We thought *the eyes* of coreference were *shut* to multiword expressions and they mostly are

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IPIPAN, Warsaw, 25 May 2023

Motivating example

By sawing logs you transform them into lumber. (en)

*He was **sawing logs** for the whole night – I could hardly sleep! He should ask a doctor how to get rid of them. (en)

Multiword expressions

Word combinations, which exhibit lexical, morpho-syntactic, semantic and/or pragmatic **irregularities**.

- (PL) ***do cna*** ‘completely’
- (PL) ***jak również*** (lit. ‘as also’) ‘as well as’
- (PL) ***biały kruk*** (lit. ‘white crow’) ‘rare person or thing’
- (PL) ***mieć muchy w nosie*** (lit. ‘to have flies in one’s nose’) ‘to be bad-tempered’

Semantic properties of MWEs

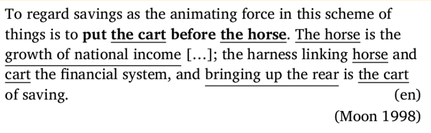
Non-compositional semantics

- The meaning of a MWE cannot be deduced from the meanings of its components, and from its syntactic structure, in a way deemed regular
- Semantic compositionality is hard to test directly but can be approximated by **morpho-syntactic inflexibility** [Gross(1988), Savary *et al.*(2018)]

Semantic properties of MWEs

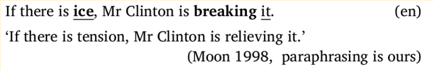
Decomposability

- Non standard meanings assigned to MWE components ⇒ compositional figurative interpretation [Gibbs and Nayak(1989), Nunberg(1978)]
  - *spill* ⇒ ‘reveal’
  - *beans* ⇒ ‘secret’
  - *to **spill** the **beans*** ‘to reveal a secret’
- (non-)decomposability of idioms is a rationale behind their **morpho-syntactic (in)flexibility**
- components of decomposable idioms “refer in some way to the components of their figurative referents”



To regard savings as the animating force in this scheme of things is to **put the cart before the horse**. The horse is the growth of national income [...]; the harness linking horse and cart the financial system, and bringing up the rear is the cart of saving. (en)

(Moon 1998)



If there is **ice**, Mr Clinton is **breaking** it. (en)

‘If there is tension, Mr Clinton is relieving it.’

(Moon 1998, paraphrasing is ours)

Semantic properties of MWEs

Figuration

- Degree to which the idiom can be assigned a literal meaning
  - *to **skate on thin ice*** ‘to be in a precarious situation’ (figurative)
  - *to **drop a line*** ‘to write a letter’ (non-figurative)

Transparency

- How understandable is the link between the literal and the idiomatic reading?
  - *to **skate on thin ice*** ‘to be in a precarious situation’ (transparent)
  - *to **kick the bucket*** ‘to die’ (opaque)

Correlation

- **Figuration**, **transparency** and syntactic **flexibility** correlate positively, since the **referent** in the literal meaning is easy to capture [Gibbs and Nayak(1989), Sheinfux *et al.*(2019)]

Semantic properties of MWEs

Blocked coreference

- Strong correlation between the **idiomaticity** of an expression and the **impossibility of coreferring** to its components [Laporte(2018)]

Our objective

- **Quantify** this correlation via a **corpus** study (first attempt in the SOA)

Verbal multiword expressions

PARSEME definitions [Savary *et al.*(2018)]

- **Verbal MWE** (VMWE) – a MWE whose **canonical form** is headed by a verb
- **Lexicalized components** – those always realized by the same lexemes
- 3 VMWE categories relevant to this study:
  - verbal idioms (**VID**)

    *ces textes **font foi*** (lit. 'these texts do faith') 'these texts apply'
  - light-verb constructions (**LVCs**)

    *la chanson **connut** un grand **succès*** (lit. 'the song knew a big success') 'the song was a big success' (LVC.full)

    *il **donne espoir** aux soldats* 'he gives hope to the soldiers' (LVC.cause)

Coreference

Mentions and chains

- **Mention** – linguistic element that refers to a discourse **entities**
- **Coreferent mentions** - those which refer to the same entity
- **Coreference chain** - cluster of all coreferent mentions
- **Singleton** - the sole mention in a **trivial** coreference chain
- Types of coreference:
  - **Pronominal** - one of the mentions is a pronoun
  - **Direct** - both mentions are noun phrases sharing a head
  - **Indirect** - both mentions are noun phrases <u>not</u> sharing a head

Coreference resolution

- Detecting the mentions in a document
- Partitioning them into chains

This work

Hypothesis

Proper subsets of lexicalized components of MWEs are **unlikely** to occur in **non-trivial coreference** chains.

