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Theoretical and methodological aspects in evaluating morphological productivity in corpus languages: A case study on Hittite word-formation

Abstract

This study addresses the theoretical and methodological challenges in evaluating productivity of word-formation processes in corpus languages, utilizing Hittite as a case study. Following a critical examination of the current application of the term "productivity" in Hittitological literature, a more precise definition is proposed, centered on the distinction between *profitability* and *availability*. The primary focus of this research lies in the investigation of availability. The challenges associated with studying morphological productivity in an extinct corpus language are confronted through a methodology that com-bines linguistic and philological criteria. Linguistic criteria, based on productivity hierarchies, include the analysis of deriva-tion from loaned bases, competing morphological rules, and derivational chains, while philological criteria draw upon in-sights derived from known Hittite scribal practices.

Keywords: productivity; availability; derivational morphology; Hittite

1. Introduction

The concept of morphological productivity (MP) is a delicate theoretical is-sue that has been treated from different perspectives. Despite the differenc-es in the formulation of MP given during the last decades (for an overview, see Bauer 2005), the term seems to frequently appear in studies that do not directly deal with this concept from a theoretical point of view. This is the case, for example, of studies and descriptions of ancient languages. It is rare, in fact, to find the term *productivity* explicitly defined or linked to a theory of MP in ancient languages studies. It seems that any statement of produc-tivity is based on an ingenuous theory of MP (for a terminological discus-sion on ingenuous concepts in Linguistics see Graffi 1991; 2021). As noted by Bauer (2005: 315), the study of MP is recent and therefore in many cas-es observations made by a researcher on the productivity of a certain affix

have long been disconnected from an explicit theory of MP. In the case of *Corpussprachen*, such an approach can be particularly problematic, since it is impossible to interview native speakers, and the dimension and representativeness of the corpus are limited by historical factors.

In this paper, I will examine the issue of measuring the productivity of word-formation rules (WFR) in a *Corpussprache*: Hittite language. Hittite is an Anatolian language, an Indo-European branch that at the present day is completely extinct. From the point of view of the attestation, the variety of genres attested and the amount of texts is large enough to consider Hittite a *Grosscorpussprache* (Rigobianco 2022: 84). However, the specificity of the *medium* (clay tablets) and the way in which these tablets have been preserved until now represent a challenge in using the corpus for linguistic purposes.

In Section 2 I will present and discuss some of the claims of MP made in the Hittitological literature. In Section 3 I will present and discuss some theoretical views of MP, while in Section 4 I will discuss them with respect to the issues presented by corpus languages and, more specifically, by the Hittite corpus. In Section 5 I will discuss qualitative strategies for identifying productive WF processes in corpus languages, distinguishing between linguistic strategies and philological strategies, exploring their possible application to Hittite data.

2. An overview on some claims of MP in Hittitological literature

In studies about Hittite language, it is possible to find many claims about MP. This section does not aim to examine every instance of mention of productivity in Hittitological literature. Instead, it will focus on four important works that deal with Hittite word-formation from different perspectives, examining how they employ the concept of productivity and related terminology: Gusmani's *Hittite Lexicon* (*Il lessico ittito*) (1968), which is one of the first study to organically consider etymological aspects of Anatolian lexicon; Rieken (1999), which is a work about stem formation in Hittite oriented to phonological formative aspects, especially with an etymological perspective; Berman's (1977) paper, which is representative of a comparative approach, analyzing the status of a suffix in Hittite with respect to a possible comparison and etymological reconstruction; finally, Matzinger (2008), which is a synchronic overview of Hittite suffixation.

Gusmani (1968: 46) affirms the *vitality* (*vitalità*) (for the use of the life image, see Bauer 2001: 11) of the derivative abstract nouns in *-tar/-t(a)n-*. He also maintains the "great productivity" of verbs derived in *-nu-* from nominal bases (1968: 96). This suggests that Gusmani uses the terms *productivity* and *vitality* as gradual concepts.

Rieken (1999) uses the term *produktiv* (referred to stems, and not to WFRs) in a gradual sense. This emerges clearly, for example, when she claims that *-ātar/-ann-* is one of the most productive suffixes in Hittite (1999, 380), or when she claims that the suffix *-eššar/-ešn-* is very productive and causes similar stems to regularize to it (1999: 404).

A discussion on productivity can also be found in Berman (1977), who uses productivity in a binary sense. In fact, listing the productive Hittite suffixes that derive nouns from verbs, he also lists some suffixes that he identifies as unproductive. However, he does not give a clear synchronic criterion for this statement[1].

Matzinger (2008) is the only one who explicitly discusses the issue of productivity. He correctly considers in the discussion only *secondary lexemes*, i.e., lexemes formed with transparent WF patterns from transparent bases attested in the Hittite corpus (Matzinger 2008: 8). Describing the derivational morphology of Hittite, he presents a list of affixes that he considers productive based on four criteria as elaborated by Panagl (1982) and revised by Casaretto (2004): a) quantitative criterion, b) qualitative criterion, c) grammatical criterion, d) typological criterion. The validity of these criteria will be discussed in more detail in Section 4. The relevant aspect to be noticed for the present discussion is that Matzinger (2008) intends productivity as a gradual concept, with intermediate stages between *Aktivität (for the use of the term activity equated to productivity see Bauer 2001: 12)* and unproductivity. Therefore, even a "weakly productive" suffix can be considered in the synchronic description of Hittite word-formation (Matzinger 2008: 9).

