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ICLC14 – Tartu – 2017.07.12

Dynamicized semantic maps of content words

Comparing long-term lexical changes in Ancient Egyptian and Greek

Outline of the talk

- Introduction
  - What are semantic maps?
  - Le Diasema (LExical DIAchronic SEmantic MAps)
- A case-study. The semantic extension of time-related lexemes in Ancient Egyptian and Ancient Greek
  - Automatically plotting synchronic semantic maps based on crosslinguistic colexification patterns
  - Adding the diachronic dimension to semantic maps of content words
- Conclusions

Introduction

Semantic maps & Le Diasema

What are semantic maps?

'A semantic map is a geometrical representation of functions (…) that are linked by connecting lines and thus constitute a network' (Haspelmath 2003). It constitutes a 'model of attested variation' (Cysouw 2007).

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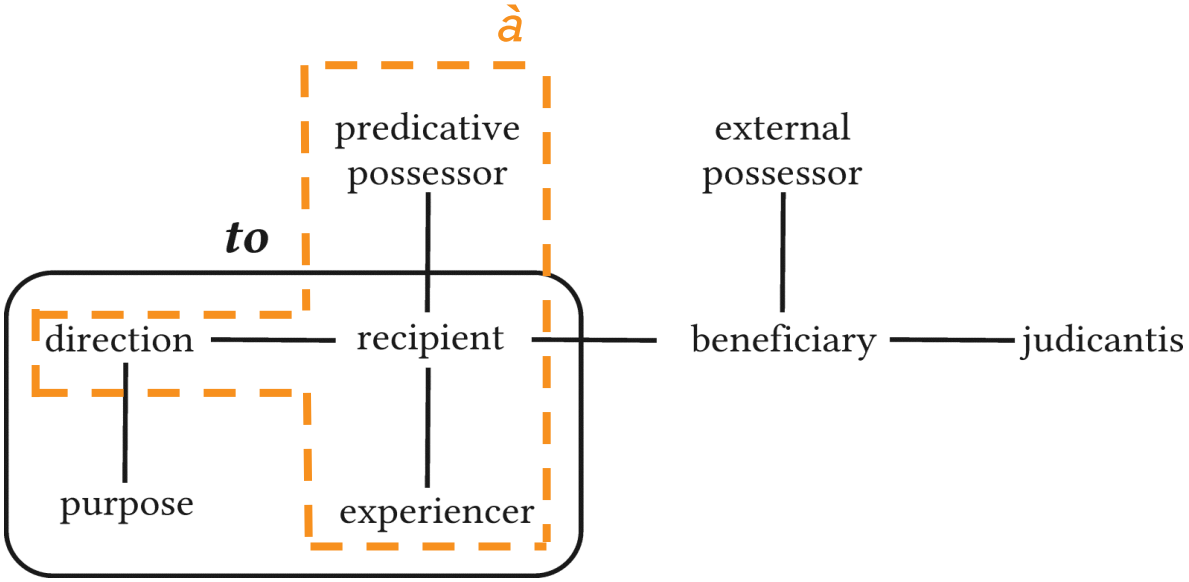

Figure 1. A semantic map of typical dative functions / the boundaries of English *to* and French *à* (based on Haspelmath 2003: 213, 215)

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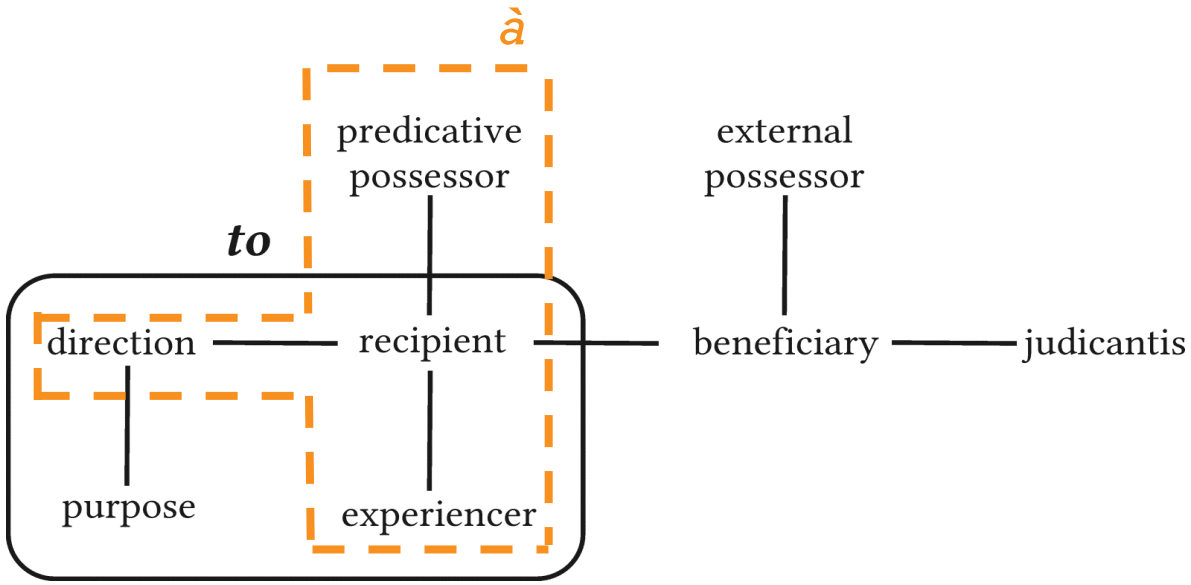

Figure 1. A semantic map of typical dative functions / the boundaries of English *to* and French *à* (based on Haspelmath 2003: 213, 215)

- Sense distinctions are based on **cross-linguistic evidence** and designed to have **cross-linguistic validity**

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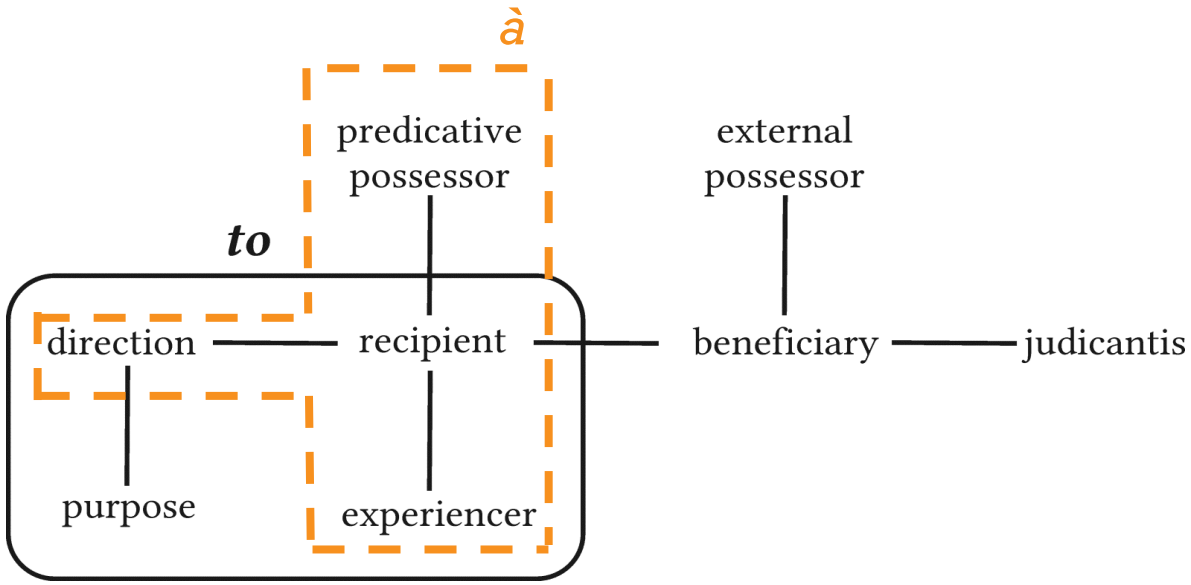

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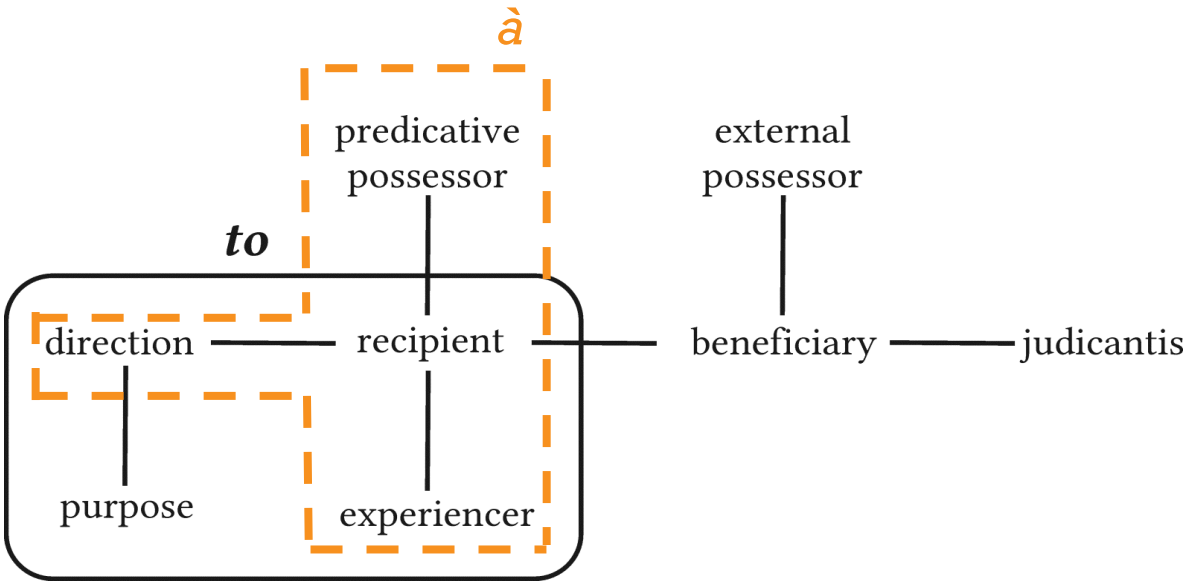

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- Sense distinctions are based on **cross-linguistic evidence** and designed to have **cross-linguistic validity**
- They combine the **onomasiological** and the **semasiological** perspective
- **Multifunctionality**. No commitment to a particular claim about conventionalization of senses

What are semantic maps?

Diachronic ('dynamicized') semantic maps

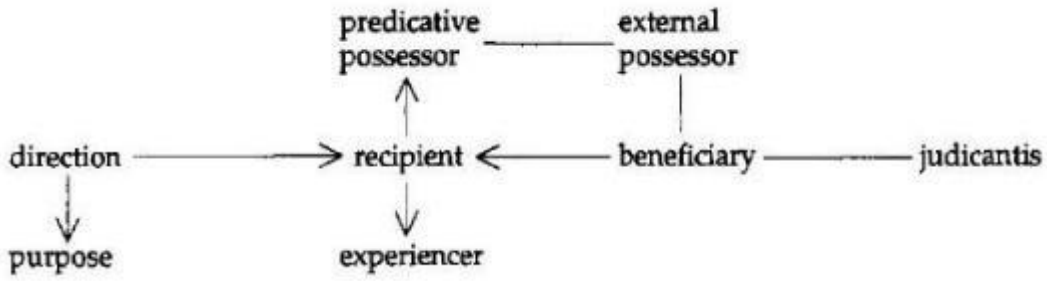

Figure 2. Dynamicized semantic map of dative functions (Haspelmath 2003: 234)

The **arrows** designate directionality of change

What are semantic maps?

Lexical semantic maps

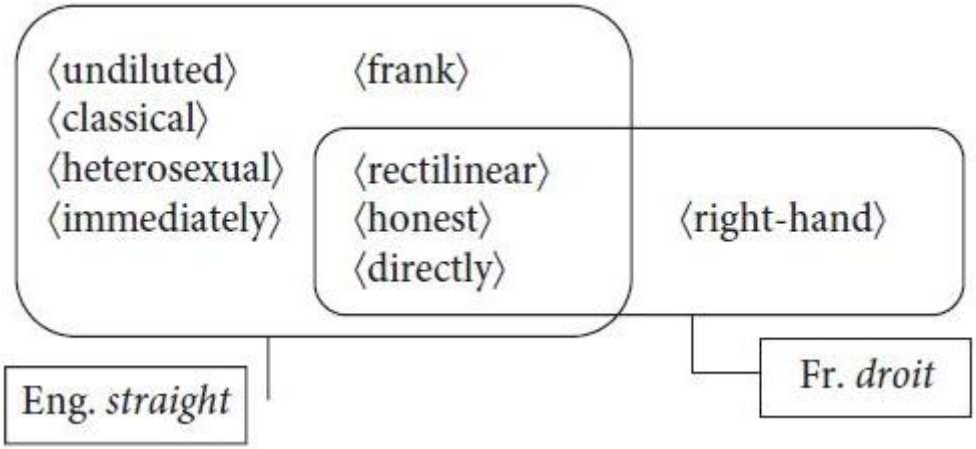

Figure 3. Overlapping polysemies: Eng. straight *vs.* Fr. droit
(François 2008: 167)

Colexification = polyfunctionality

"A given language is said to colexify two functionally distinct senses if, and only if, it can associate them with the same lexical form"
(François 2008: 170)

