/d, h* > ∅ /_#
(endings **-ah, -an*(*t*)*, -at* > *-a*; **paryauǰah* > **paryauǰa*)

(8) ⁂ • Development of *ə* (**1.4**)
**r̥* > *ər*
(**dr̥daya-* > **dərdaya-*, **mr̥ya-* > **mərya-*; **mr̥tam* > **mərtam*; PMP **gr̥bya-* > **gərbya-*)

(9) ‡ • *i/y, u/w* > OP *iy, uw* /{C}_{V,#}
(Ir. **θwām* > *θuwām*; **hw-…* > **huw-*; **hašya-* > *hašiya-*; **šyāti-* > *šiyāti-*; **mərya-* > *məriya-*; **maryaka-* > **mariyaka-*) (**1.1**)
(Ir. 3SG.MID **-tai* > *-taiy*; 3SG.IMP **-tu* > *-tuw*) (**1.2**)
‡ operates in Proto-Old Persian, does not operate in Proto-Middle Persian (**2.1–2.2**)

(10) ‡ • *h* > ∅ /_*u, m* (**1.8**)
**huw-* > OP *uw-*
‡ does not operate in Proto-MP

Within Old Persian:

(11) ⁂ • Contraction across glide
iya > *ī* (**1.1, 1.7, 2.1**)
(**mariyaka-* > OP *marīka-*; **-iyaka-* > PMP **-īka-*)
some of *uwa* > *ū*, context unclear (**1.7**)
(**huw-apah-* > PMP **hūpa-*)

OP: works for inherited *iya* (plus potentially certain cases of *uwa*) and for the output of (9);
PMP: works only for cases of inherited *iya* and some of inherited *uwa*
‣ *terminus ante quem*: Xerxes I (**1st half of 5th c. BC**) and final paragraph of DNb[106]

(12) ** • Lenition of postvocalic voiced stops (**2.8**):
b, *d*, *g* > *β*, *δ*, *γ* (at least in some vocalic and sonorant contexts)
(**gərbya-* > **gərβ/wya-*)
NB: could also be earlier

Late Old Persian:

(13) • *rwy* (and *rβy*, *rδy*, *rγy*?) > *ry* (**2.6**)
(**gərβ/wya-* > **gərya-*)
dating unsure; postdates (8) and possibly (12), antedates (14)
NB: does not operate in Parthian

(14) • Epenthesis (**2.2**)
ary* > **air* (2.1**)
(**maryaka-* > **mairaka-*; **paryauǰa* > **parauǰa*)
əry* > **əir* (2.4**)
(**mərya-* > **məira-*; **gərya-* > **gəira-*)
NB: no epenthesis in **any* > †*ēn* (**2.5**)
NB: does not operate in Parthian

(15) ** • Monophthongisation 1 (**2.7, 3.3**)
aya, *ai* > *ē*
(**mairaka-* > **mēraka-*; **paridaida-* > **paridēda-*; **dərdaya-* > **dərdē*)
awa, *au* > *ō*
(**parauǰa-* > **pērōǰa-*)
əi > *ī*
(**məira-* > **mīra-*)
‣ *terminus ante quem*: Artaxerxes II (**1st half of 4th c. BC**)

106 As repeatedly noted, the final paragraph of DNb does not show any textual coherence with the preceding text: "ursprünglich bildete der etwas abgesetzte Schlußteil DNb 50–60 (…) einen eigenständigen Text" (Schmitt 1989: 59); "This last paragraph of DNb is virtually an independent inscription, differing in manner and subject-matter from the preceding text and separated from it, in all three versions, by an uninscribed space. When Darius's son, Xerxes, issued a version of DNb in his own name (XPl), he did not include this paragraph" (Sims-Williams 1981: 1). It thus is not clear to me whether it is from the same period as the rest of DNb or not.