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[1] The formal characteristic that he identifies for productive suffix is that they all begin with <a> (Berman 1977: 238). However, this is an a posteriori observation, not the criterion he used for identifying productive suffixes in the first place.

The criteria and observations made by Matzinger (2008) do not find a place in Hoffner & Melchert's grammar (2008), the contemporary Hittite reference grammar (the derivational morphology sections, however, mainly depend on Melchert 2007). Hoffner & Melchert's grammar contains the claim that in the Hittite lexicon, the only parts of speech presenting "productive patterns of stem formation" are nouns, adjectives, and verbs (2008: 51). They also claim that the list of suffixes they give in their grammar is productive (2008: 52). However, it is not clear how they established if a suffix is productive or not. Moreover, it seems to me that they use productivity both as a gradual concept, stating, for example, that -*ahh*- is a "very productive suffix" (Hoffner & Melchert 2008: 176) and as a binary concept, although they do not explicitly commit to a non-gradual interpretation of productivity. They also use the term in relation to specific suffixes, not to WFRs or processes.

This overview is certainly not complete, but it allows shedding light on some interesting facts: 1) the term productivity is employed predominantly as a gradual concept; 2) it was not always considered a necessary aspect to take into account for a synchronic description of Hittite word-formation; 3) the criteria employed for determining whether a WF process is productive are heterogeneous and not always explicit. The situation is, therefore, perfectly consistent with Panagl's (1982: 225–226) observation that it is common for the term productivity to be employed non homogeneously in different studies, although as a technical term can have important implications on the description of the morphology of a language.

3. Defining productivity

One of the first definitions of productivity in linguistic theory was provided by Shultink (1961: 213):

> By productivity as a morphological phenomenon we understand the possibility for language-users, by means of a morphological process which underpins a form-meaning correspondence in some words they know, to coin, unintentionally, a number of new formations which is in principle infinite (translation by Bauer 2005: 317).

Although criticized in many aspects, this definition still represents the core concept of productivity. However, this concept seems to encapsulate many different aspects of the issue that cannot be necessarily captured under a single label. The heterogeneity of the uses of the concept in the morphological literature demonstrates this. Rainer (1986) resumed in six points the different conceptions of productivity in the literature, that I adapt from Bauer (2001: 25):

1. Frequency of the output words;
2. Frequency of the input category;
3. The proportion of words actually used to the number of words potentially created by a particular process;
4. Possibility of forming new words;
5. Probability of new forms occurring;
6. Number of new forms occurring in a specified period of time.

The general impression from Hittitological literature is that productivity is treated as strictly connected to point (1). In other words, a WFR is productive if we can see a lot of its outcomes. However, the frequency factor is not itself a core aspect in the definition of productivity and there are many counterexamples to it (see Bauer 2001: 20–21, 144–145). Above all, it is essential to keep in mind that a productive WFR can show low frequency for many different reasons. At the same time, a frequent WFR can be unproductive (see, for example, Bauer 1983: 76 on the unproductivity of the suffix -ment in English). A high type-frequency can therefore be considered "the result of past productivity rather than an indication of present productivity (Bauer 2001: 48–49). We can therefore consider the (impressionistic) frequency observations made in Hittitological literature as highly unsatisfactory if we want to assess which WFR was productive in Hittite.

However, none of the points above captures the theoretical core of productivity, which is the potential of a morphological process to be employed to form new lexical items. In a rule-governed view of morphology, this definition of productivity generates several ambiguities, reflected in Rainer's list. Corbin (1987: 42–44) and Bauer (2001) trace back these ambiguities to the two concepts constituting productivity in a rule-governed view of morphology:

availability and *profitability*. The availability of a morphological process is defined as "its potential for repetitive rule-governed morphological coining, either in general or in a particular well-defined environment or domain", while profitability "reflects the extent to which its [of the morphological process] availability is exploited in language use" (Bauer 2001: 211). While interest in availability can be glimpsed in Matzinger (2008), it seems to me that all the considerations about productivity in Hittite as presented above are concerned with profitability instead. This means that availability considerations are somehow taken for granted and are implicitly stated in presenting a list of affixes, which are therefore presented in this way as available. However, the question of availability as a yes/no property should be answered in a more precise and explicit way. This paper will mainly focus on availability, leaving out, for the moment, the problem of measuring profitability.

As already mentioned in the introduction, it is impossible to treat productivity without referring to a specific theory of it. However, many of the questions posed by the concept of productivity are trans-theoretical. I will limit this paper to a rule-governed approach to morphology, and I will assume that speakers have a linguistic competence to which MP pertains. Assuming that many factors at different levels can play a role in defining the details and the contents of this competence, I will distinguish more 'deep' and 'superficial' levels in treating linguistic phenomena with respect to this competence. The competence level must be distinguished from the external language as "institutional system of norms" (Dressler & Ladányi 2000: 104) and from performance. The core aspect of productivity is the potential of creating new words, and can manifest itself at the norm level as type frequency, and at the performance level as token frequency.