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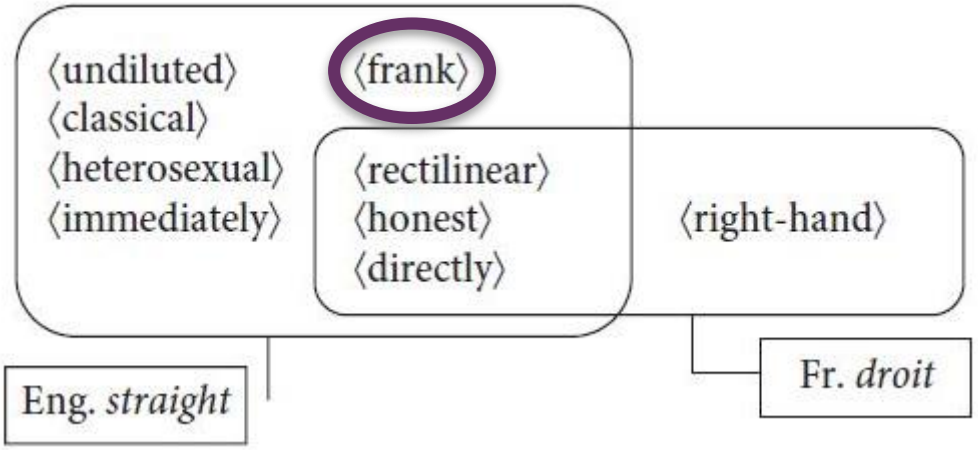
Lexical semantic maps



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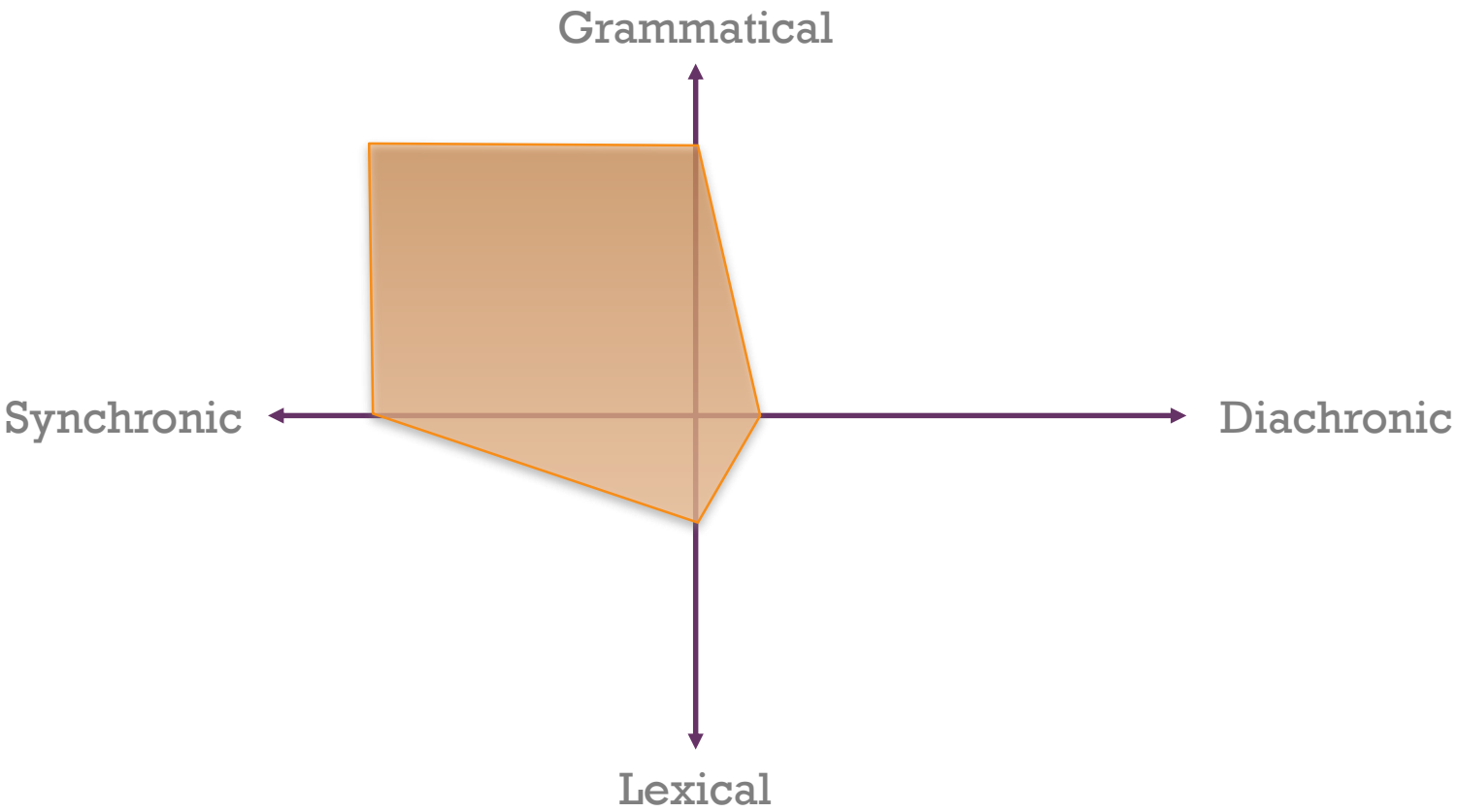
(François 2008: 170)

"A function is put on the map if there is at least one pair of languages that differ with respect to this function"
(Haspelmath 2003: 217; cf. François 2008: 168-169)

Le Diasema

Filling a gap

- Adding a diachronic dimension to semantic maps of content words



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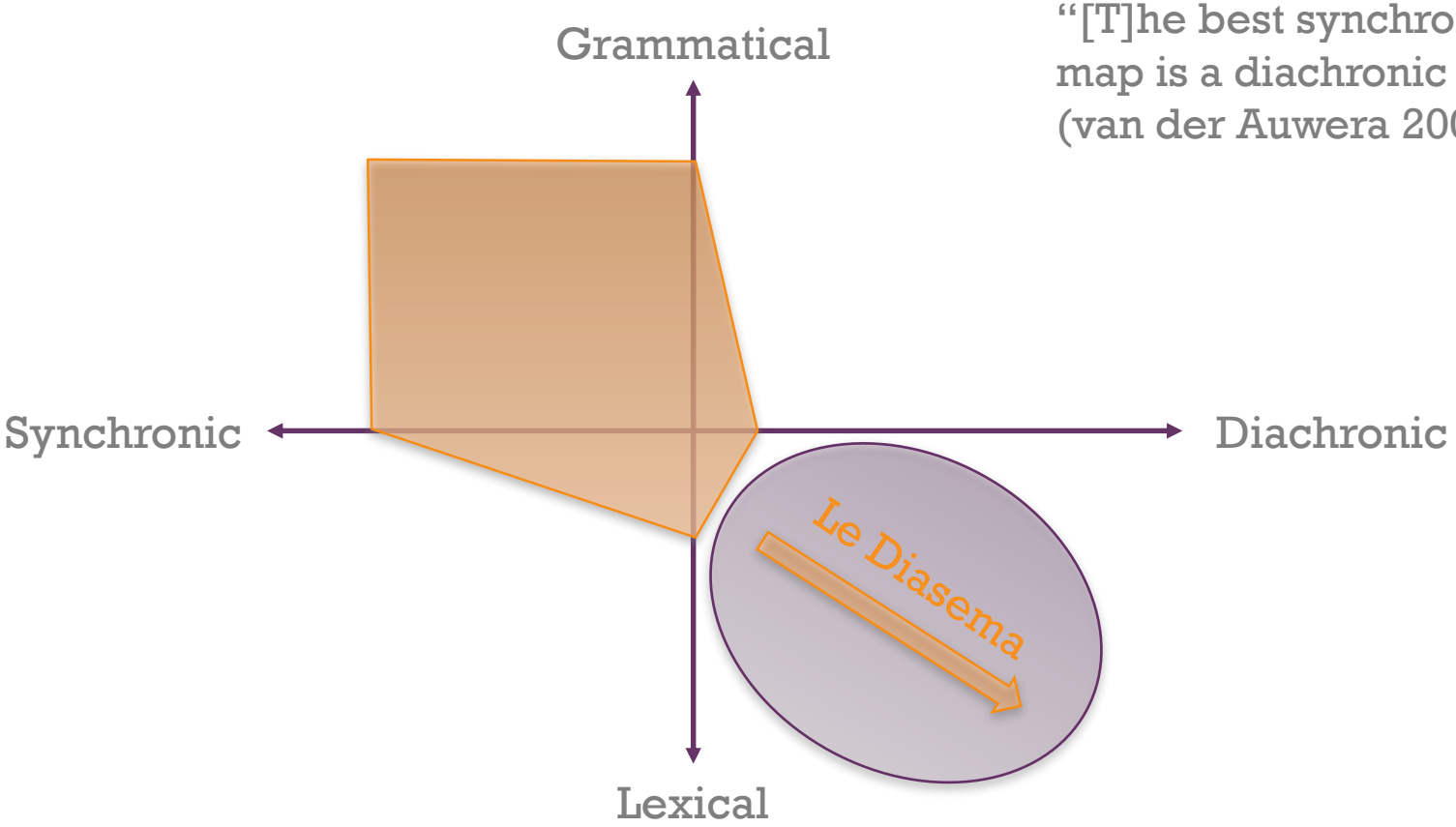


"[T]he best synchronic semantic map is a diachronic one" (van der Auwera 2008: 43)

Le Diasema

- Duration
  - December 2016 – December 2018
- Main research question
  - How semantic maps make significant predictions about language change at the lexical level?
- Funding schemes

Université de Liège

BeIPD-COFUND

http://web.philo.ulg.ac.be/lediasema/

Le Diasema

- To incorporate the diachronic dimension into semantic maps of content words
- To extend the method so as to also include information about the cognitive and cultural factors behind the development of the various meanings
- To create an online platform for automatically plotting diachronic semantic maps based on polysemy data from the languages of the world

Le Diasema

Specific objectives for today

- To incorporate the diachronic dimension into semantic maps of content words
- To extend the method so as to also include information about the cognitive and cultural factors behind the development of the various meanings
- To create an online platform for automatically plotting diachronic semantic maps based on polysemy data from the languages of the world

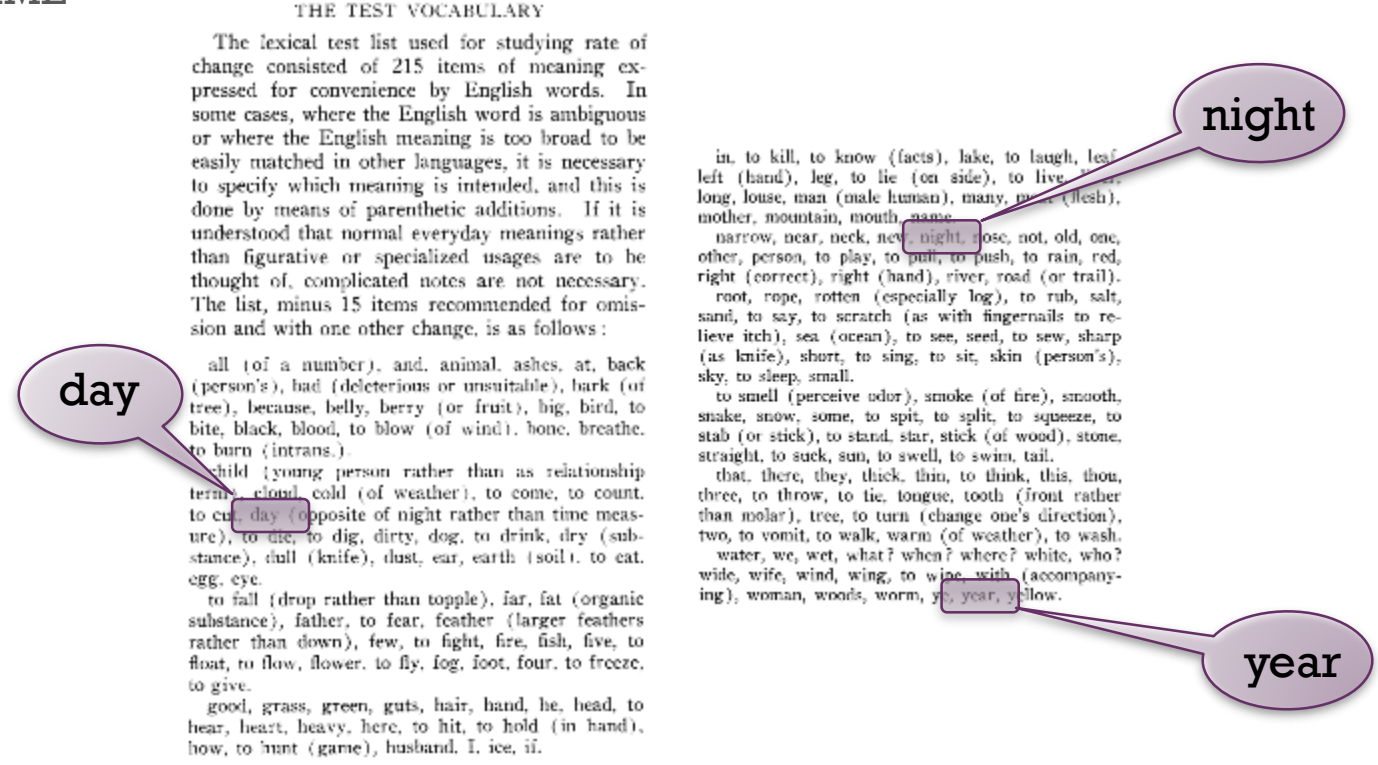
The semantic extension of time-related lexemes

Inferring a semantic map based
on cross-linguistic colexification patterns

The semantic extension of time-related lexemes

Plotting a synchronic semantic map

- For the purpose of universality and stability, we chose the entries for time-related concepts in the Swadesh 200-word list (Swadesh 1952: 456-457)
  - DAY/DAYTIME
  - NIGHT
  - YEAR



