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Laboratory Sociolinguistics

A Novel Approach to Language Variation

Abstract: This paper presents laboratory sociolinguistics, a novel approach to variationist sociolinguistics in which laboratory techniques and quantitative research methods are central. The aim is to take our understanding of the linguistic, social and cognitive mechanisms underlying language variation and its dynamics further than in previous sociolinguistic work, and to shed new light on the driving forces that turn language variation into language change. Laboratory sociolinguistics is anchored in new developments in sociolinguistics, in linguistics and in social sciences in general, and reaches out to other disciplines. This contribution is a first introduction of this novel approach. It sketches the rationale, defines its research focus, presents the type of research questions that can be tackled and invites other researchers to join this development.

Keywords: Variationist sociolinguistics, experimental linguistics, methodology, production, perception

1 The Sociolinguistic Study of Language Variation

The theoretical and methodological foundations of sociolinguistics, the study of the relationship between language and society, were developed in the 1960s. From these early days onwards, sociolinguistics has covered diverse research topics resulting in two branches: variationist and interactional sociolinguistics.

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https://doi.org/10.1515/9783110733945-045

Over the past decades, sociolinguistics has become a recognized research area of both the social sciences and linguistics.

Variationist sociolinguistics is the quantitative study of language variation and change as pioneered by William Labov. It is rooted in dialectology, language contact, and historical linguistics, studies the different structural components of language (such as sounds, morphemes, phrases and meanings), and uses methods from phonetics, sociology and psychology.

Our contribution on *laboratory sociolinguistics,* an approach making use of laboratory techniques and quantitative research methods, must be situated in the field of variationist sociolinguistics. At first sight, a laboratory approach seems to conflict with two fundamental characteristics of variationist sociolinguistics: (i) the focus on the analysis of language use in its communicative setting and (ii) the continuous strive to overcome the observer's paradox (Labov 1972) or Hawthorne effect. In this contribution, however, we will show that laboratory sociolinguistics is a child of its time, at the core of the new developments within variationist sociolinguistics and linguistics in general.

In the sociolinguistic study of language variation, three perspectives can be distinguished: (i) the quantitative study of the relationship between linguistic variables and demographic categories; (ii) ethnographic studies of the relationship between linguistic variables and local categories and social networks; (iii) studies focusing on the social meaning of linguistic variables and the way they are used to construct identity. They came into the field as successive waves of analytic practice (Eckert 2012). Although each new wave did not replace the insights and methods of the previous ones, there were differences in focus, aims and theoretical backgrounds. The first two waves had a stronger focus on understanding language variation and change and interpreting the meaning of variation as a reflection of social space. The third wave focused on stylistic variation and its meaning and role as force in social change (Eckert 2018). We also observe a growing attention for the role of individuals in language variation and change (Stuart-Smith and Timmins 2010). Laboratory sociolinguistics builds further on these premises in the study of language variation, adds new layers to it, and considers variation as the basis for the study of linguistic structure.

In this contribution, we will first sketch the scientific context in which laboratory sociolinguistics is arising. Then we will define its research domain and introduce the core research questions and methodological frameworks. In the final section we will reach out to other linguistic subdisciplines.

2 Context of the New Approach

2.1 Coping with the shortcomings of spontaneous speech data

Most variationist studies are characterized by a great endeavor to overcome the observer's paradox and focus on language use in communicative settings. Speakers-listeners should be observed in a way that does not modify their linguistic behavior. In this endeavor, the study of spontaneous speech data (as opposed to other types of speech, or even other types of data) has slowly acquired a "royal" status. Analyzing spontaneous speech data, however, turns out to be a very time-consuming task. Furthermore, the analysis is often hampered by the unequal distribution of a linguistic variable over linguistic contexts (the frequency problem), the entanglement of linguistic factors in such a way that specific combinations occur (in)frequently (the co-occurrence problem) and the existence of (groups of) speakers showing different patterns of variation (the interaction problem) (Van de Velde and van Hout 2000). Furthermore, since recordings are often made in natural conversational settings, the study of phonetic variables turns into a laborious (and sometimes infeasible) enterprise, as the recording quality often hampers acoustic analyses. Therefore, the royal status of spontaneous speech is increasingly tempered with skepticism, also within variationist sociolinguistics. At the same time, in linguistics and psychology, there is a long tradition of analyzing data collected in laboratory settings and through experimental designs and a widespread belief that these approaches can lead to valid results. Mechanistically, there is no fundamental difference between laboratory speech and spontaneous speech. There is a different timing in articulating some variables, and there are for instance higher rates of hypercorrection in strongly monitored speech and differences on the dialect-standard dimension, but the principles and primitives remain the same.