Asking in a more general way whether a WFR is available in a given language is, in a certain way, the same thing as asking whether a WFR is in fact a WFR of that given language. Given this definition of availability, it is clear that it must reflect "psychologically real distinctions between available ('living') and unavailable ('dead') processes" (Bauer 2001: 211). However, extinct languages obviously negate the possibility of investigating this aspect with experimental procedures on living speakers. The problem of the *datum* is crucial, and the corpus must therefore be dealt with the maximum care as possible.

4. Theoretical aspects of evaluating productivity in corpus languages

This chapter will address the main methodological and theoretical issues derived from the interaction between the main aspects connected to MP and the written-only attestation of the Hittite language.

The first aspect to consider is the analyzability of complex words. *Analyzability* is intended as the recongnizability of the morphological structure of a word by a native speaker (Bauer 2004 s.v.). I assume in this paper that analyzability is not enough by itself to define productivity: an existing word can be analyzable for a speaker in its internal structure, but still this internal structure may not reflect an existing WFR having the potential to create new words (Bauer 1983: 49). However, analyzability can still be considered a cue for the potential of a WFR. Comprehension and analyzability are crucial in psycholinguistic approaches to WF (see Bauer 2001: 100–124). However, since Hittite is an extinct language, the issue must be faced differently. Analyzability is an operation performed by individual speakers, and in this sense it can be used as a cue for productivity, although it is not sufficient to maintain that a process is productive. Any analysis performed *a posteriori* on a Hittite word by the philologist is therefore useless in this sense and must be avoided: the competence that drives our analyses must not be confused with Hittite speakers' linguistic competence. The approach adopted by the linguist or the philologist in segmenting lexical data is not supported by any native linguistic competence and must face the fact that regularity can also be a property of unproductive rules (Dressler & Ladányi 2000: 105).

This first issue is strictly connected, at least from a methodological point of view, to the issue of semantic regularity. In Lexicalist approaches, "the meaning of a complex word is always compositional when it has been created by a (synchronically) productive WFR" (Scalise & Guevara 2005: 162). However, this semantic aspect of WF is relatively problematic. Apart from the problem of defining a pure compositional meaning, that can be solved assuming more complex models of semantic interaction[2], establishing the exact meaning of a complex word in a dead language like Hittite remains problematic.

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[2] See, for example, the model described by Jezek (2017).

Moreover, the fact that a complex word is idiomatized (i.e., showing a change in semantic content due to lexicalization) does not mean that a speaker cannot form a word with the same process but with a compositional meaning. For example, Italian *ricettazione*, meaning the crime of receiving and dealing with stolen goods, is lexicalized, but *ricettazione*, meaning the act of making a medical prescription, has compositional meaning.

Differently from analyzability, regularity is a non-expected feature in lexicalized items. Bauer (2001: 45) defines lexicalization as "the whole process whereby an established word comes to diverge from the synchronically productive methods of word-formation". Words can undergo semantic lexicalization (also called idiomatization, see Hohenhaus 2005: 359 for a terminological overview), but also phonological lexicalization, following the distinction proposed by Bauer (2001: 45). As a result, "unavailable [...] morphological rules [...] leave multiple residues which are frequently met in synchronic language use" (Bauer 2001: 214). This residual aspect due to lexicalization is particularly problematic for the case of Hittite because of the specific features of the corpus. Since "lexicalization in the diachronic sense is clearly a gradual affair, both diachronically [...] and in the synchronic description of the results of such processes" (Hohenhaus 2005: 356), in a chronologically stratified corpus that appears 'flattened' for accidental causes we can find words that represent different stages of the lexicalization process. The 'flattened' aspect of the Hittite corpus needs some clarification. Hittite language is attested on clay tablets, and it is written in cuneiform logo-syllabic script. Of the 30,000 clay tablets pertaining to the Hittite kingdom, the vast majority comes from a few sites (Hoffner & Melchert 2008: 3). The text corpus is rich enough to allow us to obtain a valuable quantity of linguistic information. Several different textual genres are present in the corpus, although it ultimately appears not to be perfectly balanced (Giusfredi 2023: 18). A chronological division is undoubtedly present, but several issues make it problematic and uncertain in its details. First, many studies argued that the chronological span is more compressed than it was maintained before (e.g., Popko 2007); second, the solidity of paleographic dating methods has been reviewed (e.g. by Weeden 2011); finally, the practice of making copies was not a mechanic activity, and the relationship between paleographic and linguistic aspects with respect to the transmission dy-

namics was complex. All these aspects prevent a precise chronological sub-division of the corpus, and therefore assigning a word-formation process to a specific linguistic phase is far from straightforward.

Also connected to the corpus characteristics is the problem of what can be considered a new word in Hittite. Assuming the potential of creating new words as the core of MP, the creation of new words should be sufficient by itself to define a WFR as productive (Bauer 2001: 21). However, identifying newly created words in Hittite is problematic for several reasons, due to the features of the corpus as described above. Moreover, the creation of new word is sufficient, but not necessary to affirm that a WFR is productive. This means that the absence of attestation of newly created words it is not sufficient to deny the productivity of a WFR. Since Hittite is a *Corpussprache* – although a *Grosscorpussprache* – negative evidence (i.e. any absence of attestatation) must be treated very carefully.

