Metaphor-induced lexical semantic evolution and classification strategies in Ancient Egyptian

0. Introduction

Figurative language is a constant element in the expression of abstract concepts across cultures and languages (Sweetser 1990; Traugott & Dasher 2001: 95); Ancient Egyptian makes of course no exception to that (Di Biase-Dyson 2018; Steinbach-Eicke 2019). However, figurative language is notoriously difficult to study for dead languages because the lack of living native speakers usually means that we have to rely on modern interpretation of ancient texts, without having direct access to the ideas and perception of native users. In some cases, though, the language and/or the writing system can help circumventing the problem. This is the case of the Egyptian, thanks to its classifier system, which consists in *graphemic elements* "placed after the vowless root in the Egyptian script, functioning as reading aids but carrying no additional phonetic value" (Goldwasser 2006a). They thus apply to the *written language only*.

This study aims at 1) providing an overview of the classifier system in Ancient Egyptian; 2) showing the dynamics between classification strategies and metaphor-induced *colexification* (François 2008:171), in other words, "the linking of two senses by a single lexeme in synchrony (*strict* colexification) or in diachrony (*loose* colexification)". The conceptual metaphor theory (Lakoff & Johnson 2003 [1980]; Kövecses 2000a; 2005; 2010) is used as theoretical frame to analyse the data.
Following a brief introduction to the corpus, this article first presents the basic principles of hieroglyphic script, especially the classifier system. This part opens to the presentation of the theoretical frame, which details the two variables that define the interactional scenarios between metaphor and classifiers in the lexicon: classification strategies and colexification types. The last section provides concrete illustrations of the various scenarios from two test domains: COGNITION and (INTER)PERSONAL BEHAVIOUR (here meant as an umbrella term for emotion, personality and social interaction). The examples included in this last section have thus in common to illustrate metaphorical paths having COGNITION and (INTER)PERSONAL BEHAVIOUR as target domains.

The present study can be of interest for the general discussion about language change for several reasons. Besides providing an in-depth insight in the semantic classification of a dead language and its evolution in diachrony, it also provides concrete evidence for the steps leading to semantic change: contextual metaphorical use and synchronic polysemy. (Evan & Wilkins 2000, on the notion of bridging context to be discussed *infra*). Indeed, Egyptian, thanks to its system of graphemic classifiers, makes this process literally visible, which is unique. This article also highlights the fact that cross-culturally well-attested conceptual metaphors present in modern languages are represented in Ancient Egyptian as well, in spite of major cultural and temporal gaps.

1. Brief introduction to the language, corpus and tools

This study focuses on classifier use in relation to metaphor-induced colexification in *Late Egyptian*, the vernacular language spoken in Egypt between ca. 1550-525 BC. It is worth noting that another form of the language, called by Egyptologists *Classical Egyptian*, was also used at the time in parallel, as language of prestige. Ancient Egyptian displays thus a diglossia phenomenon that is worth mentioning because it impacted the evolution of the lexicon. The time frame under study, spanning almost a thousand years, is a turning point in many respects,

both for language and writing. Texts from this chronological range witness an increased use of linguistic metaphors. This may be due in part to the substantially higher number of sources available with respect to other periods, but is also a consequence of (1) semantic evolution processes (in the case of single lexemes) and of (2) a general tendency of the language at becoming more analytic (which manifests, among others, in an increased number of compound expressions). In parallel, important changes in the organisation of the classifier system also occur. Both those features – the increased number of linguistic metaphors and the "reorganisation" of the classifier system, detailed below – offer the basis for the present study. The corpus used in this study is composed of the Late Egyptian texts from the digital databank *Ramses online*[1] (*Ramses*). In its current state, *Ramses* comprises a corpus of texts of over 510.000 lexical tokens from a time period that spans approximatively 1000 years (ca. 1550-525 BC). This corpus represents a massive amount of diachronic data from all literary genres. However, sources available for Ancient Egyptian are highly dependent on conservation hazard. As a consequence, genres, language stages and dialects are unequally represented through the corpus. Data have also been cross-checked and completed with the current reference dictionaries for Egyptian (Erman & Grapow 1971 (*Wb*); Faulkner 2002; Lesko 2004; Hannig 2006) and with the *Thesaurus Linguae Aegyptiae* (*TLA*). The test domains used for this study are INTERPERSONAL BEHAVIOUR and COGNITION from which I consider only verbs and verbal adjectives.

2. Key notions about hieroglyphic and hieratic scripts: summary of sign functions and classifiers

In order to understand the present study, a short introduction to the hieroglyphic script is needed. Egyptian hieroglyphs are organised according to three main sign functions:

- *phonograms*: these signs represent only sound(s), they have no semantic value within the word-form;
- *logograms*: they represent both sound and meaning;
    1) a subcategory of logograms are *radicograms*: they are logograms not used independently but within a word, with other constituents – phonograms and/or classifier(s) – (Polis & Rosmorduc 2015);
- *classifiers*: only meaning, no phonetic value within the word-form. They are the main focus of this study.

Some examples:

 : this word reads *ꜥq* – the hieroglyphic script is defective; it notes only consonants – and means "to enter". The first two signs and are *phonograms*, which means that they have only a phonetic value (respectively /ʕVq/ and /q/, the second sign being a repeater of the second consonant of the first sign) and no semantic value within the word-form *ꜥq*. The last sign is a *classifier*. It has no phonetic value but tags the word-form as belonging to the lexeme *ꜥq* "to enter" and to the conceptual category MOTION.

 : this word reads *pr* and means "house". The hieroglyph is a *logogram*: it has both the phonetic value *pr* and the meaning "house". The small vertical stroke at the end is a sign that stresses the fact that this word is written with a logogram and is countable.

[1] Link to the beta version: http://ramses.ulg.ac.be. I express here my gratitude to the project's directors for giving me access to the entire dataset.

 : this word reads *nḏm* and means "(to be) sweet". The first sign  is a radicogram, in other words, a logogram that is not used independently. It has both the phonetic value *nḏm* and the meaning "sweet" (based on a metonymic relation: the sign represents a carob pod, fruit known for its sweet taste). It is complemented in the spelling by a phonogram  (*m*) and a classifier (ABSTRACT/NON-COUNTABLE).

The hieroglyphic script is used mainly for epigraphic texts. The texts considered in the present study are written in its cursive counterpart, called hieratic. The cursive nature of hieratic and its ligatures played an important role in the establishment and the systematization of use of fixed classifier groups, but it is not directly relevant for the present study, and it will not be discussed further.

