

Interfaces of sociolinguistics: Cognition and big data

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Summary

1/ Sociolinguistics and variationist sociolinguistics

2/ Sociolinguistics and cognitive science

Example : the field of sociolinguistic acquisition

3/ Sociolinguistics and Data science

Example : a study of French sociolinguistic variables on Twitter

4/ Risks and benefits of interdisciplinary research

1 Sociolinguistics



Sociolinguistics

General aim of sociolinguistics

The understanding of the interaction between language and society

Three research traditions in sociolinguistics

Variationist sociolinguistics	Linguistic Anthropology	Sociology of language
<p>Understanding languages as variable evolving systems, due to their internal dynamics, the cognitive constraints, contact with each other, and their links with social organization, which is itself evolving, composite and multi-layered (Laks, 2013).</p>	<p>Understanding language as a “cultural resource” and speaking as a “cultural practice”</p>	<p>Study of both language and society at the macro level (nation states or social classes)</p>
<p>Quantitative methods describing the usage of sociolinguistic variables in different social groups, regions, settings</p>	<p>Qualitative methods (ethnographic participant observation, audiovisual recording, interviews, etc.) to observe intrinsically social and cultural speech events.</p>	<p>Census and broad surveys describing the state of language diversity and inequality (e.g. number of indigenous languages in South America)</p>

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Linguistic Anthropology

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Sociology of language

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Census and broad surveys describing the state of language diversity and inequality (e.g. number of indigenous languages in South America)

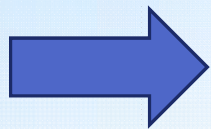
The framework of variationist sociolinguistics

A two-minute summary of five decades of research...

Linguistic heterogeneity and within-language variation : a non controversial assertion

Depending on their situation in the social or geographical space, speakers of the same language speak different dialects of this language.

The pioneering work of William Labov conferred a scientific status to the fundamental heterogeneity of languages.



Notions of variation, variable, variant

Creation of variationist (socio)linguistics

Variables : points within the linguistic system where the speaker can say the same thing in different ways.

The variants are “identical in reference or truth value, but opposed in their social and/or stylistic significance”

The framework of variationist sociolinguistics

Examples of sociolinguistic variables (studied in different languages at different linguistic levels)

	Language	Linguistic Level	Example of study
Variable pronunciation of -ing [in] vs. [iŋ] (playing / playin')	English	Phonology	Fischer, 1958; Labov, 2006
Variable omission of the first morpheme of the negation which surrounds the verb <i>je mange pas</i> vs. <i>je ne mange pas</i>	French	Morphology	Armstrong, 2002
Variable interrogation in French <i>Sont-elles là ?</i> Verb-Pronoun <i>Est-ce qu'elles sont là ?</i> Particle-Pronoun-Verb <i>Elles sont là ?</i> Pronoun-verb + rising intonation	French	Syntax	Coveney, 1997

The framework of variationist sociolinguistics

1/ The variants often carry social information about the speaker and the context (socio-indexical information)

Standard variants associated to ...	Non-standard variants associated to ...
social prestige, high education level, professional ambition... They may be valorized.	social skills, solidarity or loyalty towards the group, masculinity... They may be stigmatized.

2/ The frequency of use of the variants depends upon several factor

The sociodemographic characteristics of the speaker	Elements of the interactional context
more standard variants in women, older speakers, individual with a higher level of education and those who are peripheral in the local social network, etc.	more standard variants in formal situations, speaking about work-related topics or to a prestigious addressee, to increase the social distance and decrease connivence, etc.

For a more flexible view on socio-indexicality and usage of variants : Campbell-Kibler, 2008; Eckert, 2008 (*inter alia*)

2

Sociolinguistics and cognitive science Example : the field of sociolinguistic acquisition

The meeting of
sociolinguistique
and cognitive
sciences in the
70s and 80s...



Sociolinguists and social scientists address mental entities

Since the beginning, social science uses concepts which refer to mental entities

Emile Durkheim : Collective representation

Karl Marx: Ideology

Max Weber: Subjective meaning

Kaufman & Clément, 2011

The same is true of sociolinguistics

Social meaning, indexical meaning

Communicative intention

Social judgement or evaluation

Selection of sociolinguistic variants

Mental states

Mental processes

The same mental state can be constructed as two scientific objects : cognitive vs. social

Confidence as a cognitive fact (Cognitive economics)

- Punctual event : change in the mental state when an individual decides to engage in cooperation
- Correlation with punctual behavior, cerebral activation and oxytocin production

Confidence as a social fact (History and sociology)

- Progressive establishment of a mutual commitment
- One individual/group accepts making herself more vulnerable
- The other is committed not to exploit the vulnerability
- Social norms create mutual expectations

Long-standing convergences between cognitive and social science



Social psychology, McDougall, 1908

Social cognition, Fisker & Taylor, 1984

Cognitive sociology, Cicourel, 1974

Social neuroscience, Cacioppo & Berntson, 1992

Cognitive sociolinguistics, Kristiansen & Dirven, 2008

Sociolinguistic cognition, Campbell-Kibler, 2010

Kaufman & Clément, 2011; Lahire & Rosental, 2008; Molénat, 2012;
Morgan & Schwallbe, 1990

Five areas of contact between variationist sociolinguistics and cognitive science

Chevrot, J.P., Drager, K. & Foulkes, P. (in press). Sociolinguistic variation & cognitive science, special issue of *Topics in cognitive science*

Cognitive sociolinguistics

Kristiansen & Dirven, 200

- Interaction between language and cognition
- Grounded on corpus-based studies
- Draws on the three working hypotheses of Cognitive linguistics: language is not modular, grammar is a conceptualization of the world, linguistic structure emerges from language usage.
- **Languages and conceptualization of the world vary across cultural and social diversity**

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Sociolinguistic cognition

Campbell-Kibler, 2010;
Loudermilk, 2013

- Explores the cognitive and cerebral mechanisms underpinning the ability to memorize sociolinguistic variation, to implement it during speech production, and to process it during speech perception
- Based on experimental methods from psycholinguistics and social cognition (elicitation tasks, reaction time and eye-tracking experiments, neuroimaging, social priming)

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Computational modelling

Hruschka et al., 2009; Stanford & Kenny, 2013

- Dynamic modelling of populations of 'agents' interacting with one another and sharing simulated sociolinguistic
- Major value : to test, in a concentrated time frame, the long-term effect of linguistic, social and cognitive constraints on language variation and change that are hard to control in experiments or in the usual conditions of language use
- e.g. size and structure of populations, long-term effect of attentional bias toward leaders, etc.