Another problem to face when dealing with productivity in Hittite is attestation. It is necessary to consider the possibility that attestations of a new word are not necessarily to be considered an indication of productivity. As already pointed out in the literature (see Bauer 2001: 56 for an overview), the individual's linguistic behavior in word-formation may not reflect the behavior of the linguistic community. In the case of Hittite, the issue is also exquisitely philological and implies important sociolinguistic aspects: what is an attestation of a form in a text a hint of? Were the forms used in Hittite texts subject to the creativity of the single scribe? Is the scribes' linguistic behavior really representative of Hittite, since some of them maybe were, at a certain time, native speakers of Luwian (Yakubovich 2010: 303–308). Bauer (2001: 57) draws a list of types of words that should not be considered as the result of a productive WFR:

1. Words that appear only in poetic or literary texts;
2. Words that occur only in headlines;
3. Words that appear to be playful formations;
4. Words that appear only in the linguistic production of a single individual;
5. Processes used only for creating technical terms;
6. Words consciously formed;
7. Morphological processes instantiated in a single word.

Many of these points can be criticized, depending on the definition of productivity adopted. Moreover, some of these points are not usable for Hittite, and the remaining must be correctly contextualized. For example, factor (4) is problematic since Hittite textuality as arrived to us consists of copies that are products of scribal schools. Factors (2) and (3) are not really evaluable[3]. For what concerns point (1), it is difficult to draw a distinction between literary and non-literary texts, since, as noted by Francia & Vigo (2024: 49–51) the distinction may not be suitable for ancient cultures. In the case of Hittite, one can do nothing but assume, at least operatively, that the scribal filter in the data somehow reflects the norm level, and that their individual behavior can also reflect competence-related aspects. On this basis, it is possible to consider the occurrence of the so-called *Glossenkeil* to exclude some attestations. *Glossenkeil* consists of one or two oblique wedges preceding the word to which it refers, and, as showed by Yakubovich (2010: 368–395) it seems to be used by Hittite scribes for marking stylistically inappropriate expressions to be replaced in the edited version of the text[4], so that it is possible to regard it as a metalinguistic evaluation made by contemporary speakers/writers over the acceptability of a given form[5].

In conclusion, basic competence-related aspects of productivity are difficult to grasp in a corpus language like Hittite, and a case-by-case analysis that consider both philological and linguistic aspects may be more useful to pursue, as the next chapter will show.

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[3] The so-called *colophons* that can be found in Hittite tablets can be considered, in fact, headlines, since they are paratextual elements that refer to the textual content of the tablet. However, they mainly serve the practical purpose of identifying the tablet, and it is not clear if they always present creative aspects. Similar observations can be adduced for the so-called *labels*, small clay tablets only including roughly the same information that can be found in the colophons.

[4] See also Pisaniello (2020a) for further evidence on this account. For a different interpretation of the function of *Glossenkeil* see Zorman (e.g. 2010).

[5] On the value of metalinguistic judgments for the study of MP in corpus languages see Panagl (1982: 228).

5. Strategies for evaluating morphological availability in corpus languages

In this chapter, I will propose and discuss different strategies and observation that one can adopt as a hint of the availability of a morphological process. These strategies aim to establish if a specific WFR or a more general WF process (suffixation, prefixation, composition, etc.) is present (i.e., available) in Hittite.

The most relevant attempt to formulate possible strategies useful to identify productive WF processes in corpus languages is by Panagl (1982). He suggested four criteria:

1. Quantitative criterion (*quantitatives Kriterium*);
2. Qualitative criterion (*qualitatives Kriterium*);
3. Grammatical criterion (*grammatikalisches Kriterium*);
4. Typological criterion (*typologisches Kriterium*).

In this chapter, I will only discuss non-quantitative criteria. The criteria proposed by Panagl (1982) have been followed by Matzinger (2008), adapting them to the corpus dimension. The definition of these criteria are problematic for several reasons. First, Panagl's qualitative criterion is fundamentally coincident with semantic compositionality and opposed to lexicalization. The problem, as discussed in the previous chapter, is that this is a core aspect of MP that is not directly appreciable in corpus languages, unless one accepts a certain degree of lack of precision. The weaker point of this criterion remains, as noted by Casaretto (2004: 213), that also lexicalized complex words can be semantically transparent, so semantic compositionality remains a necessary but not sufficient condition for productivity.

Panagl's grammatical criterion is based on observations about grammaticalization: if we find in a later stage of a language that a derivational suffix grammaticalized into an inflectional suffix, then that suffix must have been productive. This observation is based on the idea that inflection is characterized by being more productive than derivation (Aronoff & Fudeman 2005: 161), and therefore "in this process their productivity is increased" (Wischer 2011: 364). However, it is important to consider that inflection can be regarded as more productive than derivation only if one considers profitability, while if one takes into account availability it makes no sense to talk about major productivity in inflection. This criterion can still be useful, as long as

the language attestation allows us to use it. In fact, only a sufficiently long time-span makes it possible to observe this process. Moreover, since grammaticalization processes are not obligatory, their attestation may be numerically limited or completely absent even though having a sufficiently late attested phase. This is even more evident if we consider that not every affix can grammaticalize into an inflectional one, but only the ones with an enough abstract meaning, as observed in typological studies (Wischer 2011: 361). Finally, on must consider that the distinction between inflection and derivation it is not always clear, and many theories struggle to clearly define it. A possible example of this derivational-to-inflectional transition in Hittite is represented by the so-called *ergative case*[6]. As illustrated by Goedegebuure (2018) and Luraghi and Inglese (2022), it seems plausible to think that the suffix *-ant-* behaved derivationally in Old Hittite, while the data from New Hittite seem to suggest that it should be considered an inflectional marker.