Secondary objective

Characterize those situations in which **coreference** with proper subsets of MWE components **does occur**.

Scope

- Nominal coreference
- Verbal MWEs
- French

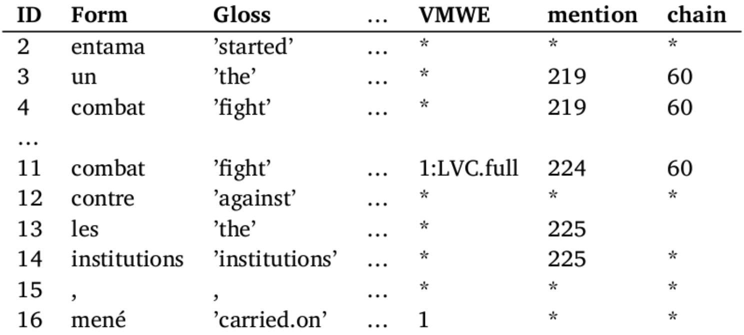
Corpora

- French ANCOR corpus [Muzerelle *et al.*(2014)]
  - Speech: transcriptions of oral **conversations**
  - Annotated **manually** for mentions and **coreference** chains
- Sequoia part of the French PARSEME corpus [Candito *et al.*(2017)]
  - **Medical** reports, **Wikipedia** articles, and **newspaper** texts
  - Annotated **manually** for annotated for **VMWEs**
- Est Républicain – regional **newspaper** corpus
  - Annotated manually for titles and text boundaries
- In total: **544,642** words, 37,888 sentences.

Pipeline

- **Coreference** pipeline (applied to Sequoia and Est Républicain)
  - mention detection: **DeCOFre** (trained on ANCOR) [Grobol(2019)]
  - coreference resolution: **OFCORS** (trained on ANCOR)
- **VMWE** pipeline (applied to ANCOR and Est Républicain)
  - segmentation + morpho-syntactic analysis: **UDPipe** (trained on French UD) [Straka(2018)]
  - VMWE identification: **Seen2Seen** (trained on the PARSEME corpus) [Pasquer *et al.*(2020)]

Format



ID	Form	Gloss	...	VMWE	mention	chain
2	entama	'started'	...	*	*	*
3	un	'the'	...	*	219	60
4	combat	'fight'	...	*	219	60
...						
11	combat	'fight'	...	1:LVC.full	224	60
12	contre	'against'	...	*	*	*
13	les	'the'	...	*	225	
14	institutions	'institutions'	...	*	225	*
15	,	,	...	*	*	*
16	mené	'carried.on'	...	1	*	*

Cases of mention/VMWE overlap

- A **VMWE** is **included** in a mention

  ce patient **atteint** d'une **maladie** grave
  lit. this patient reached by a serious disease
  'this seriously ill patient' 🚫

- A VMWE covers the **same tokens** as a mention

  mise en évidence
  lit. putting into evidence | 'highlighting' 🚫

- A **mention** is **included** in a VMWE

  trouver la mort
  lit. find the death | 'die' ✅

- A mention and a VMWE **overlap partly**

  pris en plagrant délit de vol
  lit. taken at a flagrant offense of theft
  'caught red-handed while stealing' ✅

Human validation

- 7,010 VMWE occurrences
- **1,311** automatically extracted **intersections**
- Manual validation & error annotation
  - *false*: wrong mention, wrong chain, wrong MWE, wrong MWE type, literal MWE occurrence
  - *true* – **relevant** to the research hypothesis

    (...) l'**ordonnance** de renvoi devant le tribunal (...) a été **signée** par le juge (...). Dans son ordonnance, (...)
    'the **order** of dismissal to court was **signed** by the judge (...). In his order (...)'

  - *repeated* – effect of **disfluence** in speech

    ça **fait partie** du patrimoine ça aussi je ça **fait partie** du patrimoine oui je trouve
    lit. 'this **makes part** of the heritage this also I this **makes part** of the heritage yes I think'
    'this belongs to the heritage this also I this belongs to the heritage yes I think'

  - *irrelevant* – overlap cases 1 and 2
  - *unclear*

Overall results

Type	VMWEs	Overlaps	True	%	Repeated	Irrelevant	Unclear
VID	5266	661	29	0.6	23	0	6
LVC.full	1726	642	245	14.2	84	9	2
LVC.cause	18	4	1	5.6	0	0	0
Total	7010	1307	275	3.9	107	9	8

- In **3.9% of VMWEs**, proper subsets of lexicalized components occur in non-trivial coreference chains.
- The **VMWE category** matters (0.6% VID vs. 14.2% LVC.full)