Five areas of contact between variationist sociolinguistics and cognitive science

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Comparative study of variation in animal communication

Henry, Barbu, Lemasson & Hausberger, 2015

- In the vocalization of certain species (e.g. birds, marine mammals), varieties referred to as “dialects” by Darwin (1859).
- Strong analogies with sociolinguistic variation in humans (e.g. regional and social “dialects” functioning as social passwords’ that indicate belonging to a group)
- Variation could ensure adaptive benefits via group cohesion and social recognition in different species

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Language acquisition

Anderssen, Bentzen & Westergaard, 2011; Chevrot & Foulkes, 2013; De Vogelaer, Chevrot, Katerbow & Nardy, 2017; Lacoste & Green, 2016

First and second language acquisition of sociolinguistic variation and in sociolinguistic variation

Focus on this area that illustrates the meeting of cognitive and social science

Four communities/fields of research

Chevrot, J.-P. & Ghimenton, A. (to appear). Bilingualism and bidialectalism, in Lourdes Ortega & Annick de Houwer (eds), *The Cambridge Handbook of Bilingualism*

Research on...	Speakers	Contexts
1. Child acquisition of dialectal varieties of the first language	First language learners in contact with several varieties of one language	Communities where one language is dominant
2. Child multilingual acquisition	First language learners confronted with varieties of what is considered as different languages (overlaid on dialectal variation in each language)	Multilingual communities
3. Acquisition of L2 sociolinguistic variation during second language acquisition	Second language learners confronted with L2 sociolinguistic variation	Study abroad, Migration FL classroom
4. Lifelong second dialect acquisition	First or second language learners confronted with a second or a third dialect of the same language	Geographical (move to a new area) or social mobility Political change (fall of Berlin wall).

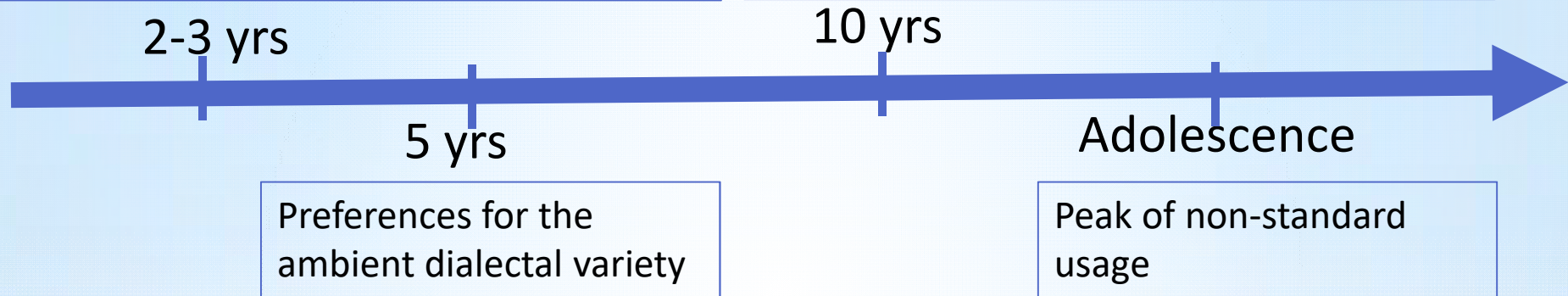
Key findings from these fields

Chevrot, J.-P. & Ghimenton, A. (to appear). Bilingualism and bidialectalism, in Lourdes Ortega & Annick de Houwer (eds), The Cambridge Handbook of Bilingualism

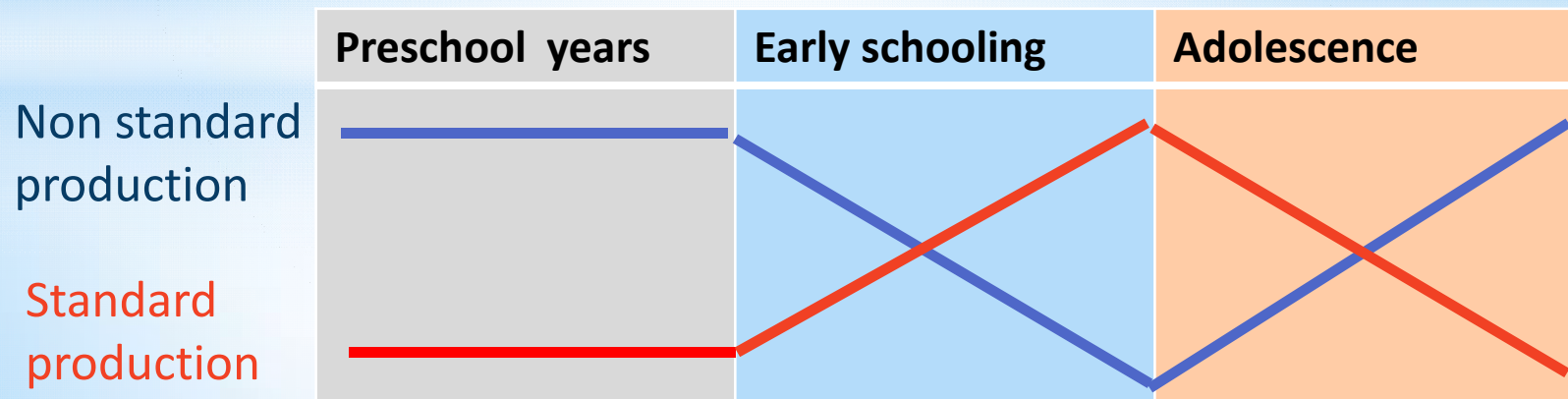
Areas 1 & 2 - The child is confronted with within or between language variation

- Production of the dialectal variants of the social or regional ambient variety
- Stylistic ability during family interaction

Preferences align with adult categorization based on the social value of language (prestige variety vs. other varieties)



Double crossing pattern in production



Key findings from these fields

Chevrot, J.-P. & Ghimenton, A. (to appear). Bilingualism and bidialectalism, in Lourdes Ortega & Annick de Houwer (eds), *The Cambridge Handbook of Bilingualism*

Area 3 - Learners acquiring sociolinguistic variation in L2

1/ L2 learners show negative attitudes to the non-standard varieties of L2

... But exposure to a greater dialectal variation increases learners' perception and production !