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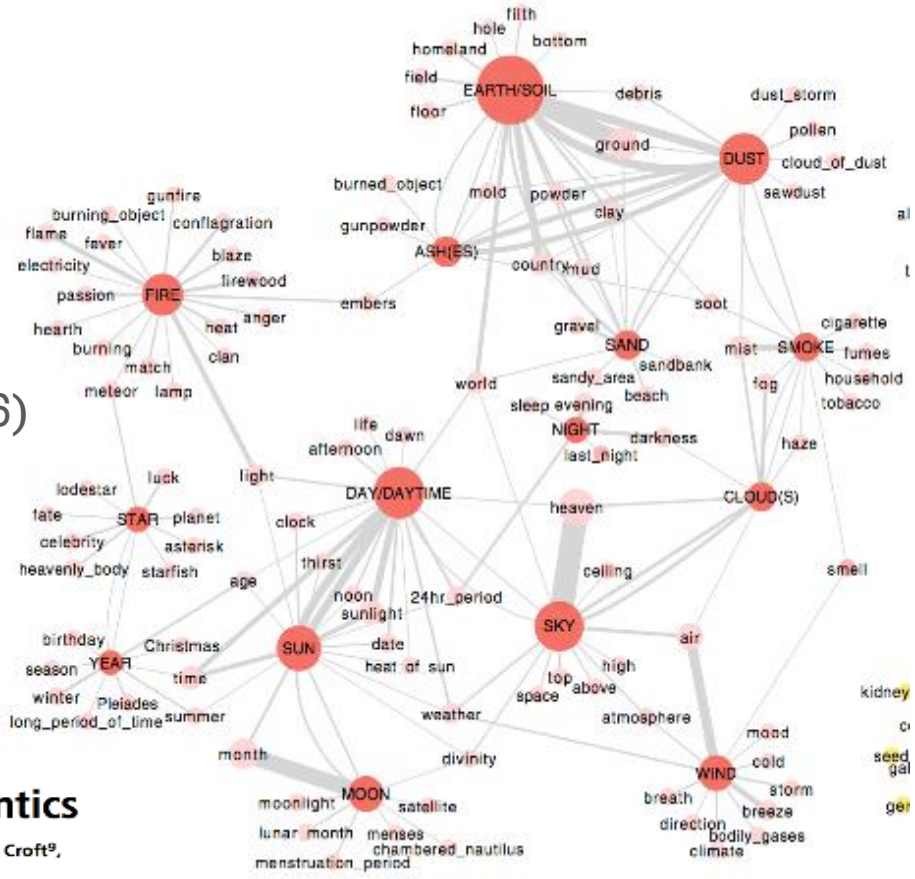
- For the purpose of comparability, these three concepts are adequate (cf., e.g. , Youn et al. 2016)



On the universal structure of human lexical semantics

Hyejin Youn[a,b,c,1], Logan Sutton[d], Eric Smith[c,e], Cristopher Moore[c], Jon F. Wilkins[c,f], Ian Maddieson[g,h], William Croft[g], and Tanmoy Bhattacharya[c,i,1]

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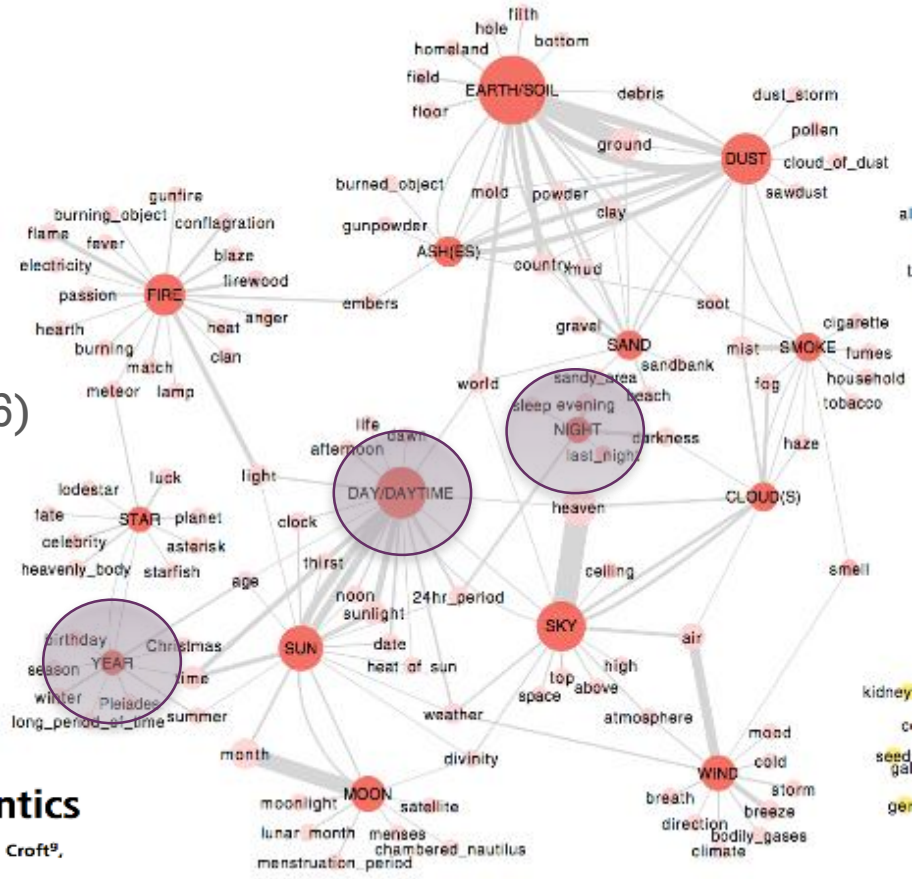

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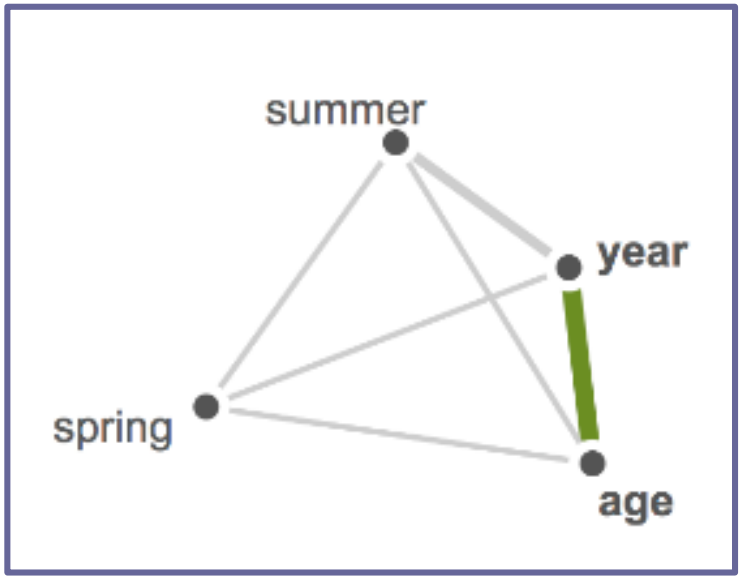
The semantic extension of time-related lexemes

Plotting a synchronic semantic map

- We identified in the database of Crosslinguistic Colexifications (CLICs; http://clics.lingpy.org/main.php; List et al. 2014) the main polysemy patterns attested for these three meanings (subgraph approach) [16 meanings]
  - **DAY/DAYTIME**: CLOCK/TIMEPIECE, HOUR, SEASON, SUN, TIME, WEATHER
  - **NIGHT**: DARK (in color), DARKNESS, BLACK, OBSCURE
  - **YEAR**: AGE, SPRING, SUMMER



The semantic extension of time-related lexemes

Plotting a synchronic semantic map

- All the colexification patterns attested for these 16 meanings were gathered in the CLICs source files (http://clics.lingpy.org/download.php), ending up with **381 colexification** patterns

	A	B	C
119	day	afternoon	hau_std:rana//ket_std:i?//plj_std:piidi//rus_std:den//tli_std:yakyee
120	day	again	kha_std:sngi
121	day	age	gui_std:ˈara//yad_std:hnda
122	day	anger	tzz_std:k'ak'al
123	day	bright	tzz_std:k'ak'al
124	day	clock, timepiece	gue_std:wurlngarn//sei_std:šā?
125	day	cloud	haw_std:ao
126	day	country	cbr_std:niti//shp_std:niti
127	day	dawn	haw_std:ao//waw_std:enmari
128	day	doubt	haw_std:lā
129	day	earth, land	cag_std:nafu//haw_std:ao//mri_std:ao//tzz_std:osil
130	day	east	tob_std:na?a?k
131	day	fever	tzz_std:k'ak'al
132	day	fin (dorsal)	haw_std:lā
133	day	fire	jpn_std:hi
134	day	go	ote_std:pa//oym_std:aa
135	day	go away, depart	ote_std:pa
136	day	hour	sap_Standard:aknim//shb_std:tham
137	day	lamp, torch	ito_std:uwayo
138	day	lick	cmn_std:tian
139	day	light (in color)	mri_std:ao
140	day	light (noun)	con_std:a?ta//crt_std:xloma//haw_std:ao//hdn_Northern:ʔkatʰkáa//ito_std:uwayo//mzh
141	day	live, living, life	shp_std:niti
142	day	Monday	shp_std:niti
143	day	morning	crt_std:xloma//guq_std:kreibu
144	day	noon, midday	ind_std:siang//plj_std:piidi

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- These synchronic polysemy patterns were converted into a **lexical matrix**

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Tmap = [Tsenses]
for t in Tclean:
        split_langWord = t[2].split('//')
        for couple in split_langWord:
                langWord = couple.split(':')
                line = [langWord[0], langWord[1]]
                for i in range (2,len(Tsenses)):
                        line.append('0')
                line[Tsenses.index(t[0])] = '1'
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                Tmap.append(line)
```

Python script α

	A	B	C	D	E	F
1			age	acid, sour	city, town	day
2	yad_std	hnda	1	1	0	1
3	vec_std	edat	1	0	0	0
4	jpn_std	toshi	1	0	1	0
5	gui_std	ʻara	1	0	0	1
6	nog_std	йуз	1	0	0	0
7	mri_std	pakeke	1	0	0	0
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Lexical matrix

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Python script α

Languages

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Languages Forms

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Python script α

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Python script α

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1 when a meaning is attested for one form

Lexical matrix

The semantic extension of time-related lexemes

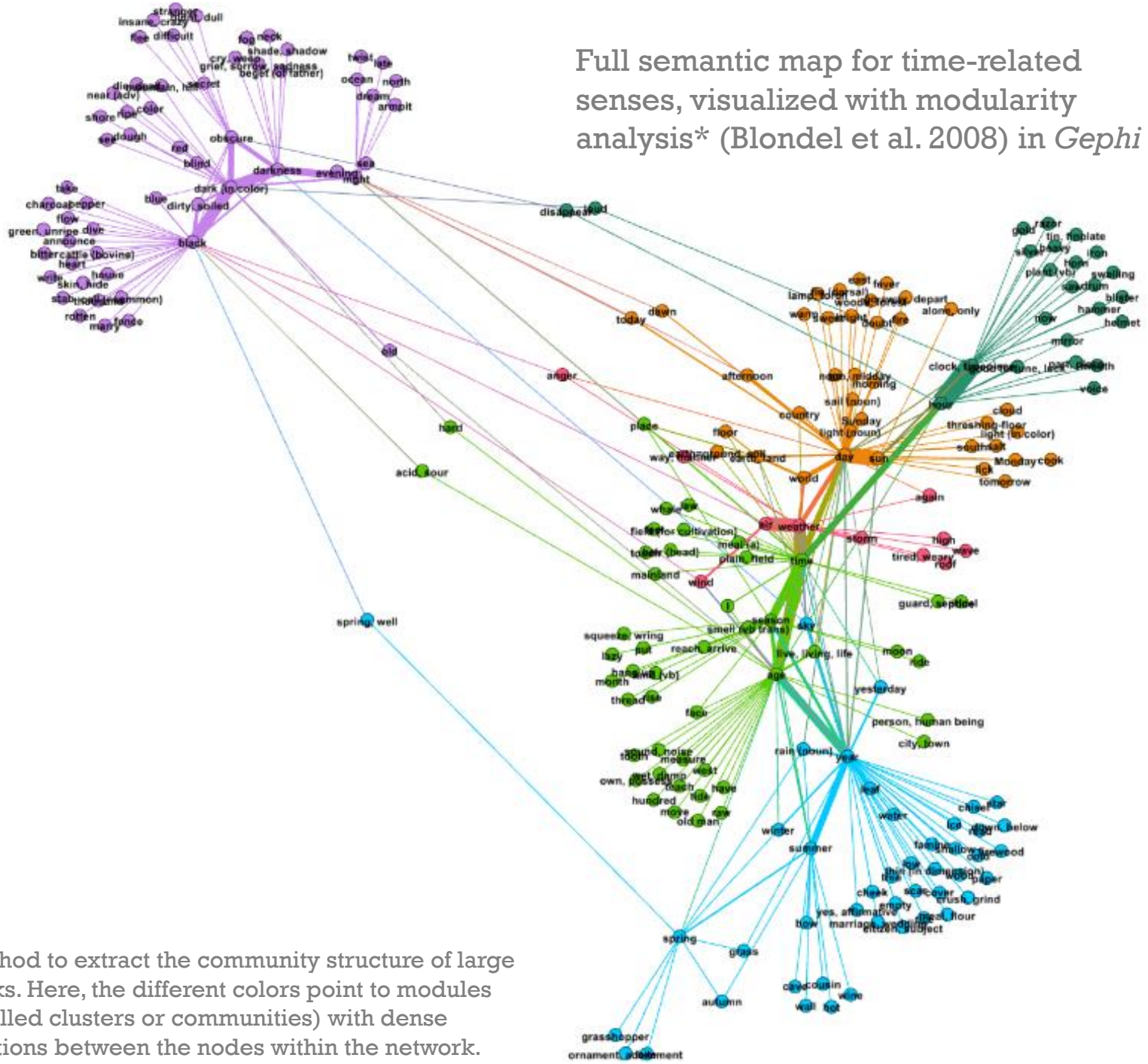
Plotting a synchronic semantic map

- All the colexification patterns attested for these 16 meanings were gathered in the CLICs source files (http://clics.lingpy.org/download.php), ending up with **381 colexification** patterns
- These synchronic polysemy patterns were converted into a **lexical matrix**
- From this lexical matrix, we inferred a **weighted semantic map** based on an adapted version of the algorithm suggested by Regier et al. (2013)