3. Introduction to the classifier system in ancient Egyptian

Classifiers in Egyptian are somewhat different from what is usually meant by the term *classifier* in linguistics. To begin with, they are *graphemic elements* instead of morphemes and thus apply to the *written language only*. They consist in "pictograms that are placed after the vowless root in the Egyptian script, functioning as reading aids but carrying no additional phonetic value" (Goldwasser 2006a). Their identification is thus bound to their final position and their semantic function within a particular word-form (Lincke & Kammerzell 2012: 60; Chantrain & Di Biase-Dyson 2017: 42). They provide precious information about the economy of the lexicon, its diachronic evolution and allow for *visually* tracking etymologies.

The denomination of these signs as classifiers is relatively recent and was first proposed in the pioneer works of Goldwasser (2002; 2006a & b), Lincke (2011), Goldwasser & Grinevald (2012) and Kammerzell (2015). In Egyptology, this category of signs has previously been called "determinatives", a terminology that was inherited from Champollion himself, who first deciphered and described the hieroglyphic writing system (Champollion 1836). The new denomination of "classifier" is still nowadays not unanimously accepted by the Egyptological community, even though the aforementioned studies have been overall well received, and this new terminology is becoming increasingly common. This denomination was suggested on basis of similarities observed by Goldwasser between the Egyptian "determinatives" and the characteristics of classifiers in classifier languages. She takes as starting point the definition of classifier given by Allan (1977:285), which consists in two main statements: a) "they occur as morphemes in surface structures under specifiable conditions"; b) "they have meaning in the sense that a classifier denotes some salient perceived or imputed characteristic of the entity to which an associated noun refers or may refer". She observed that the Egyptian "determinatives" easily fit the requirements of a classifier system, the only notable difference being the nature of the semiotic system. The above definition given by Allan thus applies to the Egyptian system, providing that "morpheme" would be replaced with "grapheme". Major basic phenomena that occur in the Egyptian graphemic classifier system have indeed parallels in morphemic classifier systems (Goldwasser 2006a: 20). It is also worth noticing that the Egyptian system is particularly detailed and elaborate, as well as semantically transparent and easy to connect with lexical sources, which is, following Aikhenvald (2000:370), a sign pointing toward a rather new system. The other criterion that likely plays a role in the system's transparency is its iconic nature which "keeps the semantic value of the graphemic system alive and slows down depletion, grammaticalization and fossilization by convention", at least to a certain point (Goldwasser 2006a). Tendencies to the latter are in fact observed in Late Egyptian, in the hieratic cursive script, which is at the core of this article.

In addition, Goldwasser (2006a and b) and especially Grinevald in the attached appendix of their joint publication (Goldwasser & Grinevald 2012:19 and 46-51), listed the basic features

of morphosyntactic classifier systems with a semantic profile and compared them to the features found in the Egyptian system. The latter displays indeed: 1) a taxonomy from general category to individual instance similar to the one observable in classifier languages (detailed infra); 2) the existence of repeaters (Allan 1977); 3) the existence of schematic (metonymic/contiguous) relations between classifier and lexeme (qualified as "extensions" by Aikhenvald 2000: 404). Besides its graphemic nature, the Egyptian system also distinguishes itself from classifier languages in two characteristics: it combines both noun and verb classifier systems – the latter means that, contrary to verbal classification, the verb and not the verbal arguments bear the classifier. A system combining both types of classification does not appear to be attested in any other language.
Finally, most lexemes are susceptible to receive a classifier in Ancient Egyptian – including adverbs and adjectives – but their use is never fully mandatory. In the period that interest us here though, they are used with much regularity. Ancient Egyptian also repetitively displays multiple classification (co-occurrence of classifiers). The latter is attested in some classifier languages, but not allowed in all. The different features listed above are detailed in the next section.

3.1. General organisation of the classifier system

The Egyptian classifier system can be described according to two axes: a vertical one (taxonomy) and a horizontal one (contiguity/similarity relations). These two axes define the way in which the classifiers are organised and chosen, in relation to the meaning of the lexeme. This organization has been described in detail by various scholars (Goldwasser 2002, 2005, 2006a & b; Goldwasser & Grinevald 2012; Lincke 2011; Lincke & Kammerzell 2012; Steinbach-Eicke 2019, Chantrain 2021). The explanations will thus be limited here to key-elements necessary for understanding this study and to the author's own findings on classification strategies.
On the vertical, taxonomic axis, categories are organized according to a hierarchy, from the most abstract/generic term to the individual instance. There are three main levels in the taxonomy: superordinate (SO), basic (BA) and subordinate (SB). The signs categorized on these respective levels meet some specific criteria, which are detailed in the next section. The most obvious case is illustrated by natural taxonomic relations, as noted by Goldwasser (2002) who based her model on Rosch's (1986). For example, LEGGED TERRESTRIAL ANIMAL is represented by the hide-and-tail sign is superordinate compared to HORSE, represented by a standardised representation of a horse  . The taxonomy principle can be applied to abstract concepts as well (e.g. TIME superordinate to SPECIFIC TIMES), and, to a certain extent, to the hierarchisation of actions, in the case of verbs – e.g.  MOTION is superordinate to SAIL). This means that a given word may often be written with several classifiers, depending on the level of precision one wants to convey. However, not all three levels of classification are in fact systematically attested for a same lexeme, but often two of them are (BA + SB or SO + BA).

Characteristics of the three taxonomic levels

Basic level

The basic level is the intermediate level of the taxonomy and also the only level to have strict lexical equivalents. This means that for the BA level, one classifier can be associated to at least one lexeme that covers the same semantics. This can be explained by the fact that its members are chosen according to the prototype theory (Givón 1986, 78-79). It means that the basic level gathers all elements seen as having the highest degree of membership (Rosch 1978) in the

category, the ones chosen to represent the whole subordinate group, which encompasses semantic nuances and formal variations.

Superordinate level
These classifiers are used for very general categories that include the BA level members. The concepts expressed by the SO classifiers are *not lexified* and that criterion is discriminating in assigning the SO status: they stand for very broad abstract concepts whose expression exists *only through the classifier*. For example, in Egyptian there is no general term for action, emotion, cognition, time, space, etc; but only for specific actions, emotions, cognitive activities, time units, portions of space, etc. Yet, SO classifiers represent specifically the first categories of concepts.
The prototype principle also applies to the choice of the SO classifier, as the chosen pictogram is the one considered as the most representative for conveying such general concepts. Finally, SO classifiers are usually BA or SB classifiers that were "upgraded" to a higher category. They went through a semantic evolution process and from a precise concept (BA level), came to express in addition a more general, over-encompassing one.