2.2 Cognitive turn and the development of cognitive sociolinguistics

Since the rise of Cognitive Linguistics and usage-based approaches in the 1980s, theory formation in linguistics has become less competence-centered and gives more credit to the interaction between the linguistic system and actual language use. The study of language-internal variation took a preponderant position when the variationist-sociolinguistic approach was combined with cognitive linguis-

tics, resulting in *cognitive sociolinguistics* (e.g. Geeraerts and Kristiansen 2014; Geeraerts 2018). Cognitive sociolinguistics developed a strong focus on meaning in a double sense: on the one hand studies of lexical (semasiological and onomasiological) variation and on the other hand research into the perception of language variation and its social meaning. The studies of the second type are good examples of studies in laboratory sociolinguistics (e.g. Impe et al. 2008; Rosseel et al. 2019a,b) and link cognitive sociolinguistics to the third wave in variationist sociolinguistics.

2.3 Statistical turn

Variationist sociolinguistics has a longstanding tradition of applying statistical techniques and analyzing social and linguistic constraints on the realization of a linguistic variable. The shareware computer program VARBRUL (and its derived packages GOLDVARB and R-VARB) became a key methodological tool of variationist sociolinguistics based on logistic regression (Sankoff 1988). However, there are problems with this variationist practice: the collapsing of data over speakers (Van de Velde and van Hout 1998), the difficulty of combining social and linguistic factors (Labov 2006) and incorporating interactions (Sankoff 1988). European variationists were more prone to apply analysis of variance techniques, which can account for individual differences in participants and items, sources of variation that other techniques implicitly neglected (Rietveld and van Hout 1993). Other techniques, in addition to variable rule analysis, were introduced in later methodological textbooks in variationist sociolinguistics (Paolillo 2002; Tagliamonte 2006).

The current century's on-going paradigm shift towards stronger statistical methods throughout all of linguistics is happily embraced by sociolinguistics and finds a key role in our proposal for laboratory sociolinguistics. The shift originated in psycholinguistics, first with mixed-effects models (Baayen et al. 2008) and later with more flexible models that relaxed linearity assumptions, most centrally (generalized) additive models (Baayen et al. 2017; Wood 2017). The mixed-effects model makes it possible to study variation at the individual level, modeling individuals not simply as nuisance terms, but as subjects of theoretical interest (see also Speelman et al. 2018; Voeten 2020a). Similarly, additive models enable the modeling of data that could not have been modeled using traditional regression methods. We also recognize the call for "the new statistics" (Cumming 2014) in response to fundamental problems with *p*-values (Gigerenzer 2004) and acknowledge the potential of Bayesian methods in addressing these issues (cfr. Wagenmakers 2007).

2.4 Experimental turn

Compared to the earlier dominance of arm-chair linguistics, theories are nowadays increasingly based on analyses of language corpora and linguistic databases, and on experimental research of language production and perception conducted in laboratories. Laboratory sociolinguistics follows this latter movement, drawing on theories of human processing and results from cognitive (neuro)science to inspire new research questions and paradigms towards answering fundamental questions about language variation. It does not simply import methods and theories from psycho- and neurolinguistics, but through its own research questions and designs it will contribute to the development of variationist sociolinguistics and its adjacent disciplines.

2.5 Larger focus on and interest in variation

The dichotomy between *langue* and *parole* (de Saussure 1916), *competence* and *performance* (Chomsky 1965), or *I-language* and *E-language* (Chomsky 1986) has shaped linguistics over the past century. Linguists have strongly focused on developing theories that attempt to model the language competence of an ideal speaker-listener in a homogeneous speech community in which the interference of all sort of external conditions (cognitive, social, individual, etc.) and within-language variation and phonetic variation are considered irrelevant and non-linguistic.