```
# CREATE INITIAL GRAPH
# graph G: add each term's nodes, no edges in graph yet.
G = nx.Graph()  # create empty graph (undirected)
PossE = []      # list of possible edges, filled below
for t in T:
        # add all nodes in t, if not already in graph
        for n in t:
                if (not G.has_node(n)):
                        G.add_node(n)
        # add to PossE a link between each pair of nodes in t
        # adding a link between every node in G is needless and slower
        for pair in allpairs(t):
                u = pair[0]
                v = pair[1]
                if (not (((u,v) in PossE) or ((v,u) in PossE))):
                        PossE.append((u,v))
```

Python script β

Full semantic map for time-related senses, visualized with modularity analysis* (Blondel et al. 2008) in *Gephi*



* A method to extract the community structure of large networks. Here, the different colors point to modules (also called clusters or communities) with dense connections between the nodes within the network.

The semantic extension of time-related lexemes

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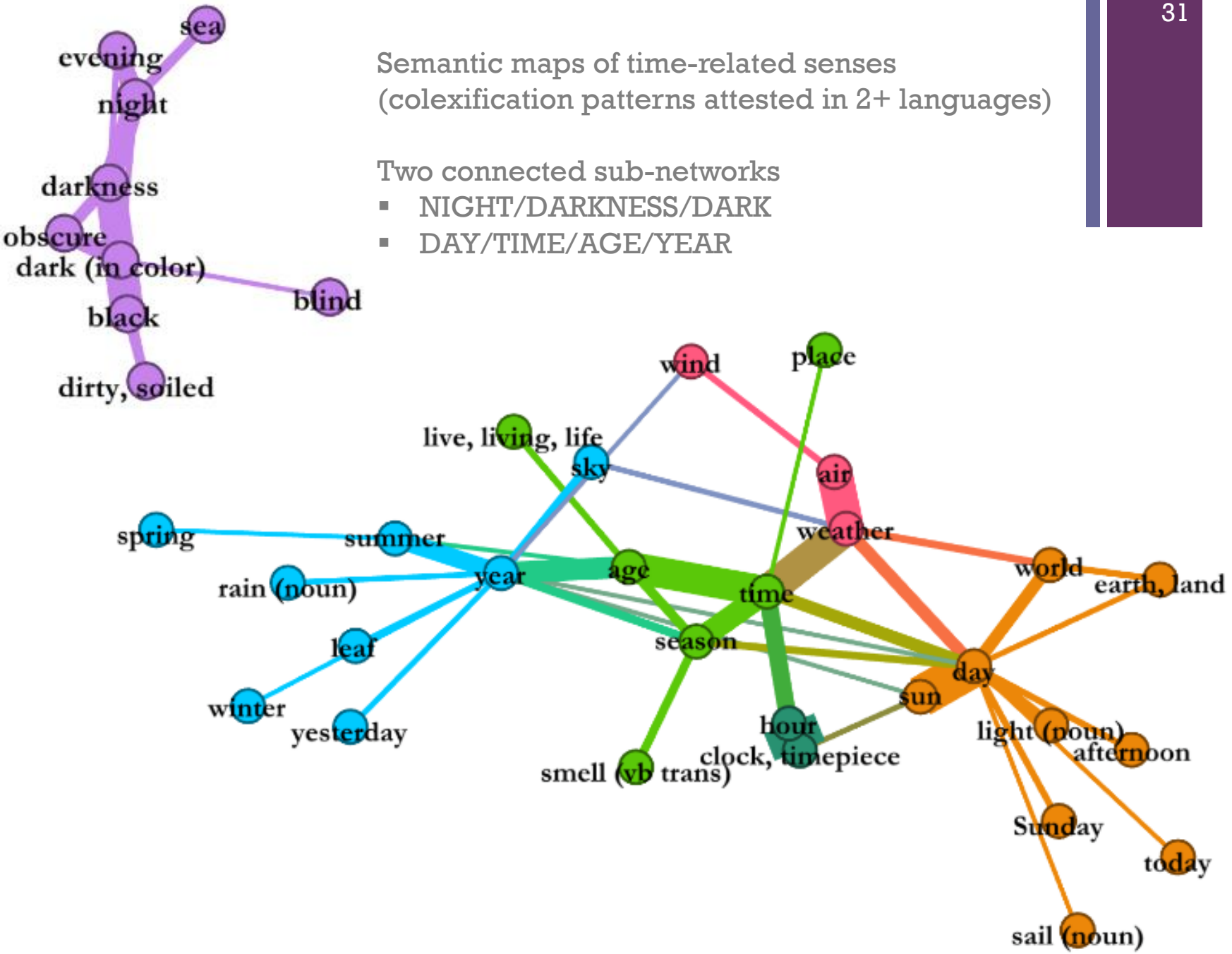
- From this lexical matrix, we inferred a **weighted semantic map**, based on an adapted version of the algorithm by Regier et al. (2013)
- Crucially, as opposed to the algorithm of Regier et al. (2013), the **weighted edges** allow us to get rid of poorly attested patterns of polysemy (keeping only those attested in 2^+ languages),

Semantic maps of time-related senses
(colexification patterns attested in 2+ languages)

Two connected sub-networks
- NIGHT/DARKNESS/DARK
- DAY/TIME/AGE/YEAR



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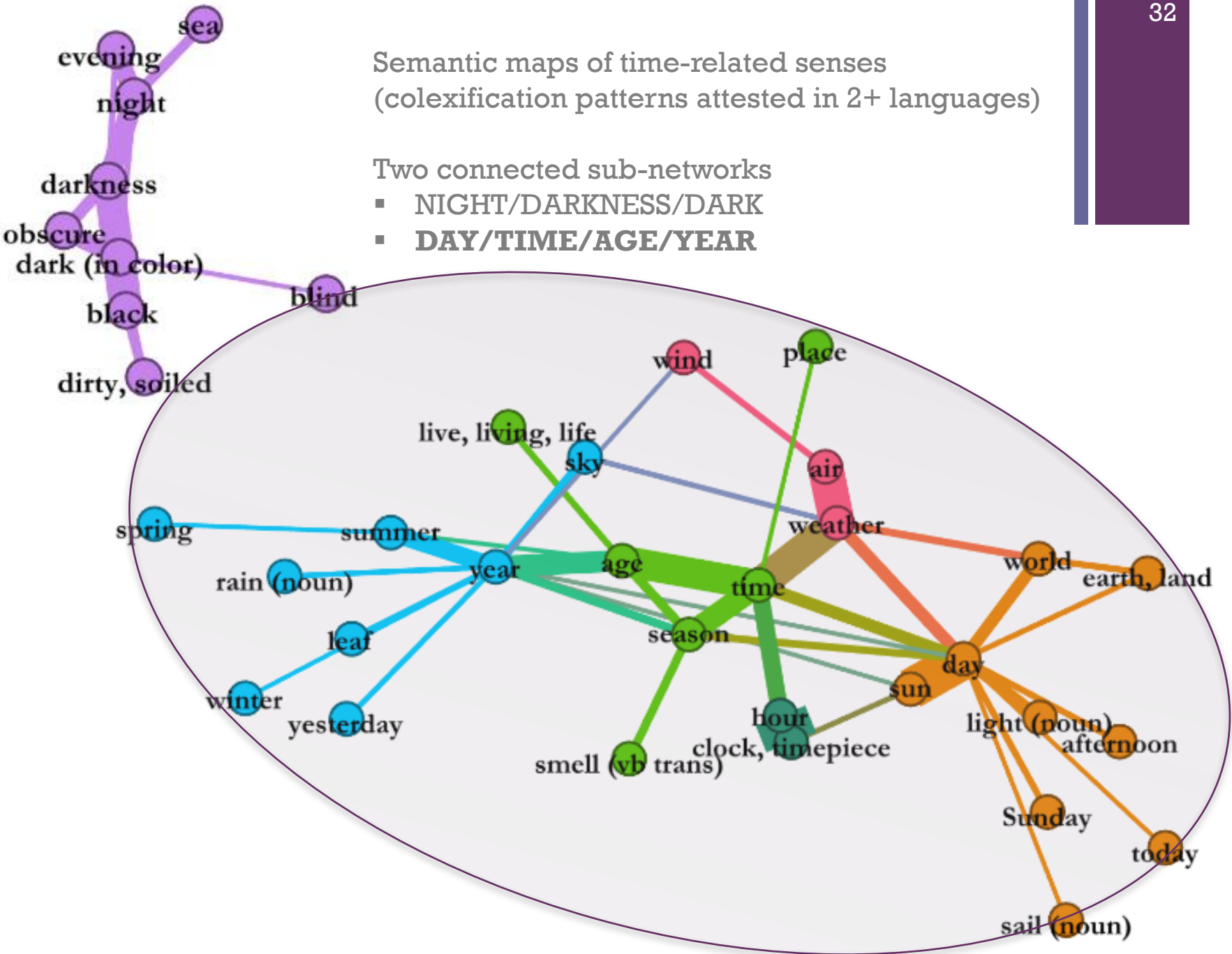


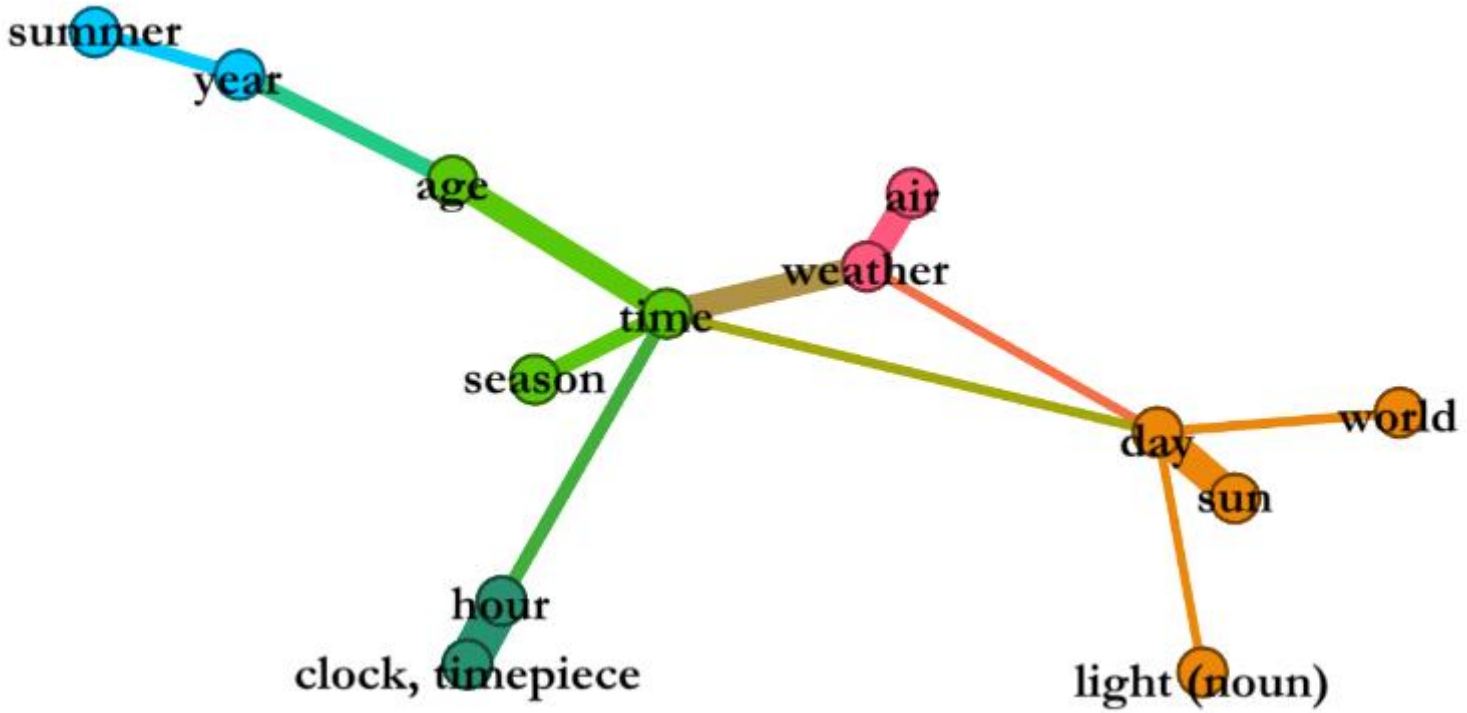
The semantic extension of time-related lexemes

Dynamicizing the map based on diachronic data

The semantic extension of time-related lexemes

Towards a dynamicized semantic map

- In order to investigate directionality of change, 13 meanings that are connected on this map in at least 8 different languages were kept as a basis for diachronic investigation



The semantic extension of time-related lexemes

Towards a dynamicized semantic map

- **Diachronic data**
  - The Catalogue of Semantic Shifts in the Languages of the World (Zalizniak, 2006; Zalizniak et al., 2012; http://semshifts.iling-ran.ru/)

DatSemShifts

Home | Semantic shifts | Meanings | Languages | Participants | Publications | Contact us | Log in

ID	Source	Direction	Target	Status	Contributed by	Accepted realization	Show
53	time	—	weather	Accepted	DG	4	Show
109	time	—	opportunity	Accepted	IG	2	Show
395	time	—	hour	Accepted	DG	2	Show
406	time	—	24 hours	Suspended	DG	0	Show
795	time	→	one time, once	New	MB	0	Show
1446	time	→	journal, magazine	Accepted	IG	3	Show

The semantic extension of time-related lexemes

Towards a dynamicized semantic map