2/ L2 learners underuse non-standard variants when learning occurs in the classroom.

The favoring effect of context on acquisition of non-standard varieties
Naturalistic context > study abroad > immersion curriculum > FL classroom

3/ Influence of social factors on L2 sociolinguistic acquisition

Social status	Higher status learners use more frequently the standard variants of the L2
Social network	L2 learners with L1 speakers in their network are less standard (Gautier, 2016)
Stylistic ability	- Learners generally do not manifest the ability to modify the frequency of standard / nonstandard variants according to the context. - When they do it, they undershoot the native nonstandard target

Key findings from these fields

Siegel (2010) summarized in Chevrot & Ghimenton (to appear)

Area 4 - Learners acquiring a second dialect (D2)

1/ D2 acquisition is difficult compared to L2 acquisition

- The similarity between D1 and D2 linguistic systems favors transfers
- Intercomprehension is guaranteed. D2 acquisition is motivated by the desire to be viewed as a local.
- Identity issues may inhibit D2 acquisition (loyalty toward the D1 community or negative reaction from the D2 community)

2/ Most important factors influencing D2 acquisition

Age	Optimal age of acquisition: the mid-teens or younger for lexicon and morphology and 7 years or younger for phonology
Social interaction	Integration in the social network of the D2 community favors D2 acquisition
Identity	How the learner identifies to D2 community speakers influences D2 acquisition.

Focus on the acquisition of phonological variation : a review

Nardy, Chevrot, & Barbu, 2013

We analysed 30 studies on phonological variation published from 1964 to 2011.

Developmental turn during the 90's

- Before : Children patterns of variation are seen in light of established adult sociolinguistic regularities
- After : increasing concern with developmental issues (earlier age groups, theoretical hypotheses to explain the developmental patterns)

Focus on the acquisition of phonological variation : a review

Nardy, Chevrot, & Barbu, 2013

1/ Appearance of adult-like patterns and effects of age and input

Topics	Number of studies and languages	Children age	Main tendencies
Social background	7 studies English, French, Spanish	[3-10]	All the studies converge: from the age of 3, the higher the social status of the parents, the more standard variants the child produces. See also, Barbu et al. (poster, this session)
Context (style)	10 studies; children aged English, French, Spanish	[3-12]	All the studies but one converge: the children use more frequently the standard variants in the formal context (from the age of 3-4 within family exchanges).
Gender	11 studies English, French	[2-10]	All possible tendencies found : - 7 studies (ages 2-9): No gender effect - 2 studies (ages 6-10): More standard variants in girls - 2 studies (ages 3 -7): More standard variants in boys
Input	2 studies English	[3-4]	- Mothers of girls address more standard variants to their 2-4 year-old daughters than mothers of boys (Foulkes et al., 2005). - At the age of 3, correlations between the use of non standard variants by mothers and by their children (Smith et al.2007).
Evaluation of variants	6 studies English, French	[2-12]	- 4 studies : Evaluation based on context or status takes place between 9 and 12 years of age. - 1 study using a very simple task (pointing the puppet who speaks correctly): 5-6 year olds from upper-class families distinguish between standard and non standard variants (Nardy, 2008)

Focus on the acquisition of phonological variation : a review

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2/ Hypotheses and new research questions

The bases for social stratification and stylistic flexibility of sociolinguistic usage are laid early within the family interactions

→ How and when do these bases meet the norms and values shared by the community ?

The gender difference seems establish later

→ How does this difference combine with the process of gender socialization ?

A lot of work should be done in two directions

- What kind of cognitive device does underpin sociolinguistic acquisition? Variable rule vs. usage-based schema; Role of awareness; Mechanisms linking social and linguistic information ?
- What is the influence parents, peers, and teachers

Sociolinguistics and Data science

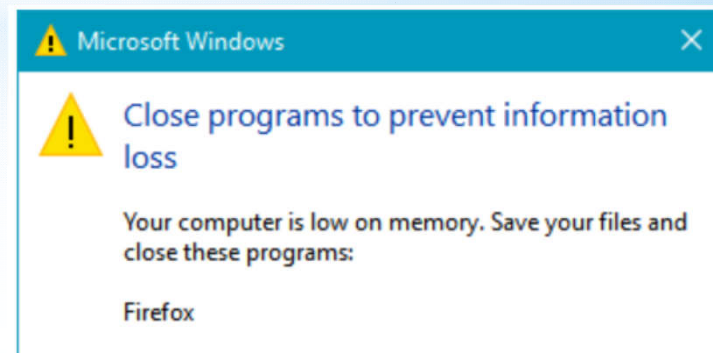
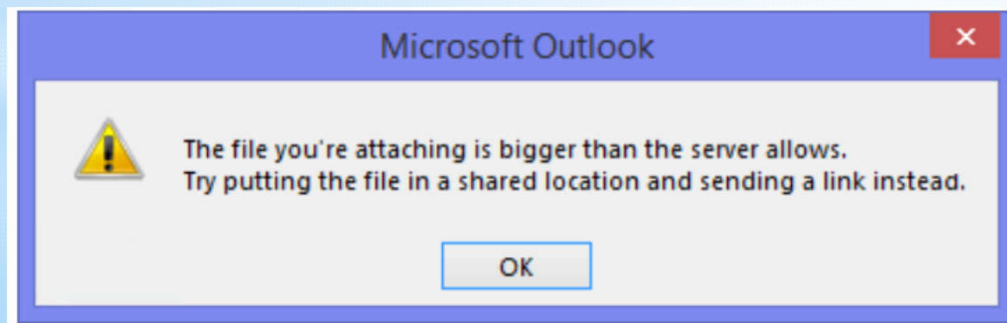
Example : a study of French sociolinguistic variables on Twitter



