

Using digital resources to study semantics and word formation in a historical language: FEAR and TREMOR in the Latin WordNet and Word Formation Latin

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Abstract

The paper aims to show how the semantics and word formation of an historical language like Latin may be investigated by means of digital resources. We focus on words pertaining to the semantic field FEAR and study them using the Latin WordNet and Word Formation Latin. We describe and analyze how these lemmas' semantics patterns with their morphology, and which relations occur between them.

1 Introduction

The combined study of semantics and morphology can be greatly enhanced by using digital resources developed by computational linguistics. For Latin, two resources appear to be particularly useful to this purpose: the Latin WordNet (LWN) and Word Formation Latin (WFL). The former is a lexical resource which represents the lexicon in a relational way and “is built around the idea of synonymy in the broad sense” (Mambrini et al. 2021: 17). Originally created by translating English and Italian data into Latin within the MultiWordNet framework (Minozzi 2008), the LWN has been refined, extended, and further developed first within the ERC project “LiLa: Linking Latin”¹ and now within the PRIN 2022 project “Linked WordNets for Ancient Indo-European languages”.² In the LWN, word senses are associated to lexical entries as synsets, i.e. sets of cognitive synonyms,

each expressing a distinct concept, so “that [the synonyms within a synset] are interchangeable in some context without changing the truth value of the proposition in which they are embedded”.³ The process of annotation in LWN consists in the association of lemmas with the synsets of the Princeton WordNet (PWN; Fellbaum 1998) that can best represent the senses of each Latin lemma; by using synsets from the PWN, the LWN can take advantage of information that is already available in the PWN, such as the lexical domains to which each synset belongs (e.g. synsets dealing with feelings like fear belong to the lexical domain Emotion). As for Word Formation Latin (Litta et al. 2019), it is a derivational morphology resource for Classical Latin, where lemmas are analyzed into their formative components, and relationships between them are established on the basis of Word Formation Rules.

The aim of this paper is to argue for the use of the LWN for investigations that focus not only on the semantics of Latin, but also on its word formation processes. In our study, we show that a WordNet-based analysis allows us to identify semantic affinities and differences between words, while a WFL-based analysis helps us explore how meanings pertaining to different lexical domains seem to pattern according to word formation.

¹ <https://lila-erc.eu>.

² <https://sites.google.com/unipv.it/linked-wordnets/home-page?authuser=0>.

³ Quoted from the glossary of the Princeton WordNet: <http://wordnet.princeton.edu>.

The semantic field chosen for this pilot study is that of FEAR⁴ in the lexical domain of Emotion. As detailed in Section 2, we find FEAR to be a concept with close (arguably trivial) links to other concepts belonging to different lexical domains, such as the concepts for TREMOR in the domains Body and Motion (due to the trembling and visible movements of the body that the sentiment of fear can induce). As described in Section 3, the manual annotation of selected lemmas from a specific semantic field allowed us to identify a specific pattern of polysemy, as well as to analyze this pattern from the perspective of word formation processes. The results are summarized in Section 4.

2 Annotation of the semantic field FEAR in the LWN with the aid of WFL

Many words related to the semantic field of FEAR are attested in Latin. The lemmas initially selected for the annotation task are listed in Table 1. This first selection was grounded on the information provided by standard Latin dictionaries of synonyms (e.g. Döderlein 2010), but further words not listed by these dictionaries were also selected for annotation, whereas other words were excluded even if listed in the dictionaries (e.g. *vereor*, whose semantics seems to be closer to the concept REVERENCE than to FEAR, being used when someone does not wish something to happen or to indicate respect for another person, usually someone with some kind of authority, rather than to refer to actual fear and dread).

Lemma	Meaning ⁵	Part of Speech
<i>formido</i>	‘dread’	Noun
<i>horreo</i>	‘to stand on end, to be terrible’	Verb
<i>metus</i>	‘fear’	Noun
<i>paveo</i>	‘to be struck by fear’	Verb
<i>terreo</i>	‘to struck’	Verb
<i>timeo</i>	‘to fear’	Verb
<i>tremo</i>	‘to quiver’	Verb

Table 1: Lemmas initially selected for the LWN annotation task.

The selection was then expanded by taking into consideration not only the single FEAR lemmas, but their entire derivational families. We used WFL to

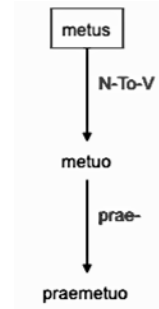


Figure 1: Derivation graph of *metuo* ‘fear’ in WFL.

extract all derivatives of each lemma, e.g. for the noun *metus* ‘fear’ we extracted the denominative (N-To-V) verb *metuo* ‘to fear’ and the prefixed verb *praemetuo* ‘to fear beforehand’ (Figure 1).