Egyptian illustrates perfectly the fact that the choice of the prototype can be highly culturally and environmentally driven. For example, the prototypical member chosen to stand for the SO category WINGED ANIMAL category is a duck, which also stands for the BA category BIRD. The first sign used for that purpose is  (Lincke 2011), which is replaced later on with the flying duck  in Late Egyptian hieratic spellings. The choice of the duck may seem surprising to some readers, depending on their own background, but can be explained by the predominant presence of this animal in the Nilotic environment. In modern western Europe for example, the sparrow, blackbird or robin would be a likely choice (Armstrong, 2005: 11). Note that the sparrow is in fact used in Egyptian as SO classifier for SMALLNESS/NEGATIVITY, likely because of its perceived negative impact on agriculture, due to its habit of eating seeds just sown (David 2000).

SO and BA level signs have standardised, canonical shapes, which is not necessarily the case of the SB level. Indeed, in the latter case, their shape varies in order to offer an ad-hoc solution to convey specific contextual nuances. This can be done within the frame of a natural taxonomy (expression of a subspecies or subtype) but often just adds specific features to the general sense of the lexeme. Details and examples of the taxonomy are given *infra*, at the end of this section. The category of SO classifiers is thus defined by three criteria: not lexified + prototype status + canonical shape. The BA classifiers share with them two criteria: prototype status + canonical shape, but diverge in the last, since the BA level classifiers correspond to entities that are lexified. In other words, to one BA classifier corresponds one concept and at least one lexeme.

Subordinate level
This level of the taxonomy is composed of very specific signs and expresses individual items without including them in a broader category. Two main configurations are attested: (1) the classifier may stand for a subspecies/subtype in the case of natural taxonomy (e.g. a specific kind of duck, cattle, etc) or, more frequently for the period that interests us in this study, (2) a *formal* variant of the BA classifier, which adds semantic features to the basic meaning in order to convey specific contextual nuances. (e.g. prancing horse, child wearing a crown for "prince", etc.). The category of SB classifiers is thus defined by three criteria: (1) the signs do not represent a prototypical member of any category, (2) they do not necessarily have a canonical shape and (3) they express features that are beyond what is lexified (= added content on the visual level only).

To give an illustration of the three levels of the taxonomy, let us look at the following sentences including the lexeme *ḥtr* "horse". The same lexeme, with exactly the same meaning may be written with three different signs. In ex. 1, the classifier used is a SO one: it stands for the conceptual category LEGGED TERRESTRIAL ANIMAL and is thus not specific to horse. This classifier has no lexical equivalent and has a canonical shape. It does not convey any specific contextual feature nor refer to any specific member of the SO category (in other words, any member of this category may be written with this classifier: horse, dog, cat, cow, mouse, etc).

Ex. 1

pȝ	*ḥtr*		*nty*	*ḫr*	*ḥm*	*=f*
ART:M.SG	horse		REL-M.SG	under	majesty	=3SG.M
						
	CLF: LEGGED TERRESTRIAL ANIMAL					

"The horse that carried his Majesty" (pChester Beatty 3, v° 3,11)

In ex. 2, the classifier used is the BA classifier for HORSE. It has a canonical shape, at least one lexical equivalent (even two in the present case: *ḥtr* and *ssm.t*, both lexemes mean "horse"). This classifier does not convey any specific contextual feature, it just stands for the concept of HORSE.

Ex. 2

rḫ	*sw*	*ḥtr*
know: PTCP	3SG.M	horse
		
		CLF: HORSE

"The one who knows horses" (Urk 4, 1279, 13)

Finally, in ex. 3, a SB classifier is used: it represents a prancing horse with a royal ornament, which reflects the actual attitude of the horse in the figurative scene that accompanies the text. It is thus an ad-hoc classification, with specific contextual features. It does not have any strict lexical equivalent (i.e. there is no specific term in Egyptian that means "prancing horse with royal ornament").

Ex. 3

ʿn	*ḫr*	*ḥtr.w*
beautiful	upon	horse-PL
		
		CLF: PRANCING HORSE W/ROYAL

"Beautiful upon horseback" (KRI 5, 57, 4)

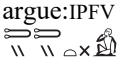
It is worth noticing that in Late Egyptian hieratic, the use of single SB classifiers to express specific features of the item became recessive. Instead, a different strategy gained in importance: combining two or more classifiers instead of modifying a single one. This strategy is called *composed classification* (author, under review).

The verb *ṯṯṯ* "to argue" offers a good example of composed classification: it can be written with the simple classifier for SPEECH, but also with the group  + for INTERACTION/OPPOSITION + SPEECH (ex. 4) or with + for LOUD/OUTREACH + SPEECH[2] (Ex. 5). The possibility to use different classifier groups for a same lexeme in a same sense is called *alternating classification* (author, under review). The principle is as follows: for a given

[2] The categories have been defined on basis of the data collected in the frame of the author's ongoing study.

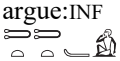
lexeme, a given sense can be decomposed in several semantic features. The principle behind alternating classification is that different semantic features can be selected as salient for a same lexeme in a same sense in a given context. For example, arguing can be described as speaking "in opposition to someone", or as speaking "loudly": the selection is on the feature OPPOSITION (×, ex. 4) in the first case and on LOUD ( , ex. 5) in the second case. In other words, *different classifiers are used for a same lexeme in a same sense*. Only different features are stressed. Alternating classification has to be distinguished from *distinctive classification*, which applies to *different classifiers used for different senses of a same lexeme*. This distinction between the two strategies is not made by Goldwasser (2006) in her initial description, which comprised only alternating classification as umbrella term for both strategies. However, it is relevant here because the two strategies reflect two different realities (colexification vs non colexification).