(16) ⁂ • Neutralisation of vowel quantity ("Quantitätenkollaps") in word-final syllables 2 (**3.4**)
$\bar{V} > \breve{V}$ /_(*m*)#
(*-ā(m)*, *-ī(m)*, *-ū(m)* > *-a(m)*, *-i(m)*, *-u(m)*, respectively)
‣ *terminus ante quem*: Artaxerxes II

(17) • Syncope 1 (**3.5**)
(**paridēda-* > *pardēd-*)
exact context unclear
‣ *terminus ante quem*: Artaxerxes II

(18) ⁂ • Neutralisation of vowel quality (**3.3**–**3.4**)
V > *ə* /_(*m*)#
(*-a(m)*, *-i(m)*, *-u(m)* > *-ə(m)*; *čim* > *čəm*)
‣ *terminus ante quem*: Artaxerxes III (**mid-4th c. BC**)

(19) • Reduction of consonant clusters (**1.1, 1.3**)
⁂ *šy* > *š* (**2.7**)
(*šyātim* > **šātəm*)
dw- > MP *d-* (**2.1, 2.3**)
(**dwarϑič-* → Arm. *dahlič*)
‣ *terminus ante quem*: Artaxerxes III

Prior to layer 1 of Middle Persian loanwords in Biblical Armenian:

(20) • *ǰ* > MP *z* (**2.7**)
(**pērōǰa-* > *pērōz*; **ǰatika-* → Arm. *zatik*)

(21) • *y-* > MP *ǰ-* (**2.7, 2.8**)
(Arm. *ǰatuk, ǰatagov*)

(22) • "Umlaut" (**3.1**)
a > *e* /_.*y*, *i*
(*pati-* > *-bed*, Arm. *pet*, **martya-* > *merd*)
a > *o* /_.*w*, *u*
(*-tama-* > *-dom*)

(23) • Vowel assimilation (**3.2**–**3.3**):
a > *e* /_*nn*, *nd*, *h*, sibilant
(**-astānəm* > *-estān*)
a > *o* /_*m*, *w*
ə > *u* in labial contexts, else *i*
(**-əm* > **-um*; **čəm* > **čum*; **mərtəm* > **murtum*; **dərdē* > *dil*)
One change with (22)?

• • •

(24) ⁂ Loss of word-final *-m* (**3.4**)
(-um > -u; čum > ču)
(25) ⁂ Loss of word-final vowels
(-u > ∅)

Pre-Middle Persian:
(26) ⁂ • Lenition of postvocalic voiceless stops (**2.7, 3.4**)
p,t,k > b,d,g /V_
• Lenition of postvocalic *č* (**2.7, 3.4**)
č > MP *z* /V_
‣ *terminus ante quem*: early Sasanian inscriptions
‣ *terminus post quem*: layer 1 of Ir. loanwords in Armenian
(27) • Lengthening of *i* and *u* in word-final syllables
i, u > MP *ī, ū* /_[*b, d, g, z*]#
side-effect of preceding item or later (Korn 2009)

Within Middle Persian:
(28) • V*γr* (and V*δr*?) > *yr* (**2.6, 2.8**)
unclear which contexts exactly participate in this change
(29) • Monophthongisation 2 (**2.8**)
ay, ay > *ē, ī*

Abbreviations, cover symbols and other signs

For the sigla referring to Old Persian inscriptions, see Schmitt (2009: 8–32); for linguistic abbreviations, see the Leipzig glossing rules (https://www.eva.mpg.de/lingua/resources/glossing-rules.php). Other abbreviations used in this article are:

.	syllable boundary	C	any consonant
#	word boundary	Ir.	Iranian, Proto-Iranian
/_	in the context of (e.g.: A > B /K_: A changes to B in the context after stop)	K	any stop
		MP	Middle Persian (MPI: inscriptional MP; MPM: Manichean MP; MPZ: Zoroastrian MP)
=	attaches clitic		
-	attaches affix	NP	(classical) New Persian
ACT	active	OInd.	Old Indic (Vedic, Sanskrit)
Arm.	Armenian	OP	Old Persian
Av.	Avestan	OPT	optative

PIE	Proto-Indo-European	V	any vowel
PMP	proto-MP (see the Introduction)	VOC	vocative
		X	any fricative
Pth.	Parthian		

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