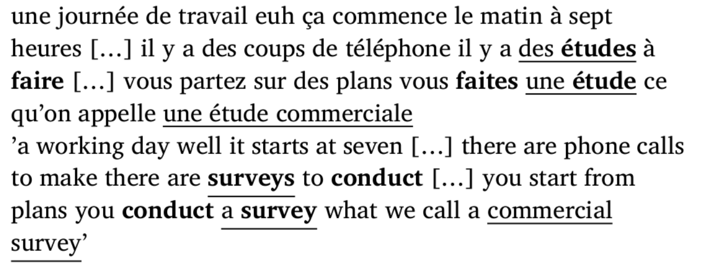
Results per corpus and VMWE category

Corpus	VID			LVC.full		
	Annotated	True	Percentage	Annotated	True	Percentage
Sequoia	204 (204)	1	0.5 (0.5)	340 (340)	22 (22)	6.5 (6.5)
ER	302 (244)	0	0.0 (0.0)	122 (198)	3 (3)	2.5 (1.7)
ANCOR	4760 (21)	28	0.6 (3.9)	1264 (2282)	220 (280)	17.4 (12.3)
All	5266 (1169)	29	0.6 (2.5)	1726 (2821)	245 (305)	14.2 (10.8)

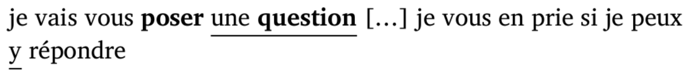
- Correction for noise and silence estimations (parenthesized)
- **Genre** of the corpus matters (more true overlaps in **speech**)

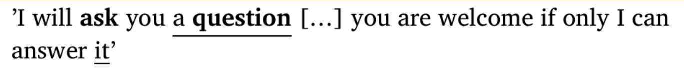
True overlaps (LVCs)

Direct coreference


une journée de travail euh ça commence le matin à sept heures [...] il y a des coups de téléphone il y a des **études** à **faire** [...] vous partez sur des plans vous **faites** une **étude** ce qu'on appelle une étude commerciale
'a working day well it starts at seven [...] there are phone calls to make there are **surveys** to **conduct** [...] you start from plans you **conduct** a **survey** what we call a commercial survey'

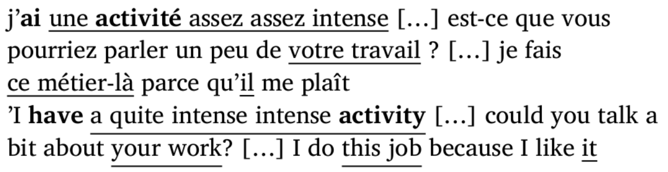
Pronominal coreference


je vais vous **poser** une **question** [...] je vous en prie si je peux y répondre


'I will **ask** you a **question** [...] you are welcome if only I can answer it'

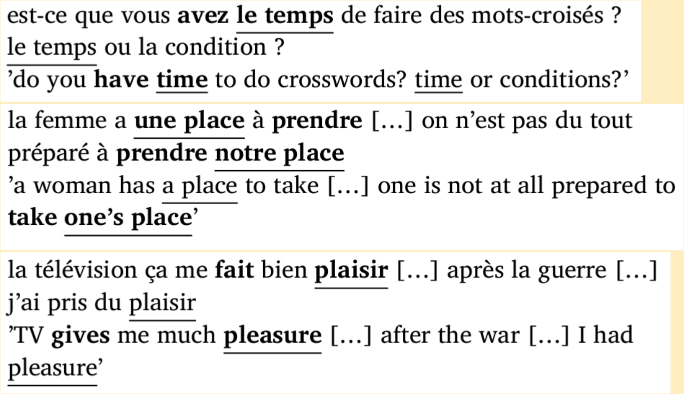
True overlaps (LVCs)

Indirect coreference (rare)



j’**ai** une **activité** assez assez intense […] est-ce que vous pourriez parler un peu de votre travail ? […] je fais ce métier-là parce qu’il me plaît
’I **have** a quite intense intense **activity** […] could you talk a bit about your work? […] I do this job because I like it

True overlaps (VIDs)



est-ce que vous **avez le temps** de faire des mots-croisés ?
le temps ou la condition ?
'do you **have time** to do crosswords? time or conditions?'