Ex. 4

m	*ḏd*	*bjn*	*r*	*ḥn*	*twt*	*hrw*	*tttt*	*=k*
NEG	say:INF	bad	against	friend	2SG.M	day	argue:IPFV	=2SG.M
								
							CLF: OPPOSITION+ SPEECH	

Do not say anything bad against a friend on a day you argue
(pDeM 1, 3, 7)

Ex. 5

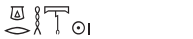
jw	*=w*	*ḥ‘.w*	*(ḥr)*	*tttt*	*ḥr*	*w‘*	*ḥḏ*
SUB	=3PL	stand:STAT	(upon)	argue:INF	upon	one	silver
							
				LOUD/OUTREACH + SPEECH			

While they were arguing about a loot (pMayer A, v° 9,19 = KRI 6, 821, 14)

In composed classification, typically, the last classifier of the group (usually a SO classifier) indicates the most general conceptual category in which the concept lexified by the lexeme can be included. As for the first classifier of the group, it provides a semantic specification about the nature of the action or about the nature/appearance of the classified item in the case of a noun. This functioning matches the first criterion of what Aikhenvald (2000) described as the general rule in case of multiple classification in classifier languages: one of the classifiers marks the *nature* of the classified item, which is usually the case for the first classifier of the group in Egyptian. It gives indeed some precision about the nature of the item or action expressed by the lexeme (e.g.  = RELATIVE TO THE NIGHT (ex. 6); × = INVOLVING OPPOSITION (ex. 4); = LOUD/OUTREACH (ex. 5)). The other classifier, according to Aikhenvald's observations, denotes the function of the lexeme. This latter rule does not really apply to Egyptian, except in isolated cases like the classifier  (or the group ACTION +  MAN/PERSON) which sometimes indicate the *nomen agentis*, as a derivation of the category ACTION. However, in most cases, the second classifier in Egyptian simply expresses the most general category in which the lexeme can be included (e.g.  = TIME (ex. 6),  = SPEECH (exs. 4 and 5)).

Exs. 4 and 5 above as well as ex. 6 below illustrate this principle, for verbs and noun respectively. Ex. 7 below illustrates a case of marking the *nomen agentis*.

Ex. 6

jw	*=f*	*ḥr*	*sḏr*	*ḥnʿ*	*tzy=f*	*ḥm.t*	*m*	*pz*	*grḥ*
CORD	=3SG.M	on	sleep:INF	with	POSS:M.SG =3SG.M	woman-F	in	ART:M.SG	night
									 CLF: DARK/NIGHT + TIME

"He slept with his wife that night"

Ex. 7

jw	*sʒw*	*ḫʿ*	*šmy*	*ḥr*	*dšr.t*
MCM	guard	personal_ name	go:STAT	upon	place_name
	 CLF:ABSTRACT + ACTION				

"The guard Kha went to Deir el-Bahari"

Besides the vertical taxonomic organisation, one should also mention the motivation principle for the choice of classifiers, which constitutes the horizontal axis. Indeed, except in the case of repeaters, in which the classifier represents the item designated by the lexeme, the choice of classifier is usually motivated by horizontal contiguity/similarity relations with the meaning of the lexeme (Goldwasser 2002, 13-18; Lincke 2011). Most of them are meronymic and metonymic relations. In the case of verbs, the relation classifier-lexeme may also more precisely be described in terms of semantic roles (SR) (Kammerzell 2015), or as simile relations. This is the case for the last example *infra*, where the choice of the crocodile for anger can be understood as experiencer or simile relation (to be angry *like* a crocodile).

Examples:
šmm.t 'fever' (metonymy: brazier with flame for 'heat')

Ex. 8

jw	*=n*	*(r)*	*šd*	*=f*	*(...)*	*r*	*šmm.t*
FUT	=1PL	FUT	protect:INF	=3SG.M		against	heat-F
							CLF: FIRE/HEAT

"We shall protect him from fever" (pCairo CG 58035, 48)

ds 'to cut'  (SR instrument: knife for the action of cutting)

Ex. 9

nn	*sḫm*	*ds.w*	*jb.w*	*m*	*=j*
NEG	be_powerful:SBJV	cut:PTCP	heart-PL	in	=1SG
		 CLF:KNIFE/CUT			

"The ones who cut shall not have power one me" (pLeiden I 347, r° VI, 11)

zd 'to rage, to be angry' (SR experiencer/simile: animal whose aggressive behaviour is reminiscent of manifestations of anger)

Ex. 10

jw	*t3*	*=sn*	*3q*	*3d*
CORD	land	=3PL	deteriorate:STAT	be_angry:STAT
				
				CLF: CROCODILE/AGGRESSIVENESS

"Their land was deteriorating and raging" (KRI 2, 244, 15)

4. Link between metaphor-induced colexification and classifiers

The relation between classifiers and metaphor in the Egyptian lexicon can be described according to two variables: colexification types and classification strategies. The combinations of these two variables result in several scenarios described in this section.

Variable 1: colexification types

Before going further, a more developed note should be made here regarding the term *colexification* used in the upcoming sections. This term was first proposed by François (2008:171). As mentioned in the introduction to this paper, he defines it as "the capacity, for two senses, to be lexified by the same lexeme in synchrony", which corresponds to "strict colexification". He also mentions that the model can then be extended to other cases such as "the linking of two senses by a single lexeme across different periods of its semantic history" ("loose colexification"). In the category "loose colexification" are also included the association of senses in form of doublets and lexical derivation. This term seems thus appropriate to encompass the different steps of the evolutionary path leading to semantic change: *metaphorical sense appearing in a bridging context* (Evans & Wilkins 2000), *synchronic polysemy* and *semantic change*. This choice of terminology allows to designate the continuum between the three steps in metaphor-induced semantic evolution, which are at times difficult to differentiate for ancient Egyptian, due to the absence of living speakers, combined with the relative scarcity of sources and conservation hazard.

For the presentation of the examples, I make the distinction between colexification of type 1 and type 2. Colexification of type 1 means that, for a lexeme X, a metaphorical sense 2 is lexified in addition to the primary sense1, but only in the frame of a bridging context. As for colexification of type 2, it encompasses polysemy and semantic change. In type 2, the derived sense 2 is lexified by a lexeme X in addition to sense1 even in the absence of the bridging context. It means that the latter is not required anymore for the sense to occur (Evans & Wilkins 2000).