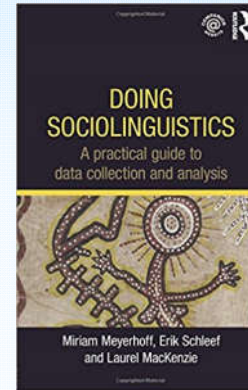
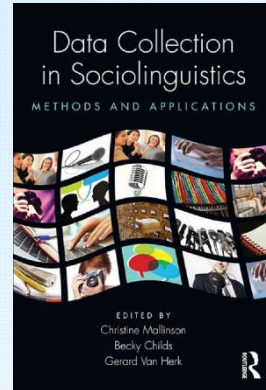
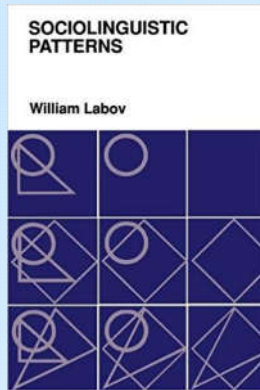
You cannot email this data to a colleague. You can't even download it on your computer. This is data on an unprecedented impossibly mind boggling massive scale. - Kenneth Benoit (2015)

From the website of Josef Fruehwald, Univ. of Edinburgh : **Big Data and Sociolinguistics**

https://jofrhwd.github.io/papers/plc39_2015/#/



From its beginning, sociolinguistics strongly emphasized the need for data



Quantity - Data allowing quantitative analysis of language variation in relation with social features

Quality - Data that are « good enough » for representing the actual language usage of the speech community

Methods to overcome the observer's paradox

“ to find out how people talk when they are not being (...) observed; yet we can only obtain this data by systematic observation”

Sociolinguistics rapidly joined the emerging computational social science

Lazer et al. (2009)
www.davidlazer.com

Our new ability to collect, analyze and model massive datasets on the behavior of individuals within collective entities

Use of sensors (proximity sensors, wearable audio recorders, etc.)

Automatic, permanent and unsupervised collection of digital data from...

- The digital communication : blogosphere, social media, e-mail exchange, etc.
- The recording of human activity : bank transaction, location of mobile calls, booking of cars, bicycles or rooms, peer-to-peer services, etc.

A way to move beyond the observer's paradox ?



Crucial political, ethical and privacy issues

Computational sociolinguistics

Nguyen et al. (2016). Computational Sociolinguistics: A Survey, *Computational Linguistics* 42(3), 537-593.
http://www.mitpressjournals.org/doi/full/10.1162/COLI_a_00258

A subfield of Computational linguistics

Study of language variation and change in large databases from digital interactions (blogs, social media)

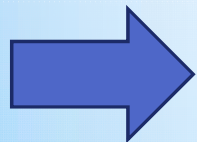
- Language data: generally written language of the digital communication. For example: studies on the written counterpart of spoken sociolinguistic variables (e.g. *in* spelling for the (ing) variable)
- Social data : network links and social profile of the users

Computational sociolinguistics contributes to the same trends

Several studies reduplicate well-known results observed in face-to-face spoken interaction

Résultats	Références
Effect of age, gender, region, ethnicity, etc.	Bryden et al., 2013; Eisenstein, 2015; Gonçalves and Sánchez, 2014; Magué et al., 2015
Dynamics of language innovation and loanwords	Altmann et al., 2011; Garley and Hockenmaier, 2012; Eisenstein et al., 2014
Convergence amongst connected people	Danescu-Niculescu-Mizil et al., 2011; Tamburrini et al., 2015

- Can digital data reveal **new** sociolinguistic patterns ?
- What is the risk of bias and how to overcome it ?
- What is the benefit for sociolinguistic theory ?

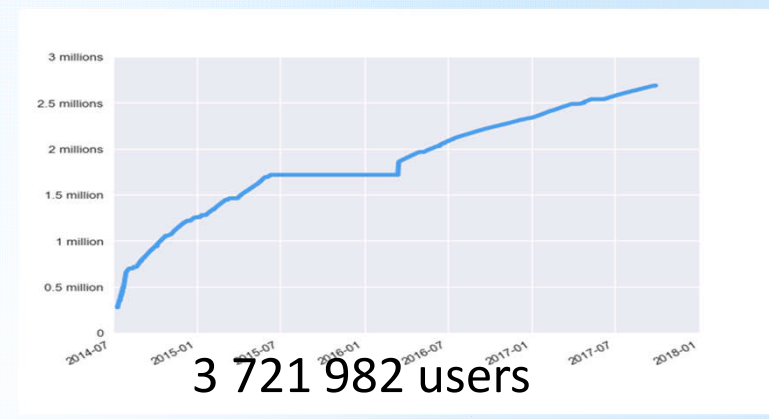
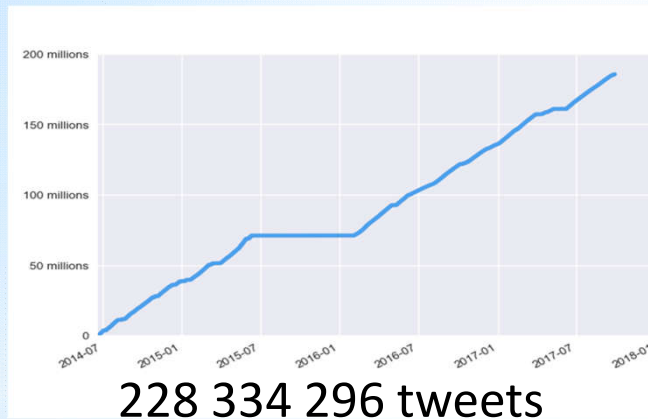
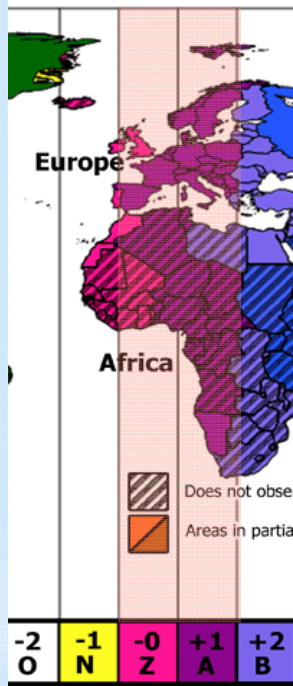


First results of the Sosweet project

Four-year collection of approx. 15%-25% of the tweets produced in 3 years ...