Finally, Panagl's typological criterion is the "extrapolation (as by analogy) from a representative sample of genetically unrelated modern languages to corresponding phenomena in corpus-laguages" (Panagl 1987: 131). Given this definition, it seems to me that Panagl's grammatical criterion could be considered a sub-type of the typological criterion. In exemplifying the typological criterion, he specifically discusses hierarchies of productivity in types of word formation. However, other observations can be included in this criterion. For example, one could consider predictions about head position. If the observation that class-changing morphology of a language can be only right- or left-headed is correct (Bauer 2005: 322), which is probably connected to Bybee *et alii* (1990: 30) claim that "V[erb]-final languages exhibit a very strong postposing tendency which leads to their preponderance of suffixes"[7], one should not expect productive left-headed class-changing morphology in Hittite. The nature of the typological approach remains, however, probabilistic, and it does not allow making strong claims about the productivity of a WFR.

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[6] On this topic, see Rizza (2014), with further references.

[7] See Luraghi (2017: 274) for the OV character of Hittite. However, the morphological universal about the connection between verb position and suffixation represents a tendency more than a real universal (Gaeta 2005, 13).

In this paper I will therefore abandon Panagl's classification, and I identify instead two levels of analysis, the *linguistic level* and the *philological level*, that correspond to two different class of hints in order to evaluate morphological availability. Both are to be intended as evidence for the main surfacing characteristics of MP as described in the previous chapter: the creation of new words, semantic compositionality, and analyzability. In general, all the evidence that it is possible to collect based on these criteria depends on the assumption that "the more productive a mechanism is, the easier it can be used in production, reception, evaluation" (Dressler & Ladányi 2000: 127). The linguistic class of hints relies on linguistic factors, therefore mostly depending on the theoretical view adopted; the philological class of hints relies on philological strategies and is therefore mostly limited to Hittite scribal and cultural practices. Since, as schematized in Figure 1, philological strategies can be both used as hint for linguistic strategies and core characteristics of MP[8], a clear distinction of the two classes in the organization of the present discussion may not be helpful.
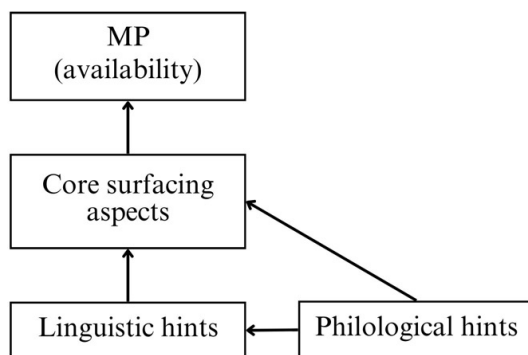

Figure 1: schematization of the relation between hints and productivity

[8] Generally speaking, a philological hint directly points to core surfacing aspects when writing practices seem to directly reflect them, like in the case of morphography in phonetic complementation, that directly suggests word analyzability (see paragraph 5.5), or in the case of hapaxes attested in lexical lists, that show the creation of new words (see paragraph 5.6). A discussion of a philological hint pointing to a linguistic hint can be found in paragraph 5.1, in which the use of Glossenkeil for identifying borrowed bases is discussed.

The criteria I am going to formulate are not all the possible criteria applicable to a corpus-language, but only the ones I think can be adopted for Hittite. It must be emphasized that these criteria give positive evidence, but not negative one. This means that a WFR for which no hint can be found in the corpus may have been productive as well.

Philological criteria depend on the specific characteristics of a written corpus. The transmission, conservation, the writing practices and, above all, the writing system (comprehensive of structural characteristics and arbitrary conventions) are specific of a given culture, and the generalization (or the simple transposition) of these methodologies to other writing traditions can be admitted only when their characteristics are largely overlapping and reasonably comparable.

For what concerns linguistic criteria, every morphological theory makes predictions on what can happen in and what pertains to morphology, what we should or can expect and how we can describe it. In this paper, I will assume as valid some intuition and formal representations of the Lexicalist framework (see Scalise & Guevara 2005), that can be found, however, also in other theories. However, I will also adopt typological and extralinguistic observations, maintaining them as complementary to the linguistic theory adopted as reference. In the context of Natural Morphology, Dressler & Ladányi (2000) developed a hierarchy of grammatical productivity criteria of WFRs that I will propose in this paper as the main guide for identifying linguistic hints. However, the hierarchy of Dressler & Ladányi (2000) is based on the idea that productivity is gradual in nature. I will instead "flatten" this hierarchy, treating it simply as a list of derivational situations to be discussed, since the focus of this paper is availability only.