Variable 2: classification strategies

Three classification strategies have been identified in association with metaphor-induced colexification:

- *no classifier variation* (i.e. only the context makes explicit the metaphor)
- *distinctive classification* (i.e. a same lexeme is written with different classifiers which explicit the colexification sense 1 vs sense 2)
- *classifier replacement* (i.e. the classifier used for sense 1 is replaced by another one when the lexeme undergoes a semantic change to sense 2)

5. Case studies illustrating the different colexification-classification scenarios

The relations between colexification and classification strategies can be divided in several scenarios that are described and exemplified in this section. All the case studies have (INTER)PERSONAL BEHAVIOUR or COGNITION as target domain. These test domains have been chosen because their high degree of abstraction makes them ideal candidates for metaphor-induced colexification. The obtention of (INTER)PERSONAL BEHAVIOUR and COGNITION as target domains is realized through metaphors or metonymy-based metaphors (Goosens 1990, Radden & Kövecses 1999, Radden 2000) and appears to have a strong embodiment anchorage (Damasio 1999; Scherer 2013; Lakoff 2014; Koptjevskaja-Tamm 2015; Zwaan 2021; Di Biase-Dyson & Chantrain 2022). Worth is mentioning here that embodied cognition has been the object of heated discussions in the past years and raises challenges, both in linguistic and interdisciplinary research (Zwaan 2021). This is however not the main topic of this article and will not be discussed further here. The structure of the present section is as follows:

Colexification type 1: synchronic colexification of sense1 and sense2 only in a bridging context with exceptional distinctive classification (i.e. metaphorical use).
- *rḫ* (to know)

Colexification type 2: synchronic colexification of sense1 and sense2 independent of a bridging context (i.e. polysemy and/or semantic change).
- with distinctive classification (*ʿm*; *wḥʿ*)
  - *ʿm* (to swallow, to learn, to know)
  - *wḥʿ* (to untie, to (be) released, to understand)
- without distinctive classification (*wḫȝ*)
  - *wḫȝ* (to search for, to want, to love)
- with distinctive classification replaced with classifier replacement

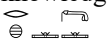
The glossing conventions applied for the examples in this section follow the adaptations to the Glossing *Leipzig Glossing Rules* suggested by Di Biase-Dyson, Kammerzell and Werning (2009).

Colexification type 1: context-bound metaphor-induced colexification
General description: the lexeme X colexifies a sense 2 in addition to its sense 1 in a specific bridging context (Traugott & Dasher 2002: 35; Urban 2015: 376); but there is not yet established colexification because sense 2 cannot be lexified by the lexeme X without this context. The classifier usually does not vary. In rare cases, though, it can be adapted to reflect the target domain. The difference with cases of established polysemy is that classifier variation remains exceptional, or even unique, as well as the metaphorical sense itself.

Scenario 1.1 *rḫ* (to know): context-bound metaphor-induced colexification with exceptional classifier variation

Ex. 11 provides an example of colexification bound to a bridging context. In its primary sense "to learn, to get to know", the verb *rḫ* is written with the classifier 𓏺 (ABSTRACT/NON-COUNTABLE), or with the group 𓏺𓁐 (ABSTRACT + COGNITION). In ex. 11, *rḫ*, as verb and as deverbal noun, is used as euphemism and is given the derived sense of "carnal knowledge". The classification is adapted accordingly: to the expected 𓏺 (ABSTRACT), the sign 𓂸 (SEXUAL ACTIVITY) is added to reflect the target domain of the metaphorical extension. This classifier variation is exceptional for *rḫ*: this verb is usually written with the classifier 𓏺 (ABSTRACT), even when used with the derived sense of "carnal knowledge", as shown in ex. 12.

Ex. 11

jw	*=f*	*(ḥr)*	*rḫ*	*=s*	*m*	*rḫ*	*n*	*ḥ3wty*
PTCL	3SG.M	on	know:INF	3SG.F	in	knowledge	GEN	man
			 CLF: ABSTRACT + SEXUAL ACTIVITY			 CLF: ABSTRACT + SEXUAL ACTIVITY		

"(He slept with her that night) and he knew her in knowledge of man"
(P. BM 10682, r° 4, 5 = LES 32, 5)

Ex. 12

jw	*jb*	*=s*	*(r)*	*rḫ*	*=f*	*m*	*rḫ*	*n*	*ḥ3wty*
PTCL	heart	3SG.F	to	know:INF	3SG.M	in	knowledge	GEN	man
				 CLF: ABSTRACT/N-C			 CLF: ABSTRACT/N-C		

"Because she desired to know him in knowledge of man" (lit: "her heart was toward knowing him")
(P. Orbiney 3, 6 = LES 12, 9-10)

Colexification type 2: established metaphor-induced colexification, independent from the bridging context (polysemy and semantic change)

General description: the lexeme Y colexifies at least two senses in the course of its semantic evolution. In all cases, a metaphor is the trigger of the process. The classifier(s) can either reflect the primary sense of the lexeme and the source domain of the metaphor, or it/they can vary to reflect the derived sense(s) of the lexeme under the target domain of the metaphor.

Scenario 2.1. metaphor-induced colexification with distinctive classification

Case 1: *ʿm* (to swallow, to learn)

When used in its primary sense "to swallow" (= sense 1), the verb *ʿm* is written with the classifiers  for ACTIVITIES OF THE THROAT or , which in this case actualises the meaning of INGESTION. From ca. 1500 BC, the verb *ʿm* is also found with a new derived sense, the one of "learning, understanding" (= sense 2) – or "knowing" when the verb is in the perfective aspect. The lexeme is written with the classifier of the eye for VISION/COGNITION when assuming sense2. The underlying metaphorical extension is the expression of LEARNING in terms of SWALLOWING, which links this case study to the conceptual metaphor of the MIND AS BODY and, more specifically, of the BODY AS A CONTAINER (Radden and Kövecses (1999: 39) and Kövecses (2010: 108)). Metaphors of embodied knowledge are well represented in Egyptian (Di Biase-Dyson & Chantrain 2022), among others through another verb, *dp*, which means to taste and can be used in the more general meaning "to experience" (EXPERIENCING IS SENSING, Steinbach-Eicke 2019). Acquiring knowledge is thus conceptualized in terms of food entering the body: the deeper it enters the body, the more the learning process is achieved (TASTE → SWALLOW → HAVING SWALLOWED = EXPERIENCE → LEARN → KNOW). In the first example below from an earlier period than the present corpus (ca. 2000 BC), *ʿm* is used in its primary sense of "swallowing" as physical action, which appears explicitly through its collocation with *sbš* "to spit".