- Written in French
- Users located in the GTM and GTM+1 areas → French-speaking countries
- + Recording of the network of follower/followee links between users

Current state of the database



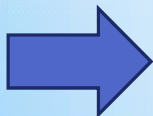
An interdisciplinary project combining four teams

Sociolinguistics + NLP + Data science + Corpus linguistics

First results on French sociolinguistic variables





Abitbol, J., Karsai, M., Magué, J.P., Chevrot, J.P. and Fleury, E., 2018, Socioeconomic dependencies of linguistic patterns in Twitter: a multivariate analysis. In Proceedings of ACM WWW conference, Lyon, France, April 2018 (WWW'18),

<https://doi.org/10.1145/nnnnnnn.nnnnnnn>



A well-known sociolinguistic variable : Negative *ne*

Standard negation	NE + verb + Part. 2 : <i>pas</i> ‘not’, <i>jamais</i> ‘never’, <i>rien</i> ‘nothing’, etc.)	Il ne boit jamais de vin ‘He never drinks wine’
Non standard negation	Deletion of ne	Il \emptyset boit jamais de vin

Standard	Non Standard
 <p>Emmanuel Macron  @EmmanuelMacron</p> <p>‘I do not have the same fights as you but I'm as free as you’</p> <p>Je n'ai <u>pas</u> les mêmes combats que vous mais je suis aussi libre que vous. #LEmissionPolitique</p>	 <p>Mister X </p> <p>‘I seem to have lost track: is Cannes vs. Netflix the new Taxi vs. Uber?’</p> <p>J'ai <u>pas</u> suivi le truc, Cannes vs Netflix c'est le nouveau Taxi vs Uber ?</p>

Several studies on spoken French and 3 studies on digital communication

Factors that influence NE realisation	References
More NE realisation in older speakers	Ashby, 2001; Blattner & Williams, 2011; Hansen & Malderez, 2004
More NE realisation in the more formal settings and emphatic contexts	Armstrong, 2002; Williams, 2009; van Compernelle, 2009
More NE realisation if the subject of the verb is a NP (vs. a clitic) and with certain Part. 2	Ashby, 1981; Armstrong & Smith, 2002; Coveney, 1996; Hansen & Malderez, 2004, van Compernelle, 2008
Effect of Socioeconomic status : no convergence	Blattner & Williams, 2001; Williams, 2009; Hansen & Malderez

An additional linguistic feature : the -s / -x plural ending in French spelling

Plural marking of written French in the nominal phrase : mute letters -s or -x at the end of the adjective and the noun.

With –s ending	Without –s ending
 <p>Le Labo des savoirs @Labodessavoirs</p> <p>‘Heated debate among researchers! Scientific battles at #JSUN2017 animated by @maximelabat’</p> <p>Les <u>chercheurs</u> sont chaaaauds ! Les battles scientifiques de la #JSUN2017 animées par @maximelabat</p>	 <p>Miss Y</p> <p>‘At high schoolers’ demonstration, it’s the cop[missing plural ending] who intervene when it is the supervisor[missing plural ending] for us and that makes the difference’</p> <p>Au monôme des lycées en ville c’est <u>les policier</u> qui interviennent alors que nous c’est <u>les surveillant</u> c’est la ou tu vois la différence</p>

Omitting mute plural -s is the most frequent error in French writing

Lucci & Millet, 1995

Correlation between standard usage of the plural ending and social status, in preteens, teens and adults

Brissaud, 1999; Lucci & Millet, 1995; Totereau et al. 2013

How to infer socioeconomic status (SES) of Twitter users?

Using INSEE* data for transforming GPS localization into SES proxy ...

INSEE : French National Institute of Statistics and Economics Studies

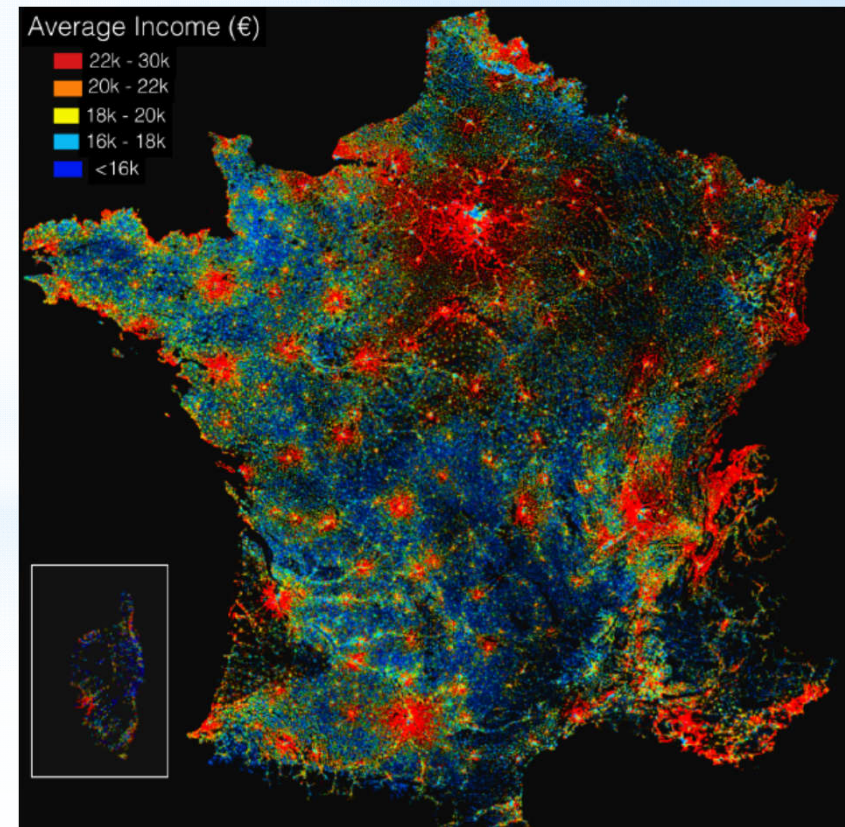
Set of sociodemographic aggregated indicators for each 200m x 200m square areas across France