5.1 Derivation from loanwords

Being the potential of creating new words the core property of MP, the derivation of a new word from a loaned word can be certainly considered a good hint of the availability of a certain WFR. This aspect is contained in points (a) and (b) of Dressler & Ladányi's (2000) hierarchy. Point (a) is represented by the application of a WFR to non-adapted loanwords that have non-fitting characteristics with respect to the ones required by the WFR. Point (b) comprehends

the cases of non-adapted loanwords that have fitting properties with respect to the applied rule. An example of (a) is Italian [ˈstaʒ] → [staˈʤista], while an example of (b) is Italian [ˈstandard] → [standardiˈʣːare]. In Dressler & Ladányi's (2000) hierarchy, (a) is a hint of major productivity compared to (b). To my knowledge, however, there is no case in the Hittite corpus that allows to make such a distinction in derivatives from loanwords, especially considering the fact that the written rendering makes it almost impossible to make any precise phonetic observation (see Albano Leoni 1977 for a discussion about epistemological and methodological issues of using written data).

However, it remains still necessary to consider the status of language contact in second millennium Anatolia (for a systematic and up-to-date overview see Giusfredi et alii 2023) in order to consider and evaluate the foreign elements in Hittite, that is in fact mostly a philological issue. The factors to be considered for determining how to identify and evaluate the foreign elements in the Hittite lexicon are: a) the time the word entered in Hittite; b) the language the word has been loaned from; c) the way the word entered in Hittite. Considering factor (a), it is necessary to exclude loanwords deriving from contact situation happened before the historical Hittite phase (see Matessi & Giusfredi 2023: 77–81). Considering factor (b), it is important to carefully consider the difference between loanwords from other Anatolian languages and loanwords from non (strictly) related languages. The issue is connected to factor (c). Considering factor (c), one should distinguish, following Pisaniello & Giusfredi (2023: 356), "1) the languages and cultures that were in synchronic direct or almost direct contact with Hittite [...] and 2) the languages and cultures of the wider ancient Near East and Mediterranean region". The distinction, as underlined by Pisaniello & Giusfredi (2023: 350–351), can be expressed in terms of synchronically and directly borrowed loanwords versus mediated loanwords, including *Wanderwörter.* Referring to factor (b), one could expect that non-related languages borrowings may be more directly employed as a hint. However, some of these loanwords from non-related languages may be entered in Hittite through the mediation of other languages potentially related to Hittite, and therefore these loanwords may have been already undergone an adaptation process to a language closer to the Hittite system.

The network of languages that directly borrowed lexical material to Hittite is represented in Figure 2.
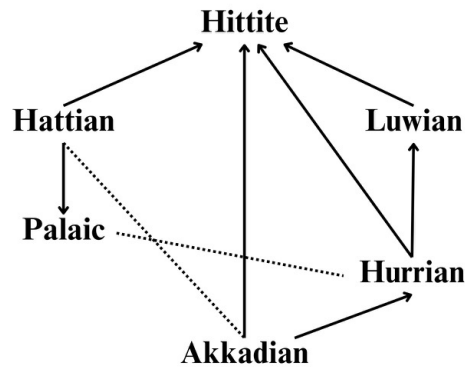

Figure 2: contact relations between Anatolian Languages
(adapted from Pisaniello & Giusfredi 2023: 359).

Other languages were instead involved in indirect borrowing, and therefore the loanwords that it is possible to assign to these scenarios are more difficult to evaluate. Table 1 presents a synthesis of the characteristics considered with respect to Hittite.

	Contact scenario		Language relation		
	direct	indirect	Strictly related (Anatolian)	Indo-European	non-related
Hattian	•				•
Palaic	•		•		
Luwian	•		•		
Hurrian	•	•			•
Akkadian	•	•			•
Sumerian		•			•
Mittani Indo-Aryan		•		•	
Mycenean		•		•	
Egyptian	(•)	(•)			•

Table 1: contact scenario and linguistic relatedness of languages in contact with Hittite

Given this overview as an assumption on the languages that it is methodologically possible to look at, it is then necessary to face the actual attestation in the Hittite corpus and the relative difficulty in identify possible loanwords and derivatives.

For example, while lexical interference between Palaic and Hattian seems to be clearly attested, "the relationship between Hattian and Hittite appears complex and is probably underrepresented in the available corpora" (Pisaniello & Giusfredi 2023: 364). Akkadian lexical interference is surely more represented in Hittite corpus, but the nature of its presence is complex and must be carefully considered. Following Pisaniello & Giusfredi (2023: 370), the methodological aspects relevant in considering Akkadian loanwords are: 1) determining if an apparently Akkadian loanword is really Akkadian, both considering etymology and the attestation in "chronologically appropriate Akkadian texts"; b) the variety of Akkadian; c) the directness or indirectness of the borrowing; d) distinguishing loanwords and Akkadograms. Given these premises, some examples[9] can be individuated:

1) Akk. *aršānu* "barley-groats" > Hitt. ᴱ*arzana-/aršana-* "inn" → Hitt. *arzanala*[10] "innkeeper"
2) Akk. *qurpiššu/quršippu* "helmet" > *$gurzip(p)i$-* → Hitt. *gurzipant-* "helmet wearing"
3) Akk. *tuppum* "clay tablet" > Hitt. *tuppi-* "id." → *tuppiyant* "id."