The extraction provided us with a total of 141 lemmas, which were then semantically annotated in LWN and associated with a total of 518 synsets from PWN. The annotation resulted in 39 lemmas sharing two or more common synsets, and 41 lemmas associated with synsets pertaining to quite different lexical domains, namely Emotion, Body, and Motion.

The analysis that follows focuses on word families whose members are often annotated with synsets linked to both concepts FEAR and TREMOR, as our data allow for the identification of a frequent and close link between the two. This seems to be the case for the verbs *horreo*, *paveo*, and *tremo*, as well as for most of their derivatives, for a total of 41 lemmas (Table 3 in the Appendix). As for *formido*, *metus*, *timeo*, and their derivatives, they do not attest this polysemy pattern, and thus lie beyond the scope of this analysis.

In what follows we briefly describe the three synsets that are most relevant to this study (Table 4 in the Appendix), evoked by words associated with the concepts FEAR, TREMOR, or both.

2.1 Synset 201784021

The definition of this PWN synset is “be afraid or scared of; be frightened of”. It pertains to the PWN lexical domain of Emotion and denotes primarily the state of BEING AFRAID (OF). It is well suited for the meaning of the verbs *horreo*, *paveo*, *tremo*, and of several of their derivatives. Its pairing with lemmas from the *tremo* derivational family is particularly interesting here, given that the primary

⁴ Small capitals are conventionally used in the paper to mark semantic concepts in general and, for practical purposes, used as shortcuts in place of complex synset IDs or synset glosses.

⁵ Meanings of Latin lemmas are taken from Lewis and Short (1879) and Glare (2016).

sense of *tremo* mainly denotes a type of motion (see below) and not necessarily an emotion. A total of 16 lemmas have been annotated with this synset.

2.2 Synset 200014027

The definition of this PWN synset is “move with or as if with a tremor”. It pertains to the PWN lexical domain of Body and it is always associated with the derivatives of the verb *tremo*, as it denotes the act of TREMBLING. It is also associated with a number of derivatives of *horreo* and *paveo*, to denote the physical TREMOR that is often linked with FEAR. A total of 19 lemmas have been annotated with this synset.

2.3 Synset 201892939

The definition of this PWN synset is “tremble convulsively, as from fear or excitement”. Its PWN lexical domain is Motion, and it may thus denote the act of TREMBLING FOR FEAR. This synset is associated with derivatives of all three verbs, and may thus be considered a link between the previous two synsets. A total of 19 lemmas have been annotated with it.

3 Semantics and word formation: FEAR, TREMOR, and the -sc- suffix

The three synsets above, henceforth labelled BEING AFRAID (OF) (2.1), TREMBLING (2.2), and TREMBLING FOR FEAR (2.3) respectively, co-occur in the LWN annotation of several lemmas, which may thus be described as polysemous.

In many cases all three synsets appear to be associated with the same lemma. Out of 22 polysemous verbs that are annotated with at least two of these three synsets, a total of 15 lemmas attest all three of them: *horreo*, *paveo*, *tremo*, and 12 of their derivatives (listed in Table 2). More than half of the latter (8; underlined in Table 2) are -sc- verbs, which are currently regarded to be dynamic/intransitive counterparts of stative/transitive base verbs or inchoative verbs referring to the beginning of a situation (Budassi et al. 2019: 240). Furthermore, in 6 of these lemmas, the -sc- suffix is combined with a preverb as well.

As for the 7 polysemous verbs taken into account that are not associated with all three synsets in the LWN, they can either be exclusively prefixed (*adhorreo*, *inhorreo*, *contremo*, *praetremo*, *intremo*) or both prefixed and suffixed (*cohorresco*, *intremesco*). The 2 verbs derived

exclusively through the -sc- suffix (*horresco*, *tremesco*) are instead both characterized by this polysemy.

Base	Derivative
<i>horreo</i>	<i>abhorresco</i> , <i>exhorreo</i> , <i>exhorresco</i> , <i>horresco</i> , <i>inhorresco</i> , <i>perhorreo</i> , <i>perhorresco</i>
<i>paveo</i>	<i>pavito</i>
<i>tremo</i>	<i>attremo</i> , <i>contremesco</i> , <i>pertremisco</i> , <i>tremesco</i>

Table 2: Bases and derivatives that attest the triple polysemy.