In each square

- Mean yearly income (winsorized mean, without extreme values)
- Rate of homeowners
- Population density

Working hypothesis

Living in an area with higher income mean, with bigger rate of owners and with smaller density (single-family house) is associated with higher SES

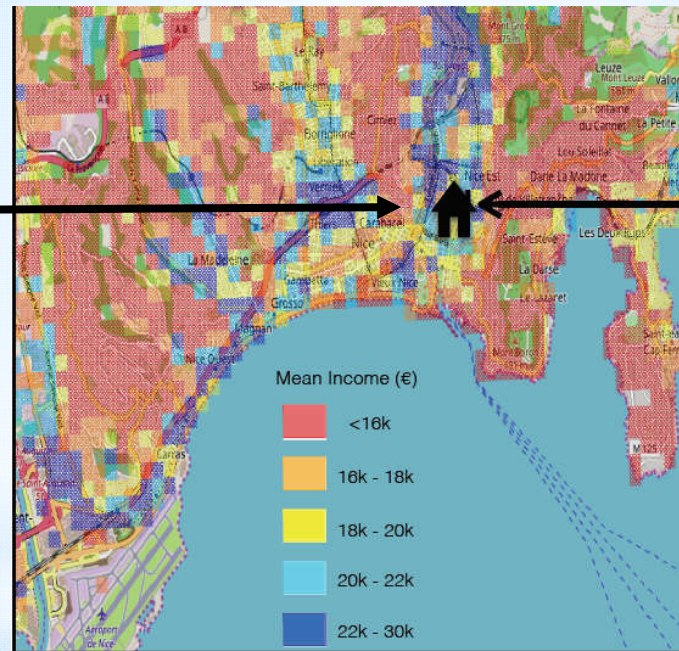


How to infer socioeconomic status (SES) of Twitter users?

Matching INSEE data and 109 000 geolocated users of Twitter

INSEE Data

Mean yearly income is 18 to 20 thousands of euros in this square area



Twitter Data

The geolocated tweets of user #878291414 are most frequently sent from this area

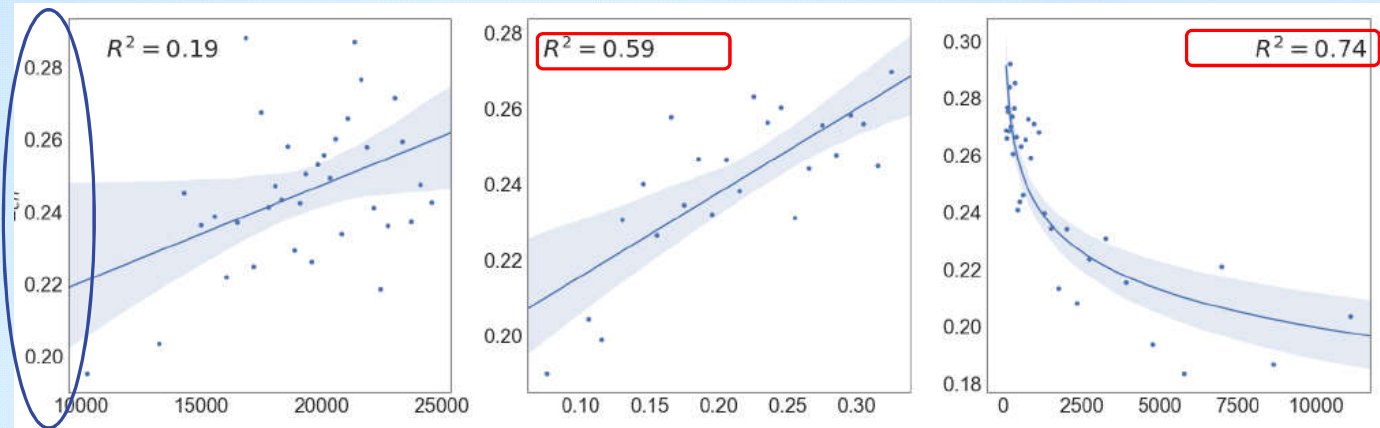
User	Lat	Lon
720624511	0.222689	47.990762
441320265	-52.983982	4.913242
982677272	2.9831989621	48.4007454896
2296639897	2.4912035419	48.9458390389
878291414	2.360299	47.116211
360954534	5.863804	49.303493
190311280	7.023194	43.552704
1498428090	2.289129	48.673666
289953393	2.386827	48.865732
482001789	4.9224447	46.8626553