Example 1 is a derivation from a very likely direct loanword from Akkadian (Pisaniello & Giusfredi 2023: 374), and can be used as a solid hint for the productivity of the rule $[[X]_N + ala]_N$ deriving agent nouns. Example (2) shows the availability of the rule $[[X]_N + ant]_{Adj}$. Example (3) shows the availability of $[[X]_N + ant]_N$ deriving names of the common class from the neuter class (also called ergative case if viewed as an inflectional markers).

Some Akkadian words entered in Hittite through Hurrian mediation (Dardano 2018: 350), and several other loanwords are ambiguous in this sense, so that it is not possible to decide if the borrowing is direct or not (Dardano 2018: 356; Pisaniello & Giusfredi 2023: 373). However, since Hurrian and Akkadian are equivalent with respect to the classification proposed in Table 1, the distinction is not relevant for the present discussion.

Derivation from loanwords from other Anatolian languages may be considered less decisive in determining MP, given the structural similarity between the two languages. However, the use of *Glossenkeil* may be a hint that the difference was perceived by scribes.

4) Luw. *nakkušša/i-* "substitute, scapegoat" > Hitt. *nakkušatar* "status of a scapegoat"

Example (4) shows that a derivative from a borrowed Luwian base can suggest the productivity of $[[X]_N+atar]_N$.

5.2 Derivation from abbreviations

Point (b) in Dressler & Ladányi's hierarchy (2000: 122–123) concerns derivation from indigenous abbreviation and acronyms. Acronyms are completely absent in Hittite corpus, and plausibly they were not used in Hittite textual tradition at all. Abbreviations can be found, for example, in oracular texts as "writing solutions used to shorten the most common and repeated technical terms and to arrange the oracle reports in the available space on the tablets" (Warbinek 2019: 137). As a mere shortening expedient in handwriting, there is no attestation of derivatives from these abbreviations.

5.3 Competing rules

Point (d) in Dressler & Ladányi's hierarchy (2000) suggests that the shift of a derivative from one WFR to another one attests the recessive state of the former and the major productivity of the latter. This criterion presents several difficulties. First, it requires a clear vision of the diachrony of the derivative in the corpus. Secondly, competition of WFRs may be determined by several variables other than productivity as defined in this paper. A clear case may be *-ške-* imperfective suffix, that sometimes, and only in post-Old-Hittite texts, derives

imperfective verbs attested in earlier documents as derivatives in *-anna-* or *-šš*(*a*)- (see Pisaniello 2020b: 142–148 for discussion and exemplification).

5.4 Derivational chains

As proposed by De Bernardo Stempel (1999: 65), derivational chains[11] can be employed in order to evaluate the productivity of a suffix. The application of rules to newly formed words represents a more convincing evidence for rule productivity than the application to old words (Dressler & Ladányi 2000: 129)

> 1) *eš/aš-* "to sit down" → *e/ašant-* "sitting" → *ašandul* "occupation force, garrison" → *ašandulatar* "garrisoning"
> 2) *haštai/hašti-* "bone(s); (metaphorically) strength" → *haštili*(*a*)- "brave, heroic" → *haštiliatar* "heroism, bravery"
> 3) *išpant-* "to libate" → (DUG)*išpantuzzi-* "libation-vessel" → LÚ*išpantuzziala-* "libation bearer"
> 4) *talugai-* "long" → *daluknu-* "to lengthen" → *daluknul-* "lengthening"

However, the circularity of the argumentation is evident: the identification of a newly formed word means establishing that this word was formed with a WFR that was available in a not-so-remote stage of Hittite (that is the very point of this paper). This is especially true for Hittite, since it is difficult to precisely restore the underlying chronological complexity of its corpus.

As noted by Dressler & Ladányi (Dressler & Ladányi 2000: 124), a distinction can be made with derivatives from non-attested complex words. The fact that a base of a WFR can also be a non-existent word has been called *overgenerating morphology (see Scalise 1986 for an overview)*. Methodologically, individuating this kind of coinages partly relieves from the hard work of distinguishing between an already existing and accepted complex word and a newly formed one. However, due to the nature of Hittite corpus, the value of being excluded from attestation is completely different, i.e. one cannot exclude that an absence in the attestation equals to an absence in the norm. Some reliable examples may come from converted bases.

> 5) *anna-* "mother" → *anniyatar* "motherhood"

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[11] Hyperderivatives in De Bernardo's terminology.

Example (5) maybe presupposes a verbal base *anniya/e-*, which is not attested. However, this example could be interpreted as a derivative in *-atar* from a Luwian base *anni-* or Hittite *anni-* with a graphic glide -y-.

5.5 Phonetic complementation as a transparency hint

Hittite scribal use of heterography[12] presents certain aspects that could be used as philological hints for evaluating morphological availability. In particular, I want to explore the cases in which phonetic complementation involves derivational suffixes. Phonetic complements are syllabic signs employed by scribes in order to give a phonetic hint for identifying the Hittite word underlying a Sumerogram (or, more rarely, an Akkadogram, Hoffner & Melchert 2008: 433). The hint may serve lexical (identifying the correct lexeme) or grammatical (identifying the correct inflected form) disambiguation purposes. Scribes, using these phonetic complements, do not always follow a phonologically minimalist logic, but sometimes consider morphological information too, for example in the case of verbs (Busse 2013: 93). I suggest that when the phonetic complementation presents a number of syllables major to the minimal number required for phonetic disambiguation, this may be a hint for perceived morphological transparency for the writers.