- **Diachronic data**
  - The Catalogue of Semantic Shifts in the Languages of the World (Zalizniak, 2006; Zalizniak et al., 2012; http://semshifts.iling-ran.ru/)

DatSemShifts

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ID	Source	Direction	Target	Status	Contributed by	Accepted realization	Show
53	time	—	weather	Accepted	DG	4	Show
109	time	—	opportunity	Accepted	IG	2	Show
395	time	—	hour	Accepted	DG	2	Show
406	time	—	24 hours	Suspended	DG	0	Show
795	time	→	one time, once	New	MB	0	Show
1446	time	→	journal, magazine	Accepted	IG	3	Show

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Ср. греч. хронограф, откуда могут быть кальки.

Confirmed by 3 Guru(s)

Derivation: German *Zeit* → *Zeitung, Zeitschrift* 'newspaper, journal'

Derivation: Karaim *вахт* 'time' → *вахтлых* 'journal'

Polysemy: Polish *czas* 'time' — 'journal'

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  - Ancient Greek (8th – 4th c. BC; in a few cases till 1st c. BC)
    - Perseus digital library (http://www.perseus.tufts.edu/hopper/), TLG (http://stephanus.tlg.uci.edu)
    - Cunliffe (*A lexicon of the Homeric Dialect*), LSJ
  - Ancient Egyptian (26th c. BC – 10th c. AD)
    - Thesaurus Linguae Aegyptiae (http://aaew.bbaw.de/tla/)
    - The Ramses corpus (http://ramses.ulg.ac.be),
    - Lexical resources (Coptic etymological dictionaries)

The semantic extension of time-related lexemes

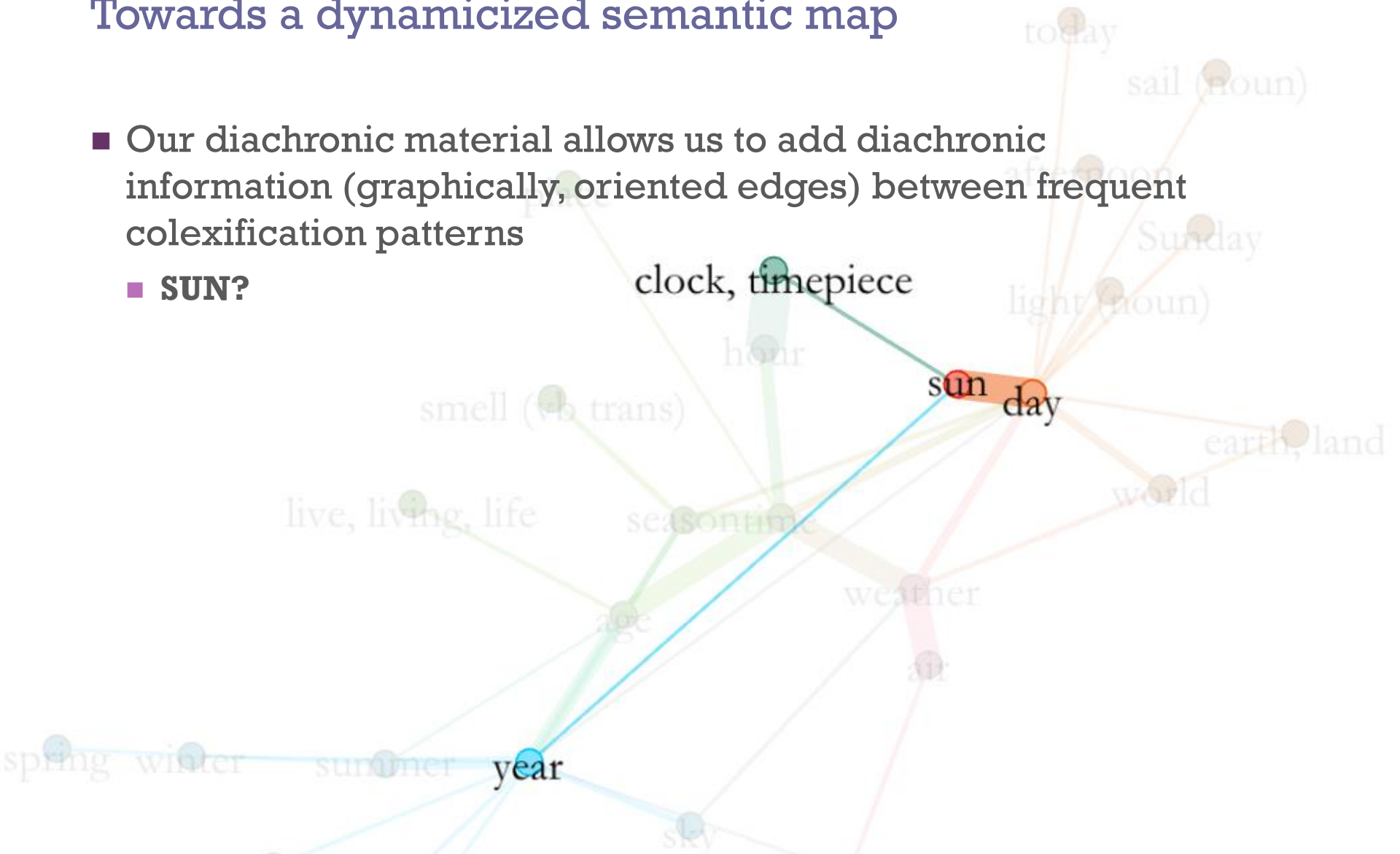
Towards a dynamicized semantic map

- Our diachronic material allows us to add diachronic information (graphically, oriented edges) between frequent colexification patterns

The semantic extension of time-related lexemes

Towards a dynamicized semantic map

- Our diachronic material allows us to add diachronic information (graphically, oriented edges) between frequent colexification patterns
  - **SUN?**



Ancient Greek

hēlíos 'sun' ⇒ 'day'

(1)

pân	*d'*	*êmar*	*pherómēn,*	*háma*	*d'*
whole:ACC.SG.N	ptc	day:ACC.SG.N	carry:IMPF.1PL.M/P	ADV	PTC

ēelíōi	***katadúnti***	*káppeson*	*en*	*Lḗmnōi*
sun:DAT.SG.M	**set:PTCP.AOR.DAT.SG.M**	fall:AOR.1PL	in	Lemnos:DAT.SG

'the whole day long I was carried headlong, and at **sunset** (lit. the sun setting down) I fell in Lemnos' (Homer, *Iliad* 1.592-593)

(2)

ékheis,	*egṓ*	*te*	*sé:*	***hēlíous***	***dè***	***muríous***
have:PRS.2SG	1SG.NOM	PTC	2SG.ACC	**sun:ACC.PL.M**	**PTC**	**infinite:ACC.PL.M**

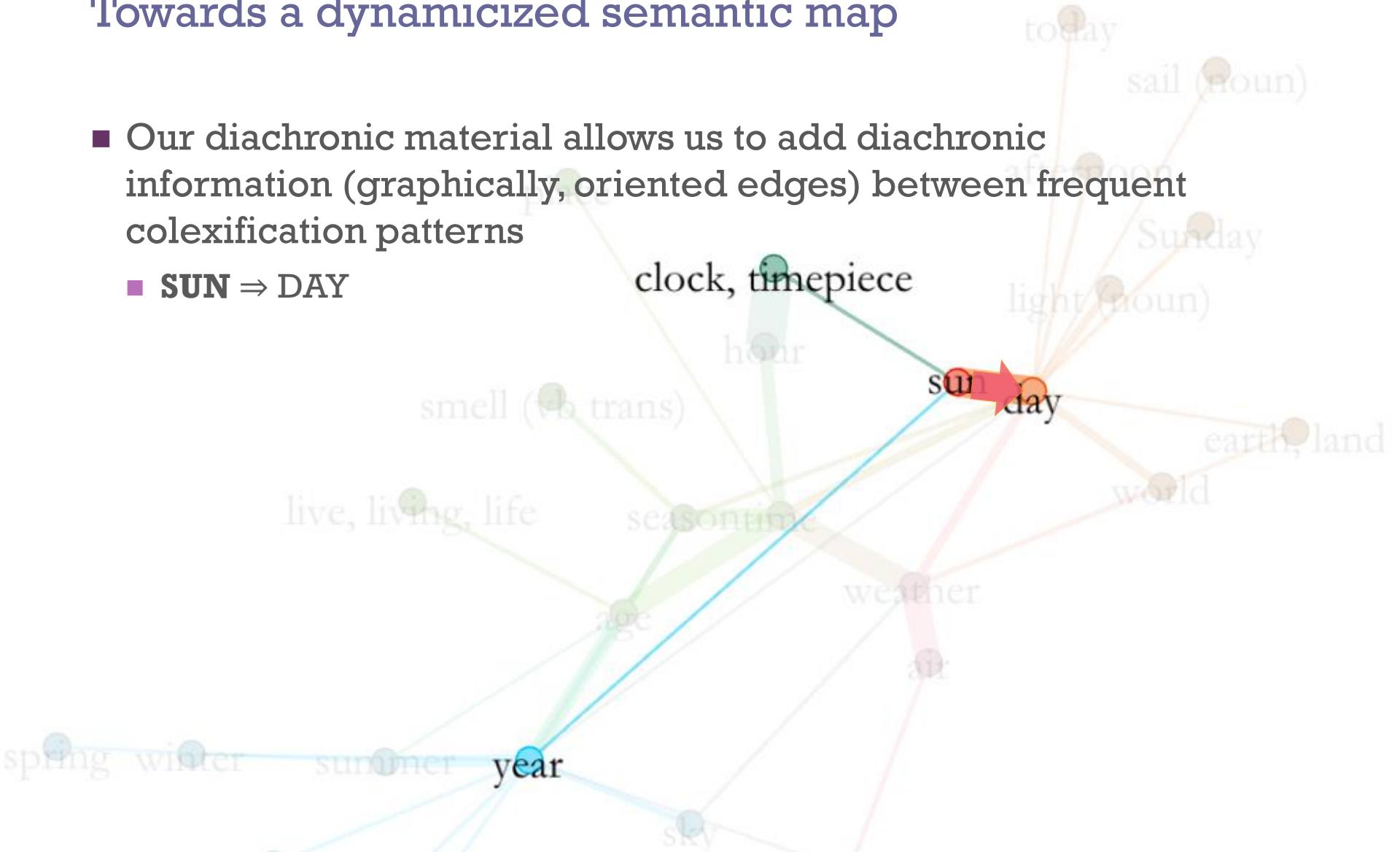
mólis	*dielthṑn*	*ēisthomēn*	*tà*	*tês*	*theoû*
ADV	pass:PTCP.AOR.NOM.SG.M	perceive:AOR.1SG.MID	ART.ACC.PL.N	ART.GEN.SG.F	god:GEN.SG

'You have me, and I have you; although it was hard to live **through so many days**, I now understand the actions of the goddess' (Euripides, *Helen* 652-653)

The semantic extension of time-related lexemes

Towards a dynamicized semantic map

- Our diachronic material allows us to add diachronic information (graphically, oriented edges) between frequent colexification patterns