Working hypotheses

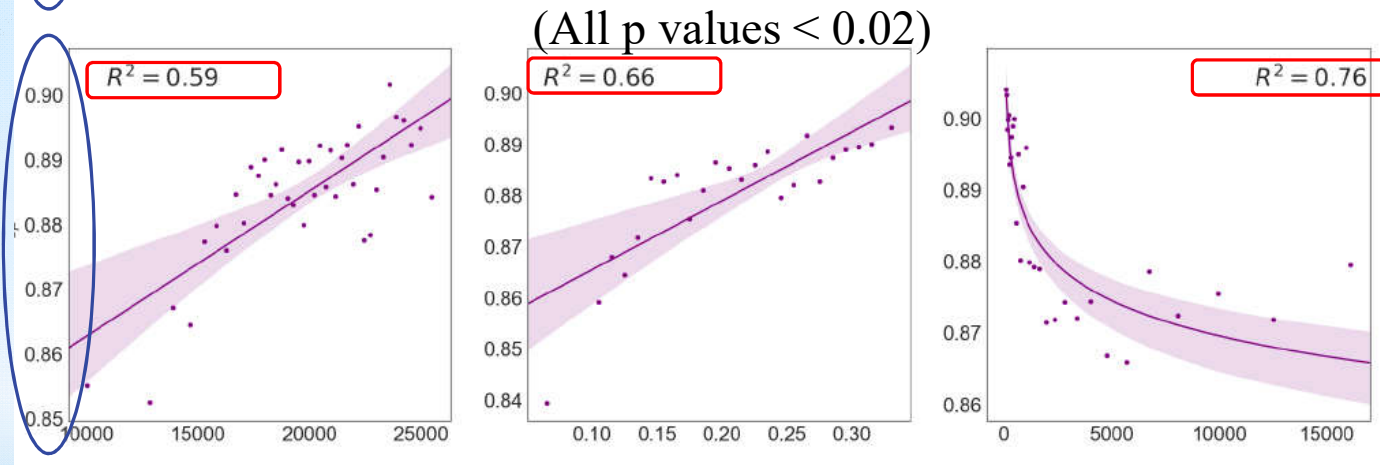
- User #878291414 lives in this area
- The yearly income of user #878291414 is 18 to 20 thousands euros

Result 1 – Correlation between language and SES

Rate of standard
ne realization



Rate of standard
-s/-x plural endings



Income

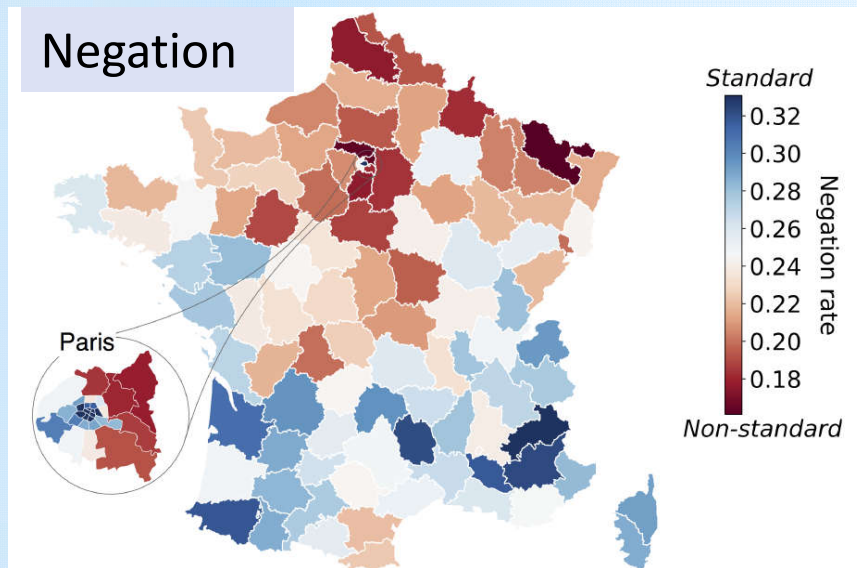
Rate of
homeowners

Density of
population

What's new for sociolinguistics ? New research questions...

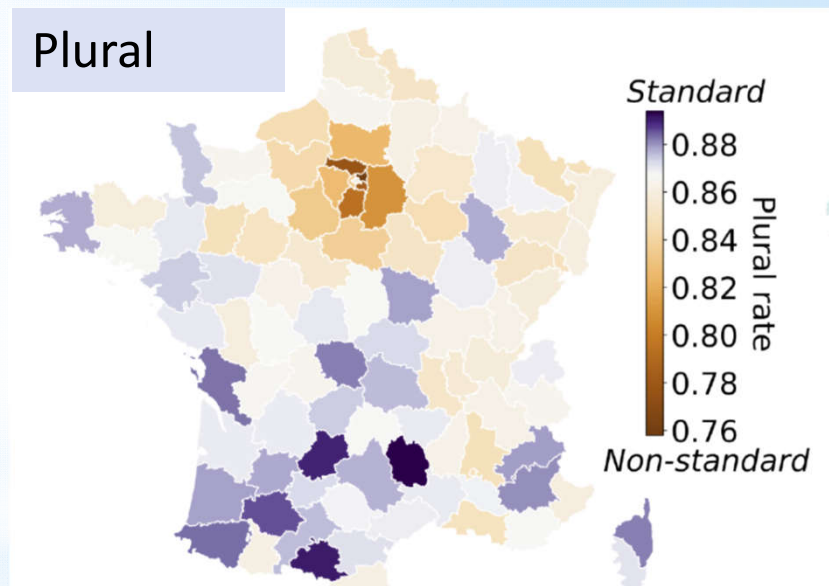
- Correlations are surprisingly strong
- Correlation appears with very small range of sociolinguistic variation
- Different correlation values with different SES proxies

Result 2 – Spatial correlation : a North-South gradient of variation ?



- Departments of South are more standard than departments of North
- Difference is gradient

Same trends for the plural endings



What's new for sociolinguistics ? The mystery gets deeper...

- No clear dialectal explanation (-s-x plural is **not** a dialectal spoken cue)
- Are twitter users the same in the North and the South : different rates of men/women, higher/lower SES; different network structures ?