In the case of the derivatives of *horreo*, verbs with the suffix -sc- seem to be those that best attest the triple polysemy (5 out of 8) – the highly polysemous verbs *horresco*, *abhorresco*, *exhorresco*, *inhorresco*, and *perhorresco* are all formed through this suffix –, but the same triple polysemy is also found with *exhorreo* and *perhorreo*, 2 verbs that are derived exclusively through a preverb. Given that their base *horreo* is a dynamic verb that already attests the triple polysemy, it is not surprising that the latter so frequently occurs among its derivatives. It must be noted, however, that 2 derivatives of *horreo* (*adhorreo*, *cohorresco*) do not seem to attest it.

As for *paveo* and its derivatives, no -sc- verbs from this derivational family seem to attest this polysemy. According to WFL, *paveo* has 3 -sc- derivatives (*pavesco*, *compavesco*, *expavesco*), but each of them has been annotated exclusively with the synset for BEING AFRAID (OF). This is exactly paralleled by *timesco* ‘to fear’, which, although a -sc- derivative, does not attest any TREMBLING sense, most likely because its base verb *timeo* did not have any semantic trait related to movement. Correspondingly, the -sc- derivatives of *paveo* may have been created when their base had not yet acquired any dynamic TREMBLING senses (like *timeo*), as opposed to the *horreo* derivatives, for which the TREMBLING sense may have been the primary one.

This may indeed be the case for *tremo* and its derivatives, which seem to often attest this polysemy, especially when they present the -sc- suffix (*contremesco*, *pertremisco*, *tremesco*), but also without it (*attremo*), perhaps because their (already polysemous) base *tremo* was a verb with a primary dynamic sense TREMBLING in the first place. According to Haverling (2000: 51), “the

suffixed verb indicates that something trembles at something, i.e. when something happens [...], whereas the unsuffixed verb describes the action more generally”; our data, however, does not seem to allow for this generalization, as both the base verb and its *-sc-* derivatives attest the polysemy.

The presence of a prefix, although very frequent in our list of verbs, does not seem to be the most frequent trigger of the triple polysemy. If the latter’s triggering factor did involve word formation, it may rather have been the *-sc-* suffix, as exemplified by the verbs *adhorreo* and *horresco*, ultimately both derived from the highly polysemous *horreo*. The prefixed verb *adhorreo* simply means ‘to shudder’ and has been annotated with the synsets for TREMBLING and TREMBLING FOR FEAR, while *horresco* may mean ‘to be frightened of’, ‘to shudder’ and ‘to shake with fear’, and has thus been annotated with all three synsets for BEING AFRAID (OF), TREMBLING, and TREMBLING FOR FEAR. The fact that the polysemy of *horreo* is retained by *horresco* may thus be linked to the presence of the *-sc-* suffix, as opposed to its lack in *adhorreo*.

A further interesting case is that of *contremo*, mentioned above as one of the 4 prefixed verbs that do not attest the triple polysemy, whose *-sc-* counterpart *contremesco*, however, actually does attest all three synsets. In general, among the 22 polysemous verbs analyzed here, the only derivational category (however small) that always attests the triple polysemy seems to be the one consisting of the two non-prefixed *-sc-* verbs, *horresco* and *tremesco*.

In brief, our data seem to support the impression of a link between the *-sc-* suffix and the attestation of all three synsets BEING AFRAID (OF), TREMBLING, and TREMBLING FOR FEAR. It must be noted, however, that a few verbs that are both prefixed and *-sc-* suffixed (e.g. *cohorresco* ‘to shake’ and *intremesco* ‘to tremble’) do not attest the triple polysemy, prompting the question if in such cases the presence of a prefix may have neutralized the effect of the *-sc-* suffix.

4 Conclusions

The origin of the triple polysemy discussed in this paper is most likely to be traced back to the close and visible link between the act of BEING AFRAID (OF) and that of TREMBLING in human experience, which ultimately combine in TREMBLING FOR FEAR. This association may sound trivial to our

ears; however, the co-occurrence of these three synsets is not attested in the LWN anywhere outside of the derivational families taken into account here, namely those of *horreo*, *paveo*, *tremo*, and their derivatives. Within the FEAR semantic field, no further LWN lemmas show such a constant and precise connection between FEAR and TREMOR. For instance, at least 3 further LWN lemmas – *mico*, *moveo*, *trepido* – may be annotated with at least one of the three synsets discussed here, but none of them (or their derivatives) attests traces of this triple polysemy.