  - **SUN** ⇒ DAY



The semantic extension of time-related lexemes

Towards a dynamicized semantic map

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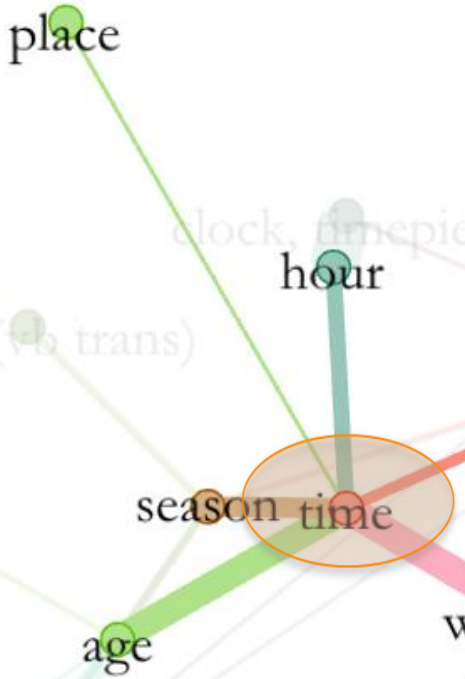
  - SUN ⇒ DAY
  - **TIME?**



Ancient Greek

hṓra 'season/time/moment'

Approx. **8th c. BC**

(3) *hóssá* *te* *phúlla* *kaì* *ánthea*
REL.NOM.PL.N PTC leave:ACC.PL.N CONJ flower:ACC.PL.N

gígnetai ***hṓrēi***
become:PRS.3SG **season:DAT.SG.F**
'as are the leaves and the flowers in their **season**' (Homer, *Iliad* 2.468)

(4) *óphra* *Poseidáōni* *kaì* *állois* *athanátoisin*
CONJ Poseidon:DAT.SG.M CONJ other:DAT.PL immortal:DAT.PL

speísantes *koítoio* *medṓmetha:*
pour.libation:PART.AOR.NOM.PL.M bed:GEN.SG.M think.of:PRS.1PL.SUBJ.M/P

toîo *gàr* ***hṓrē***
dem.GEN.SG PTC **time:NOM.SG.F**
'that when we have poured libations to Poseidon and the other immortals, we may bethink us of sleep; for it is the **time** thereto' (Homer, *Odyssey* 3.333-334)

Ancient Greek

hṓra 'season/time/moment' ⇒ 'hour'

Approx. **5th c. BC**

(5) *anastàs* *dè* *prỳi* *pseustheìs*
raise.up:PTCP.AOR.NOM.SG.M PTC early deceive:PTCP.AOR.PASS.NOM.SG.M

tês ***hṓras*** *badízein*
ART.GEN.SG.F **time:GEN.SG.F** walk:PRS.INF

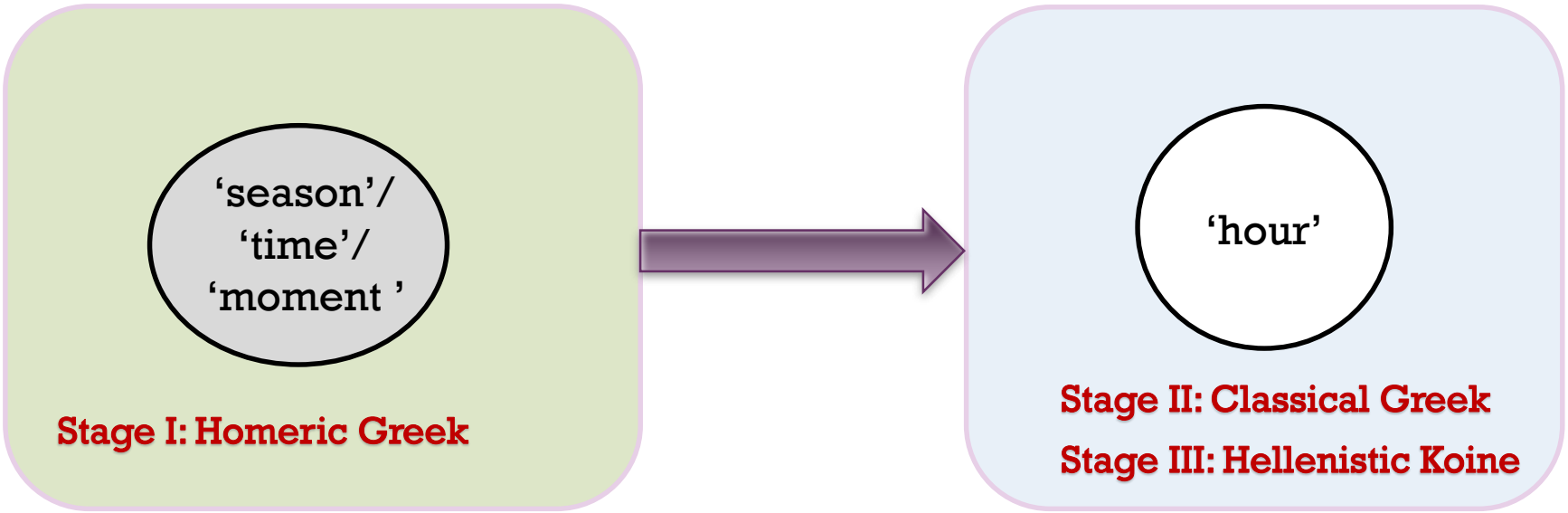
'He arose early, mistaking the **time/hour**, and started off on his walk' (Andocides, *On the Mysteries* 1.38)

Approx. **1st c. AD**

(6) *oukhì* ***dṓdeka*** ***hôrai*** *eisin* *tês* *hēméras;*
NEG **twelve** **hour:NOM.PL.F** be.PRS.3PL ART.GEN.SG.F day:GEN.SG.F

'Aren't there twelve hours of daylight?' (New Testament, John 11.9.2)

Ancient Greek

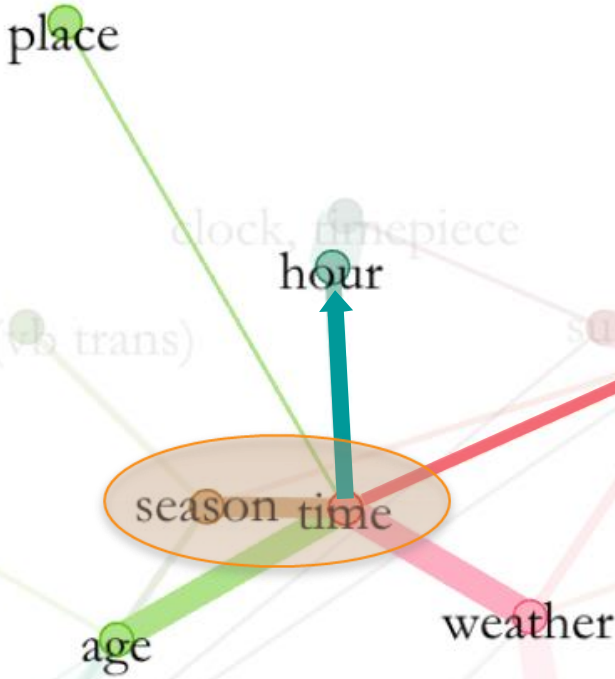


Metonymy: due to the correlation between the canonical time periods and the time these take to unfold.

The semantic extension of time-related lexemes

Towards a dynamicized semantic map

- Our diachronic material allows us to add diachronic information (graphically, oriented edges) between frequent colexification patterns
  - **SUN** ⇒ DAY
  - **TIME** ⇒ HOUR



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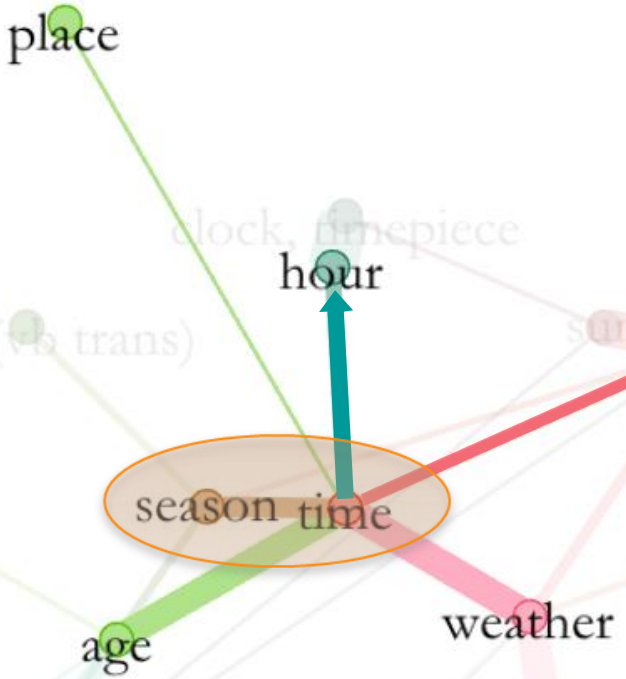
  - **TIME** ⇒ HOUR
- Opposite pathways?



Ancient Egyptian

nw ‘hour/moment (time)’ ⇒ ‘period (time)’

Approx. **23rd c. BC**

Pyr., §1383b (Spell 556)

(7)	jw	**nw**	pn	bkA
	come	**hour/moment**	DEM.M	second_day/tomorrow

‘When this **hour/moment** of tomorrow comes, (and this moment/hour of the third day comes, father Osiris Pepi …)’ (= Sethe 1910: 255)

Approx. **11th c. BC**

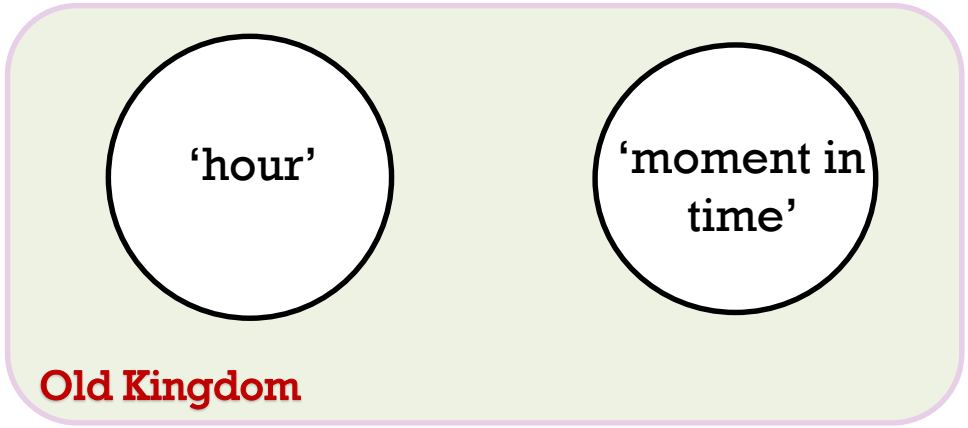
P. Harris 500, v° 6,1

(8)	jw-n	dy	Hr	**ir-t**	**nw**
	SBRD-1PL	here	PROG	**do-INF**	**time**

‘(It’s been three full months) that we’re here **spending our time** [jumping]’ (= *LES* 4,6-7)

Ancient Egyptian

nw ‘hour/moment/time’ ⇒ ‘period/time’



Ancient Egyptian

nw ‘hour/moment/time’ ⇒ ‘period/time’

The semantic extension of time-related lexemes

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  - **SUN** ⇒ DAY