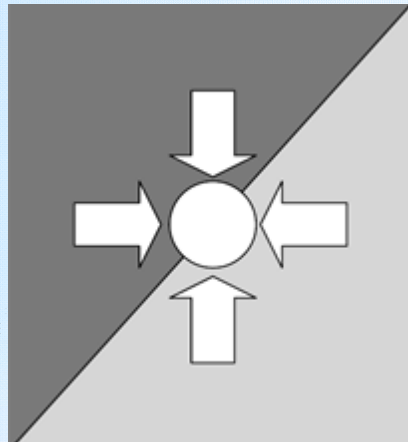
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To conclude
Risks and benefits of
interdisciplinary
research



The (power)relationships between disciplines

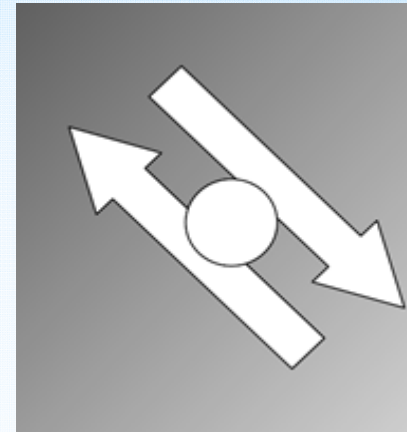
Case 1 – Balanced relationships between disciplines



Coordination

Disciplines coordinate for a better understanding of the same object

Methods and theories of each one remain identical



Fusion

Methods and theories influence each other

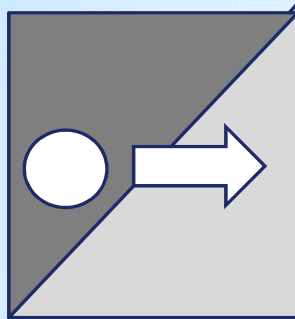
Toward the creation of a new area

Degree of integration between the disciplines

The (power)relationships between disciplines

Case 2 – **Unbalanced** relationships between disciplines

Degree of **dominance** between the disciplines



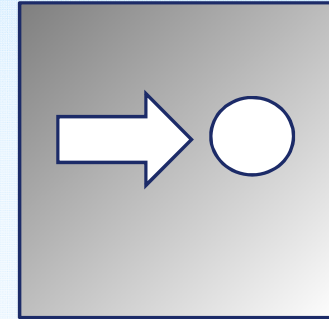
Subcontracting

Discipline A uses the services of discipline B

Object of study specified by discipline A

Potential risk when social science interacts with ICTS and Life or Physical sciences

Example of risky question : Social science helps Life science to deal with ethical issues of brain imaging data



Annexation

Discipline A partially replaces discipline B

Methods of A apply to objects of B

In the case of **Computational social science** : Researchers from Statistical physics and Computer science analyse « social data ».

There is a risk that the object of social science is annexed by computational social science

The (power)relationships between disciplines

Example of annexation ?

SOCIAL PHYSICS

SOCIAL PHYSICS ABOUT BLOG VIDEOS PAPERS NEW & EVENTS CONNECTION SCIENCE CLASS

See also, Cho, 2009, *Ourselves and Our Interactions: The Ultimate Physics Problem?* *Science* 425, 406-408

Social Physics is a new way of understanding human behavior based on analysis of Big Data.

The contributors to the Social Physics are a set of researchers who are connected through their association with the Human Dynamics Lab at MIT.

Contributors include:

<http://socialphysics.media.mit.edu/about/>

Not “Physics” but another way of doing Sociology because the objects of study are not matter, space and time!

My experience

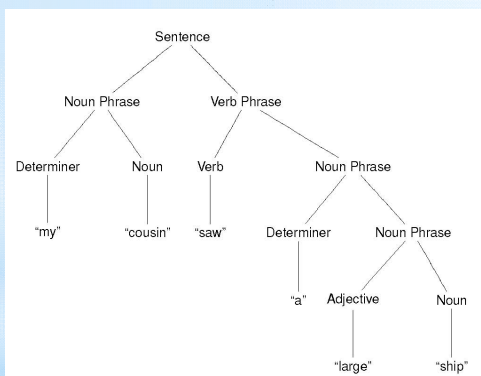
If sociolinguists do not explain, computational scientists ignore the conceptual framework of Sociolinguistics
Debate within the Sosweet project : “incorrect language” and “nonstandard language” are not identical concepts !

However interdisciplinary research will help Language science facing a basic challenge

Bender, EM. and Good, J.. 2010. A Grand Challenge for Linguistics: Scaling Up and Integrating Models.
White paper contributed to NSF's SBE 2020 initiative.
<https://faculty.washington.edu/ebender/papers/GrandChallenge.pdf>

1/ The complexity challenge : integrating the perspectives

Building theories that integrate the different aspects of language: the structural, the social and the cognitive sides at the collective and individual levels



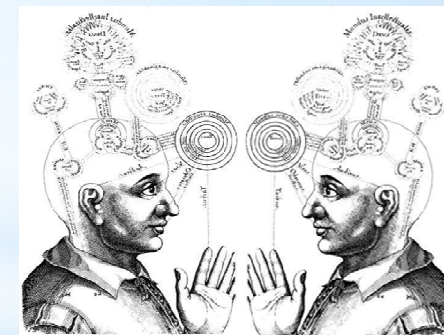
Structural side

Phonology,
grammar, and the
lexicon



Social side

Language usage and
interaction



Cognitive side

Brain and cognitive
devices underpinning
language usage and
interaction

However interdisciplinary research will help Language science facing two basic challenges

2/ The data challenge

Meeting the complexity challenge involves collecting and processing large sets of thick and diverse data

Datasets allowing to extract information about

- The structural organization underpinning the linguistic knowledge
- The social usage of language
- The cognitive cues of the speakers

Need for computational methods

- For assisting linguists in analyzing large-scale data
- For building and testing models accounting for language complexity

Conclusion : The role of sociolinguistics in interdisciplinarity

1. Language science needs collaboration with...

- Subfields of Social science
- Subfields of Cognitive science
- Subfields of Computational science

2. A way of avoiding unfair subcontracting and annexation is to ensure that each discipline meets its own challenges

3. The inherent interdisciplinarity of sociolinguistics and its numerous connections with other fields place it in a strategic position for facing the challenge of integrating the linguistic, cognitive and social aspects of language both across groups and within individuals.

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THANK
YOU

The image shows the words "THANK YOU" painted in large, bold, yellow capital letters on a grey asphalt surface. The paint is cracked and peeling in several places, particularly in the middle of the letters. The background shows a concrete curb on the left and a dark shadow on the right.