Sociolinguistics developed as a reaction to the exclusive focus on language competence and made speakers-listeners and performance central to the study of language. Since the 1990s, an increasing interest and focus on language variation is witnessed, stimulated by the development of theories and usage-based approaches that provide an alternative to the generative paradigms such as exemplar theory, sociophonetics, laboratory phonology and cognitive linguistics. This change has also taken root in generative linguistics, with the rise of Optimality Theory and the focus on regional microvariation in syntax.

Psycholinguists have devoted considerable attention to the processing of variation, albeit with almost completely opposite goals to variationist sociolinguists. Variation has mainly been treated as noise, asking how – despite the presence of phonetic, lexical, syntactic, environmental, and processing variation – we can understand each other. More recently, however, psycholinguistics, related to its participation in laboratory phonology, has come to embrace variation, demonstrating that it is not in fact discarded, but rather used to inform the mapping of sensory stimuli to linguistic categories (Cutler 2012). This psycholinguistic

development complements the sociolinguistic insight that change is drawn from a pool of synchronic variation (Ohala 1989).

2.6 Technological developments

During the last decades, we have witnessed spectacular instrumental and technical developments. Crucially, the power density and the speed of computers has increased exponentially. Many computing-intensive techniques are now available for everyone, even on portable devices. Technological innovations also resulted in the development of portable equipment linguists can use in experiments and fieldwork (EEG, eye tracking, ultrasound, etc.).

Besides these general developments, several analytical instruments designed for linguistics have become widely available. Thanks to packages such as Praat (Boersma and Weenink 2021), acoustic analysis is now more widespread and easier to perform than ever before and computational techniques are rapidly gaining popularity in what is called computational sociolinguistics (Nguyen et al. 2016).

2.7 Multiple disciplinary turn

Over the past decade, there has been a growing call for research involving multiple disciplines to solve complex problems in science, technology and society. Such studies comprise multidisciplinary, transdisciplinary, and interdisciplinary research. Transdisciplinary research studies a question only drawing on knowledge from different disciplines, while interdisciplinary research crosses the boundaries between these disciplines and integrates the new insights into a coherent whole that contributes to development in its constituted disciplines. Interdisciplinary research creates new conceptual, theoretical, and methodological innovations by integrating and transcending the traditional disciplines and focusing on real-world problems with a larger impact on society.

All these developments created a scientific environment conducive to a new approach within variationist sociolinguistics. Laboratory sociolinguistics emerges based on maturation within variationist sociolinguistics (accepting the limits of spontaneous speech and a new statistical turn), within linguistics (with a larger focus on and interest in variation and the cognitive turn) and outside the field in a more general scientific advance (technological developments and a general move towards multidisciplinary research).

3 Laboratory Sociolinguistics

3.1 Research domain/framework/core questions

Laboratory sociolinguistics is a branch of variationist sociolinguistics that makes use of laboratory techniques and quantitative research methods. It will try to strengthen the link with interactionist sociolinguistics and more qualitative approaches, a tendency which is already visible in the third wave. The aim is to understand the linguistic, social, and cognitive mechanisms underlying language variation and its dynamics, and the driving forces that turn language variation into language change. The study of language variation as observed in speakers and groups of speakers is the point of departure. Linguistic variables can be directly selected at all linguistic levels from traditional qualitative observations and quantitative corpus analyses. Laboratory sociolinguistics is therefore not limited to the study of phonological variation.