As noted above, quite often the verbs that attest the triple set of synsets are either *-sc-* derivatives or derivational bases of such verbs. It may thus be worth noting that, according to WFL, the verb *mico* ‘to quiver’ does not attest any *-sc-* derivatives (but it attests prefixed derivatives such as *praemico* ‘to glitter very much’), and the same is true for *moveo* ‘to move’ or *formido* ‘to fear’. A connection between the *-sc-* suffix and the triple polysemy discussed here may thus be worth being pursued further in future studies, which may investigate if the derivation through this suffix could indeed have been a triggering factor for the broadening (or the retaining, as in some cases above) of the synsets associated to each lemma.

This study has shown some possibilities of an analysis of a historical language that is based on digital resources like LWN and WFL. The inquiry conducted through the annotation in LWN of synsets associated to Latin bases and derivatives belonging to specific derivational families (collected through WFL) may help us detect quite consistent patterns. We have found that words related to the semantic field of FEAR are more likely to become – or remain, if their bases already were – polysemous when they are derived through the suffix *-sc-*, as this kind of derivation (at least when it is not combined with prefixation) is the only one that consistently attests the triple polysemy described above. Even though the association of these three concepts (BEING AFRAID (OF), TREMBLING, and TREMBLING FOR FEAR) is obviously grounded in human experience, it does not occur frequently outside of the specific lexical families discussed here.

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<i>exhorresco</i>	to tremble or shudder exceedingly, to be terrified
<i>horrentia</i>	a shuddering, horror
<i>horreo</i>	to stand on end
<i>horresco</i>	to tremble or shudder greatly at
<i>horrifer</i>	that brings trembling or terror
<i>horrificus</i>	that causes tremor
<i>horripilation</i>	a bristling of the hair
<i>horripilo</i>	to bristle with hairs, be shaggy
<i>horror</i>	a standing on end a terror
<i>inhorreo</i>	to stand on end
<i>inhorresco</i>	to send forth sharp points to tremble
<i>intremefactus</i>	shaken
<i>intremesco</i>	to tremble
<i>intremo</i>	to tremble
<i>intremulus</i>	shaking
<i>paveo</i>	to be struck with fear
<i>pavidus</i>	trembling, quaking
<i>pavatio</i>	a trembling
<i>pavito</i>	to tremble or quake with fear
<i>pavor</i>	a trembling
<i>perhorreo</i>	to tremble or shudder greatly at
<i>perhorresco</i>	to tremble or shudder greatly
<i>pertremisco</i>	to tremble greatly at
<i>praetremo</i>	to tremble beforehand
<i>tremebundus</i>	trembling
<i>tremefacio</i>	to cause to shake
<i>tremesco</i>	to begin to shake
<i>tremidus</i>	trembling
<i>tremipeda</i>	with trembling feet
<i>tremo</i>	to shake, quake
<i>tremor</i>	a shaking
<i>tremulus</i>	shaking

Table 3: Lemmas linked to FEAR and TREMOR

A Appendices

Table 3 presents all the lemmas linked to FEAR and TREMOR and their generic meaning.

Lemma	Meaning
<i>abhorresco</i>	to tremble or shudder greatly at
<i>adhorreo</i>	to shudder
<i>attremo</i>	to tremble at a thing
<i>cohorresco</i>	to shudder
<i>contremebundus</i>	trembling
<i>contremesco</i>	to tremble to be afraid of
<i>contremo</i>	to tremble greatly, to quake
<i>contremulus</i>	trembling
<i>exhorreo</i>	to tremble or shudder exceedingly at

Table 4 contains the lemmas associated with the synsets presented in sections 2.1, 2.2, and 2.3.

Synset ID	Definition	Lemmas
#201784021	be afraid or scared of; be frightened of	<i>horreo, exhorreo, inhorreo, perhorreo, horresco, exhorresco, inhorresco, perhorresco, paveo, pavito, tremo, attremo, praetremo, tremesco, contremesco, pertremisco</i>

#200014027	move with or as if with a tremor	<i>horreo, adhorreo, exhorreo, inhorreo, perhorreo, horresco, exhorresco, inhorresco, perhorresco, paveo, pavito, tremo, attremo, contremo, intremo, tremesco, contremesco, intremesco, pertremisco</i>
#201892939	tremble convulsively, as from fear or excitement tremble convulsively, as from fear or excitement	<i>horreo, adhorreo exhorreo, inhorreo perhorreo, horresco, abhorresco, cohorresco, exhorresco, inhorresco, perhorresco, paveo, pavito, tremo, attremo, tremesco, contremesco, intremesco, pertremisco</i>

Table 4: Lemmas associated with the synsets
presented in sections 2.1, 2.2, and 2.3