  - **TIME** ⇒ HOUR
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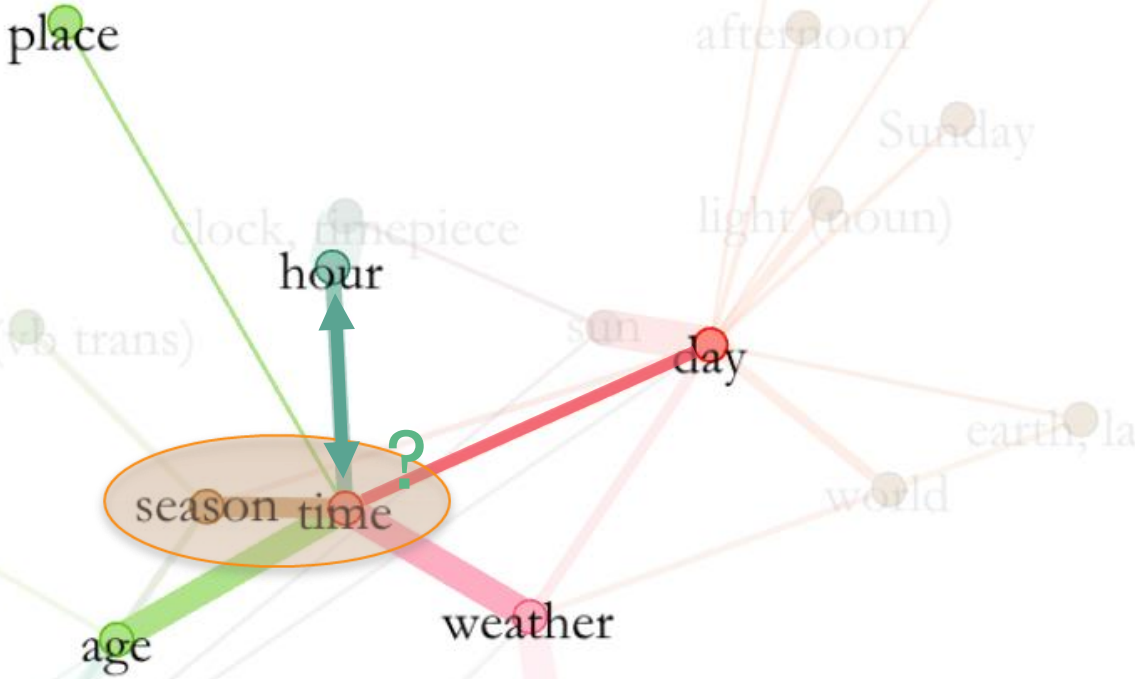
  - HOUR ⇒ TIME?



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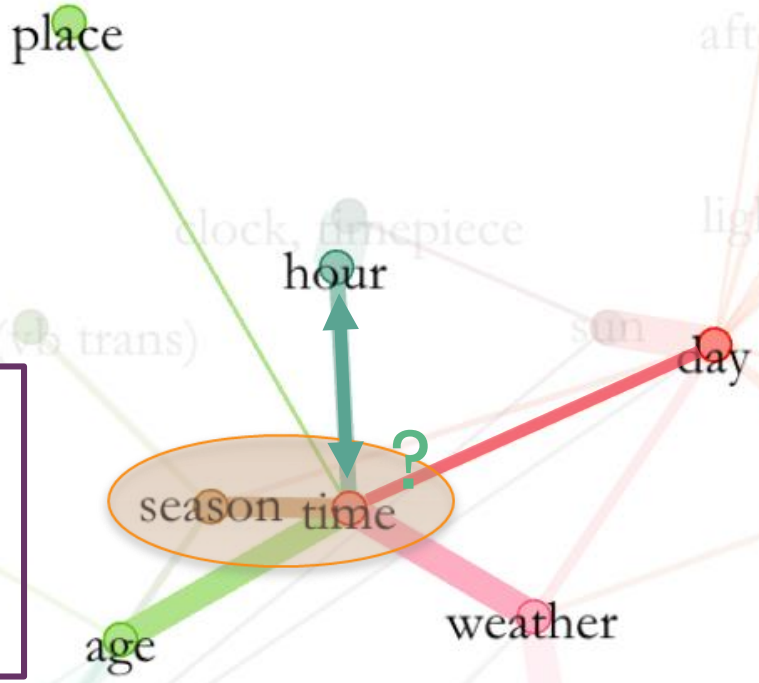
- Opposite pathways?
  - HOUR ⇒ TIME?

A recurring issue: English as metalanguage and the lack of (contextualized) definitions for the meanings in the typo-logical literature and resources

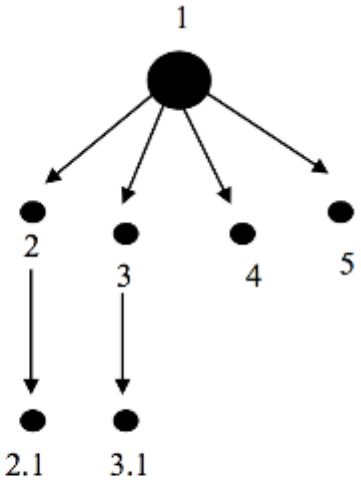


The semantic extension of time-related lexemes

Towards a dynamicized semantic map

	Stage A	Stage B	Stage C
Duration	✓	✓	✓
Moment	–	✓	✓
Event	–	✓	✓
Matrix	–	✓	–
Agentive	–	✓	✓
Commodity	–	✓	✓
Measurement-system	–	–	–
Grammatical	–	–	✓

The senses of *khrónos* in the diachrony of AG
(Georgakopoulos & Piata 2012)



1: The Duration Sense
2: Matrix Sense
2.1: Agent Sense
3: Moment Sense
3.1: Event Sense
4: Commodity Sense
5: Grammatical Sense

The radial structure of *khrónos* in AG
(Georgakopoulos & Piata 2012)

The semantic extension of time-related lexemes

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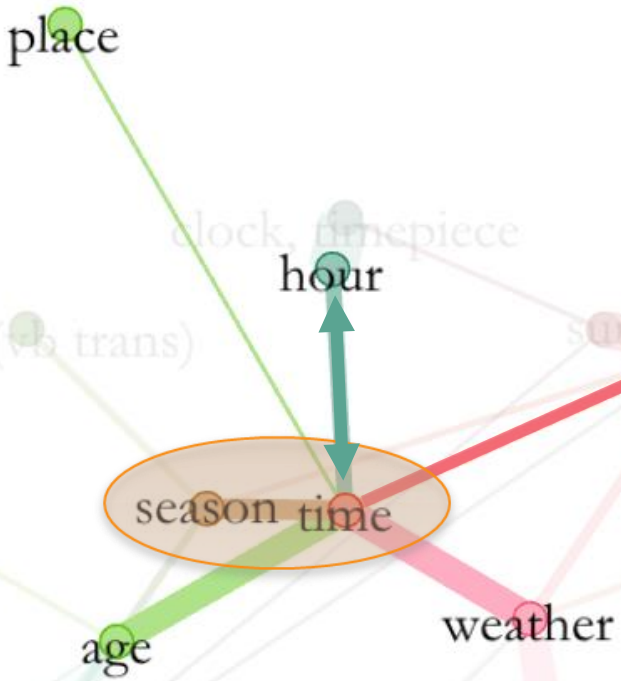
  - **SUN** ⇒ DAY
  - **TIME** ⇒ HOUR
- Opposite pathways?
  - HOUR ⇒ TIME
- Pivot meanings
  - TIME ⇒ DAY(LIGHT)



Ancient Egyptian

 nw ‘hour/moment/time’ ⇒ ‘day(light)’

Coptic ⲛⲁϥ
(Crum 1959: 256-257)

- hour
- time
- **day(light) [rare]**

The semantic extension of time-related lexemes

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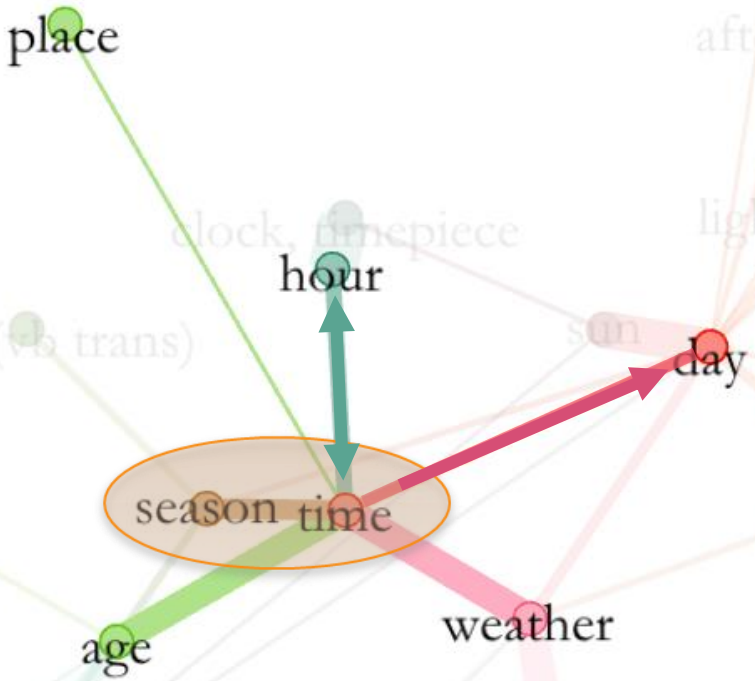


(Ancient) culture-specific colexification patterns

- **Summer?**

There are 17 links involving the concept "summer": ?

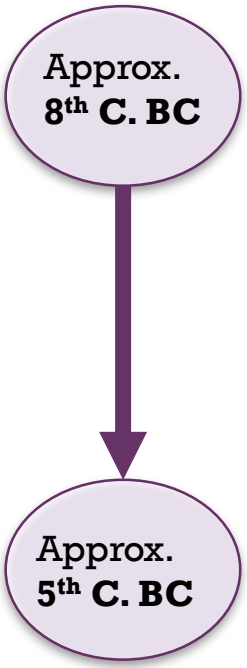
Concept	IDS-Key	Occurrences	Families	Languages	Network		Forms
year	14.73	233	10	16	COM	SUB	FORMS
age	14.12	257	2	3	COM	SUB	FORMS
bow	20.24	231	2	2	COM	SUB	FORMS
spring	14.75	174	2	3	COM	SUB	FORMS
autumn	14.77	167	1	1	COM	SUB	FORMS
cave	1.28	256	1	1	COM	SUB	FORMS
cousin	2.55	346	1	1	COM	SUB	FORMS
hang up	9.341	280	1	1	COM	SUB	FORMS
hot	15.85	303	1	1	COM	SUB	FORMS
put	12.12	306	1	1	COM	SUB	FORMS
rain (noun)	1.75	257	1	1	COM	SUB	FORMS
reach, arrive	10.55	329	1	1	COM	SUB	FORMS
rise	10.21	334	1	1	COM	SUB	FORMS
season	14.78	193	1	1	COM	SUB	FORMS
sun	1.52	245	1	1	COM	SUB	FORMS
wall	7.27	239	1	1	COM	SUB	FORMS
wine	5.92	162	1	1	COM	SUB	FORMS

Ancient Greek

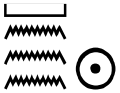
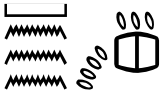
théros ‘summer’ ⇒ ‘harvest’

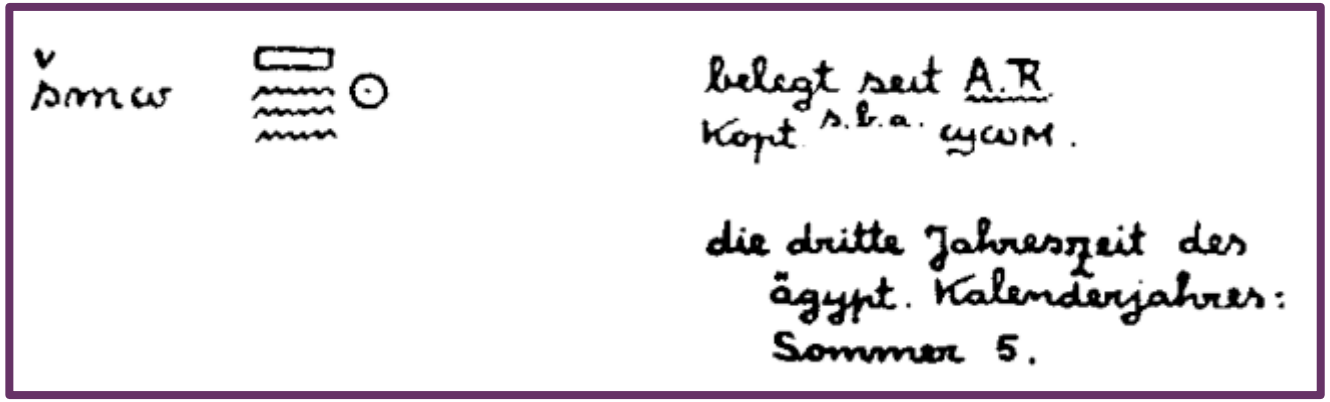
(9) *autàr* *epèn* *élthēisi* ***théros*** *tethaluîá*
PTC when come:AOR.SUBJ.3SG **summer:NOM.SG.M** thrive:PART.PERF.NOM.SG.F
t’ *opṓrē*
PTC autumn:NOM.SG.F
‘But when **summer** comes and rich autumn’ (Homer, *Odyssey* 11.192)

(10) *kâit’* *anèr* *édoksen* *eînai,* *tallótrion*
ADV man:NOM.SG.M seem:AOR.3SG be.INF another:GEN.SG
amôn ***théros***
reap.corn:PTCP.PRS.NOM.SG.M **summer:ACC.SG.N**