Ex. 13

dj	*=s*	*sbš*	*njk*	*ʿm.n*	*=f*
give=PFV	=3SG.F	spit:SBJV	enemy	swallow-REL-ANT	=3SG.M

CLF: THROAT + INGESTION

"She caused the enemy to spit what he had swallowed"
(pBoulaq17, IV, 1)

In ex. 14, *ʿm* is used in the metaphorical derived sense of "knowing" and accordingly is written with the classifier 𓁹. The translation of "knowing" is obtained because the verb is conjugated at the relative form of the perfective and therefore indicates that the process of learning is completed. In the imperfective, *ʿm* is rather translated as "learning" or "getting to know".

Ex. 14

m-k	*jb*	*=j*	*pr.{t}w*	*m-ṯzwt*	
ATTN-2SG.M	heart	1SG	exit:RES-3SG.M	furtively	
See, my heart went away furtively					
sw	*ḥn.w*	*<r>*	*bw*	*ʿm*	*=f*
3SG.M	hurry: RES-3SG.M	to	place	know: REL.PFV	3SG.M

CLF: VISION/COGNITION

"He ran away to a place that he knows"
(pAnastasi 4, 4, 1 = LEM 39, 9)

Some clues indicate that the etymological relation between *ʿm* "to swallow" and *ʿm* "to learn"/"to know" remained transparent in Late Egyptian. Ex. 15 illustrates this transparency through a play on words and classifiers. In this section of a popular tale, a lady swallows a wood chip and becomes pregnant. The classifier of *ʿm* in the primary sense "to swallow" should be 𓅱 and/or 𓂝. However, it is here exceptionally written with the eye 𓁹 for VISION/COGNITION, which is the usual classifier for *ʿm* in the derived sense "to learn", "to know". This substitution of classifiers reveals a play on words on the two senses of *ʿm*: the fact that the noble lady swallows (= sense 1) the chip of wood and becomes pregnant is associated to the sense "to know" (= sense 2), but carnally, mirroring this use of the verb *rḫ* (attested in the same text). The verb *ʿm* is thus ultimately used as euphemism here, just like it was the case for *rḫ* in example 11, but without the addition of the classifier 𓂸 (SEXUAL ACTIVITY) in the present case. Finally, one should note that the Coptic descendant of am primarily means "to know"[3].

Ex. 15

jw	*=f*	*ḥr*	*ʿq*	*m*	*rɜ*	*n*	*tɜ*	*špss.t*
MCM	3SG.M	on	enter:INF	in	mouth	of	ART:F.SG	noble lady

"It (=the chip of wood) entered into the mouth of the noble lady

wn.jn	*=s*	*ḥr*	*ʿm*	*=f*
CJVB:CNSV	3SG.F	on	swallow:INF	3SG.M

CLF: VISION/COGNITION

and she swallowed it" (pOrbiney, 18, 5 = LES 28, 6-7)

Case 2: *wḥʿ* (to untie, to release, to explain/understand)

The case of the verb *wḥʿ* constitutes another very interesting case where the different senses colexified by a single lexeme are explicitly disambiguated by different classifiers. Attested from a very early stage in the language (ca. 2680 BC), the verb *wḥʿ* primarily means "to untie"

[3] https://coptic-dictionary.org/entry.cgi?tla=C897.

(= sense 1) and is accordingly written with the classifiers  or  (both for ACTION/ACTION OF STRENGTH) and/or sometimes  (ABSTRACT, "default" classifier). Later on (ca. 2125 – 1770 BC), the lexeme starts to colexify two new senses: "to release oneself" or "to be released" metaphorically (= sense 2), when applied to abstract entities (e.g. being released from a task or releasing power – not the physical act of releasing someone from bounds for example) and "to solve", "to understand", based on the metaphor of solving a problem like one unties a knot (= sense 3). Both metaphorical senses are thus conceptualized through the idea of "untying" and actualise the paths MENTAL ACTIVITY IS PHYSICAL ACTIVITY (Vanhove 2008; Lakoff 2014) and THE SOCIAL WORLD IS THE PHYSICAL WORLD.

wḥʿ thus colexifies three distinct senses, distinction that becomes gradually reflected on the classifier level as well, in a slower process. Indeed, it first went through a phase of transition, until the end of the so-called 19th dynasty (ca. 1295 – 1186 BC), in which for all senses, the same group  (ABSTRACT + ACTION) was used (at least in hieratic texts). This group appears to have been the "non-marked", generic, spelling for all senses of *wḥʿ*. In parallel, specific spellings with distinct classifier groups for each sense emerged and gradually became systematized: (1) the group  ([OVER]STEPPING/RUSHING + MOTION) for the sense 2 "to stop, to leave" or also just "release" (an *abstract* entity) – see the ex. 17 vs ex. 18 – and (2) the group  (ABSTRACT + COGNITION) or just  (COGNITION) for the sense 3 "to solve, to understand" – see ex. 19 vs ex. 20. Finally, (3) the verb *wḥʿ* in its sense 1 "to untie" or "to release" (physically) always kept the group  . In example 16 below, *wḥʿ* is used in its primary sense "to untie". Accordingly, it is classified with the group (ABSTRACT + ACTION)

Ex. 16

wḥʿ	*ky*	*jw*	*gm*	*=k*	*sw*	*snḥ*
untie:IMP	other	PTCL	find:PFV	2SG.M	3SG.M	tie:RES

CLF: ABSTRACT + ACTION

"Release anyone that you found tied"

(pChester Beatty 4, v° 2, 1)

19th dyn.

In exs. 17 and 18, *wḥʿ* bears the sense 2 "to release oneself" (from a task). In ex. 17, the non-marked group  is still used (ca. 1295 – 1186 BC), while in ex. 18, from a later date (ca. 1186 – 1069 BC) and thus from a later phase in the evolution of the system, one finds already the classifier group  , specific to the sense "to stop, to be released".

Ex. 17

spr	*=k*	*r*	*wḥʿ*	*m*	*rwhȝ*
reach: IPFV	2SG.M	to	release:INF	in	evening

CLF: ABSTRACT + ACTION

"When you manage to stop (working) in the evening"

jw	*ḫʿ*	*=k*	*nb*	*nḏ*	*hdhd*
PTCL	body	2SG.M	all	crush:RES	break:RES

"It is while your entire body is crushed, broken"

(*Satirical letter of Hori*, pAnastasi 1, 19, 9)

19th dyn.