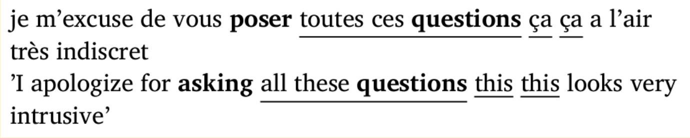
la femme a **une place** à **prendre** [...] on n'est pas du tout
préparé à **prendre notre place**
'a woman has a place to take [...] one is not at all prepared to
take one's place'

la télévision ça me **fait** bien **plaisir** [...] après la guerre [...]
j'ai pris du plaisir
'TV **gives** me much **pleasure** [...] after the war [...] I had
pleasure'

Semantic properties of true overlaps

- Lexicalized **nouns** bear their **literal sense**, and are **abstract** and/or **generic** (*temps* ‘time’, *problème* ‘problem’, *place* ‘place’, *plaisir* ‘pleasure’)
- When a MWE is strongly semantically **non-compositional**, **non-decomposable**, **figurative** and/or **non-transparent**, its components **do not corefer** with other mentions.
- This correlation has the same nature as between semantic properties of VMWEs and their lexical and morpho-syntactic **flexibility**

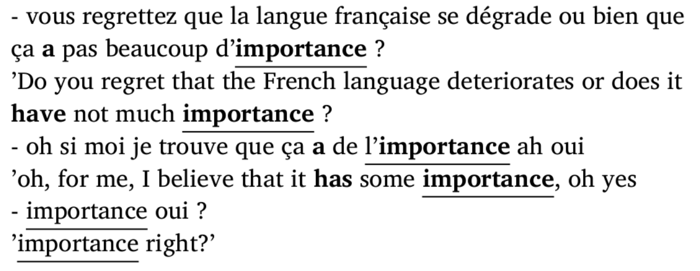
Pronominal coreference with LVCs



je m’excuse de vous **poser** toutes ces **questions** ça ça a l’air très indiscret
’I apologize for **asking** all these **questions** this this looks very intrusive’

- The pronoun *ça* ‘this’ corefers both with the **questions** and with the act of **asking** them
- This is inherent to LVCs (the noun alone refers to the **same event** as the verb+noun)
- **25%** of the true overlaps in ANCOR contain *ça* ‘this’

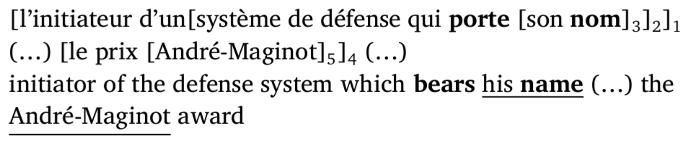
Coreference in spontaneous conversational speech



- vous regrettez que la langue française se dégrade ou bien que ça **a** pas beaucoup d'**importance** ?
'Do you regret that the French language deteriorates or does it **have** not much **importance** ?
- oh si moi je trouve que ça **a** de l'**importance** ah oui
'oh, for me, I believe that it **has** some **importance**, oh yes
- importance oui ?
'importance right?'

- No disfluence but **reuse** of the whole MWE by the second speaker

A mention as a referent



[l'initiateur d'un[système de défense qui **porte** [son **nom**]$_3$]$_2$]$_1$
(...) [le prix [André-Maginot]$_5$]$_4$ (...)
initiator of the defense system which **bears** his **name** (...) the
André-Maginot award

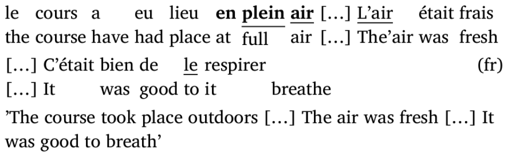
- 5 mentions
- 4 referents:
  - *r*1: the statesman (*André Maginot*)
  - *r*2: defense system (*ligne Maginot* 'Maginot line')
  - *r*3: the award (*prix André-Maginot* 'André-Maginot award')
  - *r*4: the name of the statesmen (***porte*** *son* ***nom*** 'bears his name')
- Do mentions 3 and 5 corefer?
  - *André Maginot* acts both as a mention (a naming expression) referring to *r*1 and as a referent to which mention 3 refers.
  - ⇒ The boarder between the referents (items of the discourse word) and mentions (items of the language) is **fuzzy**.

Wrap-up

Conclusions

- Coreference is likely to ***shut its eyes*** 'to ignore' MWE components
- Frequency of true overlaps heavily depends on the **MWE type** and on the **text genre** – higher for LVCs and speech True overlpas occur mostly with **direct** and **pronominal** coreference but rarely with indirect coreference
- True overlaps contain nominal objects which are **abstract** and **generic**, and occur in their literal rather than figurative sense
- True overlpas in speech are somewhat **coincidental**

Future work



le	cours	a	eu	lieu	**en**	**plein**	**air**	[…]	L'air	était	frais
the	course	have	had	place	at	full	air	[…]	The'air	was	fresh

[…]	C'était	bien	de	le	respirer	(fr)
[…]	It was	good	to	it	breathe	

'The course took place outdoors […] The air was fresh […] It was good to breath'

- Extension to other languages and types of MWEs

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