For example, at least observing the data in Fagiolo (2023), *-atar* derivatives are never complemented with *-ar*, but always with at least *-tar* or with a vowel *-Vtar*. However, a more systematic analysis of the phonetic complementation from this point of view is still to be done, and none of the existing linguistic and philological instruments allow for a rapid and at the same time trustable verification of this hypothesis. This observation is also complicated by several factors. For example, the use of complements oscillates in diachrony and seems also depend on the word class (Busse 2013: 92). Moreover, the choice of a syllabic sign may depend on writing brevity or minor complexity (Pisaniello 2022). Concluding, only a systematic study of phonetic complementation in Hittite will demonstrate if this could really be used as a transparency hint.

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[12] See Kudrinski & Yakubovich (2016) for an up-to-date terminological discussion on heterography in Hittite.

5.6 Derivatives in translation: lexical lists and *hapax legomena*

The *hapaxes* in the Hittite corpus must be considered carefully. Differently from living and highly documented languages, the likelihood that the Hittite corpus is representative of the Language is sensibly lower. This means that a *hapax* in the Hittite corpus does not necessarily reflect a scarcely occurring word in language usage (Palmer 2008: 236–237): the corpus is too small to allow us to say that. However, if we find a case in which it is certain that the *hapax* is attested in a 'forced' context, the chances that it is an ad hoc formation increase. This is the case of lexical lists, where some attested words are in fact complex words not attested elsewhere (Pozza & Fagiolo 2023: 182). Pozza & Fagiolo (2023) identify, for example, different derivatives in *-war* that are attested only in lexical texts. Of the different cases identified in the literature (see also Scheucher 2012), I am interested here only in derivatives that it seems plausible to assess that were formed for a specific aim, in this case translation. For example, the verbal noun *kaniniyawar*, derived from the verb *kaneniye/a-*, is attested only in a lexical list (KBo I 42 II 43 e 45), translating Akk. *ganāšu*. Kloekhorst (2007: 434) observes that

> This verb [i.e. *kaneniye/a-*], which has not been preserved in other IE languages, was almost completely lost in Hittite as well, apart from the participle *ganenant-* 'bowing'. In NH times, when a verbal noun was necessary to gloss Akk. *ganāšu* 'to bend', an ad hoc formation *kaniniyauwar* was secondarily created.

Concluding, a careful consideration of lexical lists can provide a philological strategy for identifying the availability of a WFR.

6. conclusions

The productivity (considered only in its availability aspect, i.e. as a yes/no property of a WFR to have the potential of creating new words in a synchronic stage of a language) hints presented in this paper aim to give a methodological answer to the epistemological problem of what we can consider a WFR of an extinct (i.e. without descendants) corpus language. Having a methodological guide of this kind can help to distinguish linguistic realities from *a posteriori* interpretations of lexical items. Bad data characterizing historical linguistics

impose a reflection that encompasses both linguistic and philological issues. The analysis of derivatives from loanwords, of derivational chains, and of competing rules seem the most reliable linguistic hints, while solely philological hints such as the analysis of *hapaxes* in lexical lists, and morphography in phonetic complementation, although apparently promising, seem to require more systematic study before they can be used for the study of morphological productivity in Hittite.

As noted by Varvara (2019: 189), availability is only of marginal interest for modern productivity research, that in fact is moving the focus on quantitative aspects, investigating profitability (see, for instance, the empirical investigation by Gaeta and Ricca 2003). This aspect, however, is difficult to study for smaller corpora. As observed in Palmer (2008: 236–237), smaller corpora tend to have an exaggerated number of hapaxes; moreover, they can have gaps that may hide the presence and the frequency of a WFR in a specific phase. Although some methodologies have been developed in order to try to investigate these quantitative aspects in smaller and limited corpora, a serious and specific reflection on Hittite corpus characteristics is needed before starting such an attempt. It must also be noted that a digital annotated corpus complete enough to serve this purpose is still lacking[13].

However, a consideration about WFRs availability in Hittite is still relevant for several reasons, and it is an unavoidable issue in dealing with morphology and word-formation in Hittite. First, it is an aspect that should be the basis of every (synchronic) study of Hittite word-formation. Second, identifying productive WFRs can help to better reconstruct the Proto-Anatolian phase, suggesting that lexicalized but parsable complex words were formed with a productive WFR in a previous and non-attested linguistic phase (i.e. Proto-Anatolian or a non-attested Hittite phase). Trying to individuate what is productive and what is not, still distinguishing a PIE phase from an Anatolian one, can help us to identify changes in productivity. Changes in productivity can have great consequences on the word formation system of a specific language. As summarized by Scherer (2015: 1786–1787), a change in productivity can lead to a reassessment of the scope of other WF processes or rules. This,

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[13] The text corpus TLHdig on the HPM, although very promising, is still an ongoing project.

for example, can help us shade light on the behavior of various competing suffixes in Hittite.

In conclusion, the paper suggests that an explicit theory of MP is always required in order to discuss these morphological aspects not only for Hittite, but for any other corpus language. However, it also emphasizes the importance of a critical reflection on the limits imposed by data available for corpus languages with respect to the aims of the theory adopted.

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