Ex. 18

wḥʿ	*=f*	*r*	*pr*	*=f*	*m*	*rwhȝ*
release: NMLZ~IPFV	3SG.M	to	house	3SG.M	in	evening

CLF: (OVER)STEPPING/RUSHING + MOTION

"It is in the evening that he stops (working)"
(pLansing, 5, 5)
20th dyn.

The same opposition between non-distinctive vs distinctive classification can be seen in exs. 19 and 20, in which the verb *wḥʿ* bears the derived sense 3 of "solving", "understanding". In the first one, from an earlier date (ca. 1295 – 1186 BC), *wḥʿ* is still written with the old non-marked classifier group  . In the second example, from a later date (1069 – 945 BC), the new classifier group, specific to the meaning "solving", "understanding", is used.

Ex. 19

rnpj	*sṯn*	*ȝbw.t*	*twt*	*jm*	
young man	characterize:PTCP.IPFV	aspect	enjoyable	shape	

"A young man, with a good-looking aspect and a slim figure

wḥʿ	*jtn.w*	*gn.wt*	*mj*	*jr.t*	*sn*
	difficulty-M.PL	annals-F.PL	like	do-PTCP	3PL

CLF: ABSTRACT + ACTION

the one who solves the difficulties of the Annals, like the one who made them"
(pAnastasi 1, 1, 6-7)
19th dyn.

Ex. 20

jmy	*ḫȝty*	*=k*	*r*	*wḥʿ*	*=w*
give:IMP	heart	2SG.M	to	understand:INF	3PL

CLF: ABSTRACT + COGNITION

"Apply your heart to understand them (= the teachings)"
(*Amenemope*, pBM 10474, 3, 10)
21st dyn. (later document)

To sum up, the verb *wḥʿ* colexifies three distinct senses which are made explicit by three different classifier groups. This phenomenon is called *distinctive classification* (author's concept and terminology).

Scenario 2.2. *wḫȝ* (to search, to want, to love): metaphor-induced colexification without classifier variation

The verb *wḫȝ* meant primarily "to go and search" (for something). The verb then evolved into referring to searching as intellectual process (i.e. without the implication of *physical motion*), and from there, into expressing volition "to want". The senses colexified by *wḫȝ* in Late Egyptian are thus: (1) to (go and) search; (2) to search/research (intellectually); (3) to want. In some contexts, the sense conveyed by *wḫȝ* appears to be very close to the emotional domain by expressing a desire, but always remains characterized by a certain control of the subject on the events (i.e. the subject remains an agent, not an experiencer), which rather indicates that it stays under the VOLITION domain.

It is only in Coptic – the last evolutionary stage of the Egyptian language – in the form of the verb ⲟⲩⲱϣ (**wōš* – Sahidic dialect), that *wḫȝ* further entered the EMOTION domain and started to lexify the sense "to love" in addition to the formerly attested ones, which remain in use. The evolutionary path of *wḫȝ* can therefore be described as MOTION > VOLITION > EMOTION. The physical motion is used as source domain for mental/emotional motion toward an object or person ("desire", "wish" and "love").

Ex. 21

jw	*=w*	*(ḥr)*	*wḫȝ*	*n*	*=f*	*ḥ.ḥw*	*qȝ*	*zp-sn*
PTCL	IMPRS	on	wish:INF	for	3SG.M	lifetime	high	two_times
								
			CLF: MOTION					

"One wishes for him a very long (lit: high) lifetime

jw	*=f*	*ḥr*	*tp-tȝ*
SBRD	3SG.M	on	top_of_hearth

while he is on Earth" (Neskhonsu, T. CGC 46891, l. 49)

In pre-Coptic Egyptian, *wḫȝ* retained throughout its history the same classifier 𓂝, reflecting its sense 1 "to go and search" and, at the same time, the source domain of the metaphor (MOTION). It also remained polysemous: the first sense of *physical search* gradually became recessive, but did survive until demotic.

In the corpus, only two attestations[4] of *wḫȝ* are written with the classifier 𓁐 instead of 𓂝. Both have exactly the same spelling  but, unfortunately, both of them are also too lacunar even to determine whether the meaning of the word in context is "to search" or "to want/wish".

Scenario 2.3. *shȝj* (to bring down, to disappoint): metaphor-induced colexification with distinctive classification followed by classifier replacement

The verb *s-hȝj*  is the causative form of the verb *hȝj* which meant at first "to go down" and then evolved into meaning "to fall". The causative form is characterized by the addition of the prefix *s-* to the root. The primary sense of *shȝj* was thus "to cause to go down" or "to cause to fall". Around 1500 BC, *shȝj* adopted the metaphorical sense (= sense 2) "to act in a downgrading way", "to cheat", "to lie" (Winand 2018: 130, 132). It seems that the causative form with *s-* became then exclusively affected to the derived metaphorical sense. The sense 1 of "making go down" (the actual motion) became then assumed by the so-called *new causative* construction [*rdj* (= do, make) + *hȝj*]. The case of *shȝj* clearly illustrates a transfield extension from MOTION to INTERPERSONAL BEHAVIOUR. On the classifier level, two changes can be seen: instead of the initial classifier 𓂝 reflecting the source domain MOTION, most attestations take the classifier 𓂧. This classifier represents legs walking backwards and stands for the conceptual category NON-STRAIGHTFORWARD MOTION. In addition to this, this classifier can also be used in a meta-semantic function of metaphor marker in some texts with high literary qualities. I argue that the choice of this classifier as metaphor marker is stemming from a transfield extension from non-straightforward motion to non-straightforward expression. It was thus primarily used to mark *shȝj* in the sense "to cheat" as metaphorical use.

The verb *shȝj* underwent a complete semantic change from the sense1 "to cause to go down" to the sense2 "to cheat" and it was reflected on the classifier level: the initial classifier 𓂝 (MOTION) used for the sense1 was replaced with the classifier 𓂧 (NON-STRAIGHTFORWARD MOTION), which became the regular classifier for the verb *shȝj* in the sense2. In so doing, it lost

[4] Graffito TT63, l. 3 and P. Harris 500, v° 7, 7 (= LES 6, 14).

its meta-semantic function for this specific verb and became a fossilized orthography. The examples below illustrate this evolution process. One shall note that the difference between polysemy and semantic change is often very difficult to establish for ancient Egyptian, due to the absence of speakers and the relative scarcity of data. This is, as said in the introduction, a reason why the term colexification appears as preferable because it is neutral in terms of interpretation. However, the case of *sh3j* is non ambiguous in this respect since sense 1 was clearly replaced by sense 2 for the lexeme *sh3j* and reaffected to the construction *rdj h3j*.