‘he has only made himself a name by reaping another’s **harvest**’ (Aristophanes, *Knights* 392)



Ancient Egyptian

 Smw ‘summer’ ⇒  Smw ‘harvest’



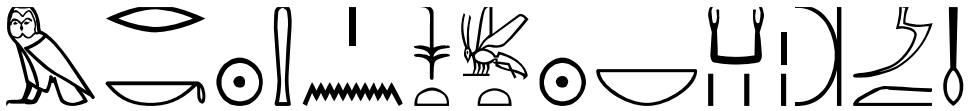
Old Kingdom

Middle Kingdom

(Ancient) culture-specific colexification patterns

- Languages and constructions shaping specific polysemy patterns
  - **Time ⇒ Space**
    - **Temporal proximity ⇒ Spatial proximity**

(Ancient) culture-specific colexification patterns



Peasant, B1, 103-104

(11)	**m**	**rk**	Hm-f	nswt-bity	nb-kAw-ra
	in	**time**	Majesty-3SG.M	King of U. and L. Egypt	Nebkaure

'(Now, the peasant spoke these word) **during the time** of his Majesty, the King of Upper and Lower Egypt, Nebkaure (the justified)' (= Parkinson 1991: 19)

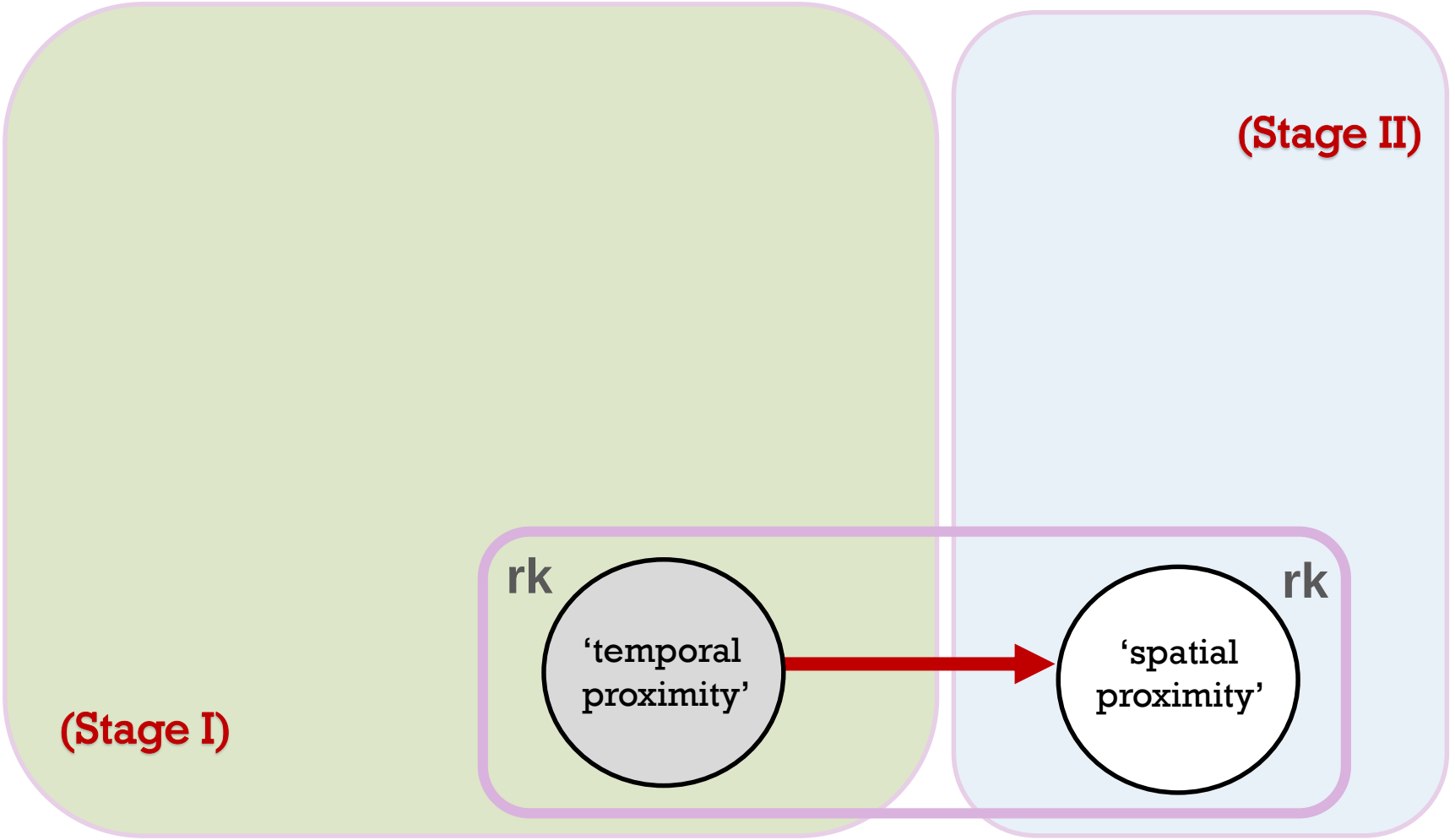
Approx. **1400 BC**

Approx. **1250 BC**

(12)	sbty	Dr	**m**	**rk**	mSa-f	(= K*RI* II, 6,8)
	rampart	strong	**in**	**proximity**	army-3SG.M	

(speaking of the King who is)
'A strong rampart around his army, (their shied in the day of fighting)'

(Ancient) culture-specific colexification patterns

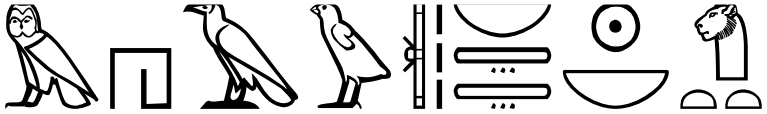


(Ancient) culture-specific colexification patterns

- Counterexample to the TIME IS SPACE metaphor?
  - Cross-linguistically Time to Space transfers are extremely rare

(cf. French *depuis*; Haspelmath 1997)

(Ancient) culture-specific colexification patterns



Biography of Ahmose, 5

(13) **m hAw** nb tA-wj nb-pH.tj-ra

in prox-time lord land-DU Nebphtire

(And then I became a soldier (…),)
'**during the time** of the lord of the Two Lands, Nebpehtire (justified, when I was a young man, not having a wife yet)' (= *Urk*. IV, 2,13)

Approx. **1350 BCE**

Sinuhe, B8

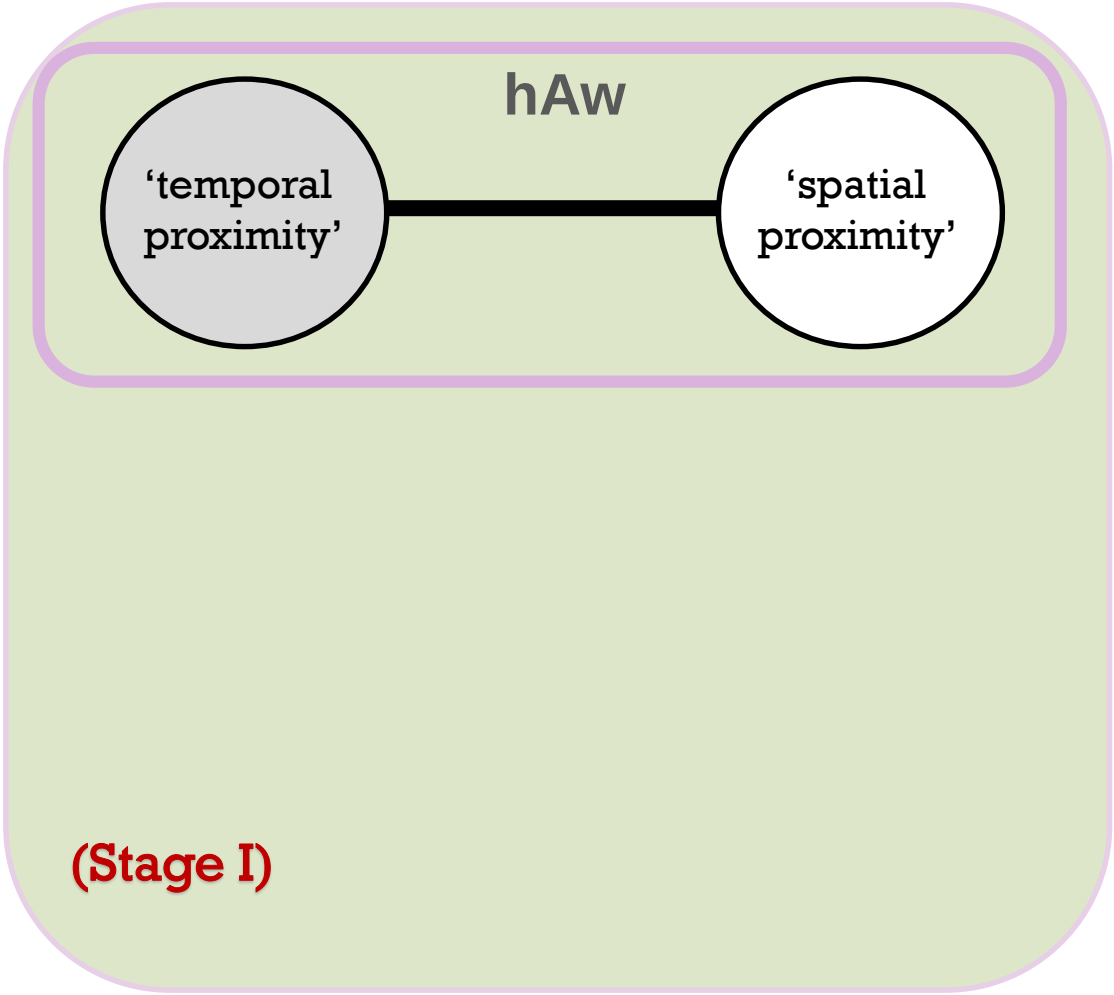
(14) **m hAw** nh.t

in prox-space Sycamore

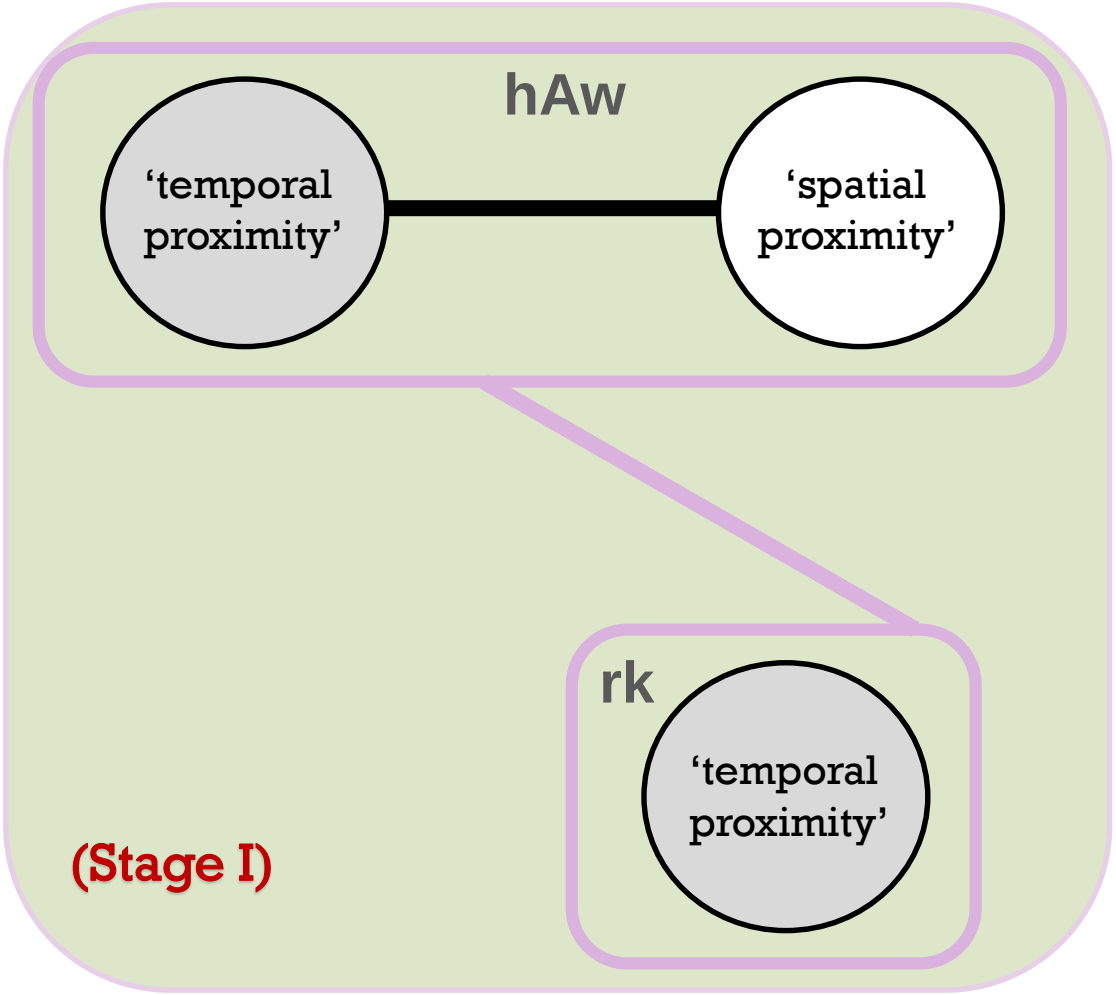
'(I crossed the place called The Two Truths,) **in the vicinity** of The Sycamore" (and I landed at The Island of Snefru)' (= Koch 1990: 14)

Approx. **1500 BCE**

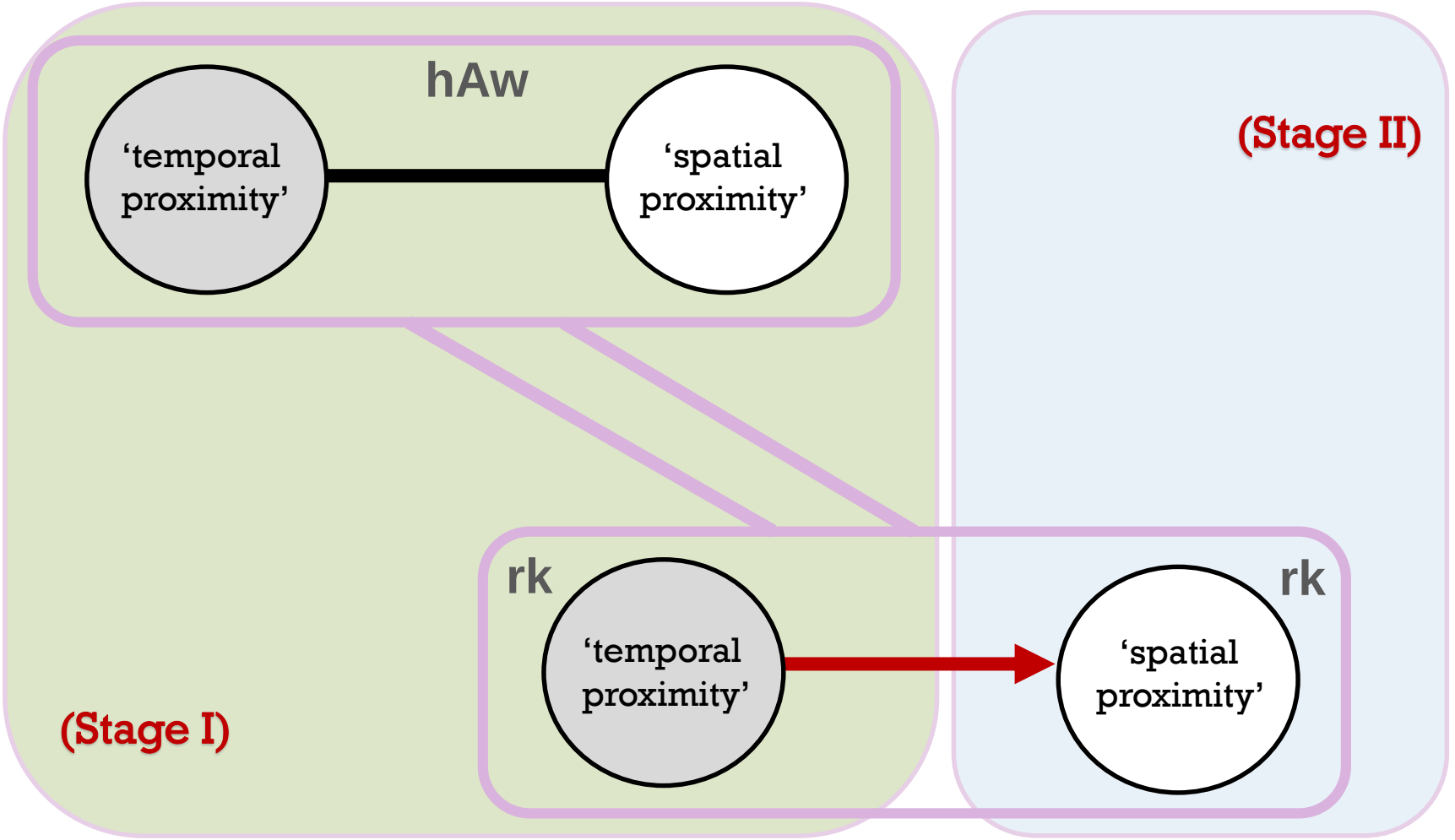
(Ancient) culture-specific colexification patterns



(Ancient) culture-specific colexification patterns



(Ancient) culture-specific colexification patterns



Conclusions

and avenues for future research

Conclusions

- The diachronic dimension for semantic maps of content words, is an important extension to the semantic maps research
  - Replicable methodology
  - Balance between large-scale typological works and small-scale linguistic studies, focusing on few languages (need for further attention to the hyper-/hyponymic relationships; van der Auwera 2013)
- Language-specific studies reveal interesting colexification patterns, some of which might contradict well-established generalizations
  - (Ancient) culture specific colexification patterns
  - Language internal polysemy copying

Selected references

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Thanks!

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