Ex. 22

ḥnʿ	*jrj.t*	*n*	*=s*	*sh3j.t*	*snf*
and	do:INF	for	=3sg.f	CAUS-go_down:PTCP	blood
				 CLF: MOTION	

"And make for her something that makes the blood go down"
(pEdwin Smith, 20, 17)

Ex. 23

jr	*ptr*	*=k*	*ky*	*jw*	*=f*	*(ḥr)*	*sh3*
PTCL	see:SBJV	2SG.M	other	PTCL	3SG.M	on	CAUS-go_down:INF  CLF: REROUTED MOTION/ METAPHOR MARKER

"If you see another one committing fraud,

j.jr	*=k*	*sw3*	*n*	*=f*	*m-w3w*
THMZ	2SG.M	pass: INF	for	3SG.M	away

You should go away from him" (*Amenemope*, P. BM 10474, 18, 6-7)

6. Conclusions

Classifiers offer a unique tool for the understanding of semantic evolution dynamics and several scenarios can be clearly identified. This study focused on metaphor-induced colexification. Two colexification types and four scenarios were highlighted and exemplified:

Colexification type 1: synchronic colexification of sense1 and sense2 only in bridging context (metaphorical use)

- with exceptional distinctive classification
  - *rḫ* "to know"

Colexification type 2: synchronic colexification of sense1 and sense2 outside of bridging context (polysemy and semantic change)

- with distinctive classification
  - *ʿm* (to swallow, to learn, to know)
  - *wḥʿ* (to untie, to (be) released, to understand)
- without distinctive classification
  - *wḫ3* (to search for, to want, to love)
- with distinctive classification followed by classifier replacement (*sh3j*)

Classification strategies can 1) help tracking etymologies, when the classifier reflects the source domain); 2) indicate the directions of transfield mapping process, when (one of) the classifier reflects the target domain.

The present study provides an in-depth insight in the semantic classification of a dead language and its evolution in diachrony, it also shows the steps leading to semantic change: apparition context-bound metaphorical sense and synchronic polysemy. The particularity of Egyptian is that it makes the process visible thanks to its system of graphemic classifiers, which is unique, at least with such level of development. This point directly validates the idea that metaphors do play a role in semantic change, thus providing a concrete illustration of a phenomenon that has been so far primarily a theoretical hypothesis and cannot be proven in many cases because of a lack of historical depth.

Another point indirectly highlighted in this study is that cross-culturally well attested conceptual metaphors are represented in Ancient Egyptian, both on the linguistic and the visual levels. This observation adds a consequent historical depth to the validation of the conceptual metaphor theory as well as further data exploitable for cross-linguistic comparison. From the data obtained, it appears that, adding to cross-linguistically well-documented examples (Kövecses 2005), the expression of interpersonal behaviour (social interaction, personality, emotion) and cognition in Ancient Egyptian is widely based on the MIND AS BODY metaphor (Sweetser 1990; Barsalou 1999; Traugott & Dasher 2001: 95; Casasanto & Gijssels 2015). Under this general path, one can identify a variety of other paths that apply to Egyptian as well: BODY AS A CONTAINER; MENTAL/EMOTIONAL ACTIVITY IS PHYSICAL ACTIVITY (Vanhove 2008) ; EMOTION IS MOTION, MENTAL/EMOTIONAL STATE IS PHYSICAL STATE, EXPERIENCING IS SENSING (Koptjevskaja-Tamm 2015 ; Steinbach-Eicke 2019 ; Vanhove & Hamid 2019 ; Di Biase-Dyson & Chantrain, *forthcoming*) and THE SOCIAL WORLD IS THE PHYSICAL WORLD (Kövecses 2010: 255; Di Biase-Dyson 2018). These paths were illustrated through examples in the present study.

List of abbreviations

Glossing;
ADV adverb(ial) ; ANT ART article ; ATTN attention marker ; CAUS causative ; CLF classifier ; COMP complementizer ; EXLM exclamative ; F feminine ; GEN genitive ; IMP imperative ; IMPRS impersonal ; INF infinitive ; IPFV imperfective ; M masculine ; MCM main clause marker ; NEG negation ; NMLZ nominalizer ; PFV perfective ; PL plural ; POSS possessive ; PROH prohibitive ; PROS prospective ; PTCL particule ; PTCP participle ; Q question ; REL relative ; RES resultative ; SBJV subjunctive ; SBRD subordinate ; SG singular ; STAT stative : THMZ thematizer.

Other terms:

BA basic; SB subordinate; SO superordinate.
OK Old Kingdom; MK Middle Kingdom; NK New Kingdom; TIP Third Intermediate Period.
SR semantic role

Recapitulative table of classifiers appearing in the article and their corresponding conceptual categories

Classifier	Gardiner code	Referent	Conceptual category
	A2	man bringing his hand to his mouth	INGESTION, SPEECH, EMOTION, COGNITION
	A24	striking man with a stick	ACTION /ACTIVITY
	D6	eye with eyelid	VISION/COGNITION
	D40	arm holding a stick	(VIOLENT/POLEMICAL/STRENGTH) ACTION /ACTIVITY
	D53	ejaculating phallus	PHALLUS AND ITS ACTIONS, MAN, SEX-RELATED
	D54	moving legs	MOTION
	D55	legs moving backwards	BACKWARD/REROUTED MOTION, METAPHORICAL USE
	E6	horse	HORSE
	E6b	Prancing horse with ornament	prancing horse with ornament
	F10	bull head with throat	ACTION OF THE THROAT
	F18	elephant tusk	TEETH AND ITS ACTIONS, LOUD SPEECH, EXTERNALISATION
	F27	hide and tail	LEGGED TERRESTRIAL ANIMAL
	G37	sparrow	SMALLNESS, NEGATIVITY
	I3	crocodile	CROCODILE, AGGRESSIVENESS
	N5	sun disc	DAYTIME, TIME
	Q7	brazier with flame	FIRE, HEAT
	T30	knife	KNIFE, ACTION OF CUTTING
	Y1	papyrus scroll	ABSTRACT, NON-COUNTABLE
×	Z9	crossed sticks	INTERACTION W/OPPOSITION, ALTERATION

Table 1. Recapitulative table of classifiers appearing in the article and their corresponding conceptual categories

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