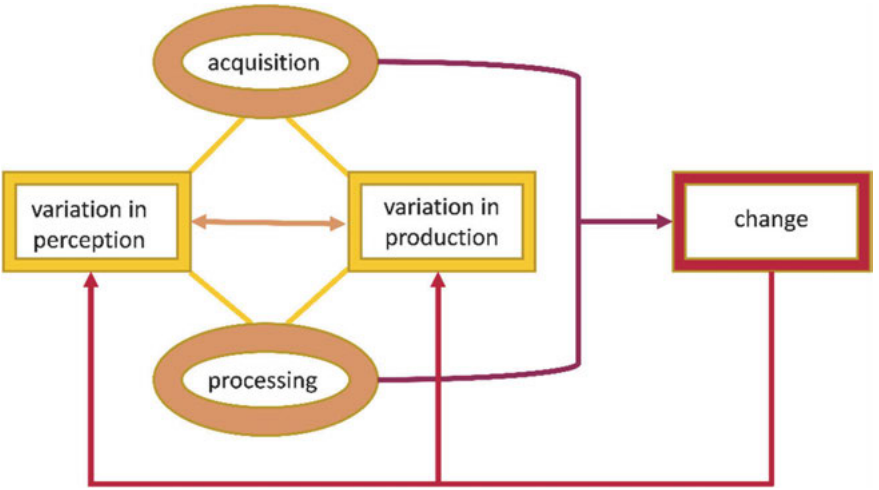

Fig. 1: Schematic overview of the research focus in laboratory sociolinguistics

Figure 1 gives a schematic overview of the research focus in laboratory sociolinguistics. It investigates variation from multiple perspectives on the individual and the group level:

- Variation in language production and perception.
- The processing of language variation in production and perception.

- Variation in the processing of language production and perception.
- The acquisition of variation in production and perception (child L1, across the lifespan, bilingualism).
- The interplay between variation in production and variation in perception.
- The interplay between variation at the individual and the group level.
- Changes in production and perception.
- The relationship between short term accommodation and long-term change.

These are some of the core general research questions we want to address in laboratory sociolinguistics:

- What is the role of cognition-based imitation capacities in language variation and change? Is there a threshold for imitation capacities needed to become a leader of language change, and one that causes speakers to stay conservative and block individual (stylistic) variation and change across the lifespan? What are the factors shaping this neurocognitive capacity?
- Why are some articulatory differences not perceived and/or not interpreted as meaningful?
- What is the role of consciousness in language variation and change? How can we define and measure language consciousness? How and why does it differ between different linguistic levels? What is its relationship with overt and covert prestige?
- What is the relationship between variation and change in production and variation and change in perception? Does one precede the other, in all stages of language change and at all linguistic levels?
- Under which conditions do short term accommodation and stylistic variation turn into language change?

3.2 Methodology

Sociolinguistics is the study of language in its communicative setting and is in principle conducted outside the laboratory. On the one hand, we aim to conduct studies that directly connect to observations done and research questions raised in traditional sociolinguistic studies, by trying to simulate these real-world observations in a laboratory setting in order to refine the existing insights. On the other hand, we intend to develop laboratory approaches that cope as much as possible with the challenge of overcoming the observer's paradox.

Laboratory sociolinguistic research will make use of experimental and quasi-experimental designs to tackle its research questions. Mixed-effects models will be an important statistical tool to analyze the relationship between individual

and group variation. We furthermore believe that laboratory sociolinguistics should strive to stay up to date with innovations in statistics and computational modelling and try to find inspiration in models of variation and change applied in other disciplines.

Portable and less obtrusive laboratory techniques and bringing these techniques to the research participants home environment are crucial. These offer the possibility to test participants in a more natural setting for the studies of speech production and perception within a mobile lab, or to install this type of equipment in a short amount of time in the participants home environment (possible with perception experiments, electroglottography, eye-tracking, airflow, nasality measurements, ultrasound, etc.). This will provide access to people who will never come to a lab at a university due to social and/or geographical distance. At the moment, most experimental studies in linguistics are heavily biased towards the university populations: highly educated and young people (and members of their network). Investigating a large range of language varieties produced and perceived by various kinds of individuals is crucial if we aim to understand the mechanisms underlying language variation.

3.3 Examples

A first step in the move towards incorporating more experimental approaches in variationist sociolinguistics was to collect speech data in which linguistic factors varied systematically (e.g. Van de Velde and van Hout 2000; Kissine et al. 2005). The laboratory approach was recently expanded and applied to the study of the relationship between perception and production in sound change (Pinget 2015; Pinget et al. 2020). Pinget's large-scale study (N=100) was designed in a multi-experimental, cross-sectional manner: it consisted of a series of different types of experiments conducted on the same participants (in order to investigate the links between speech production, speech perception, imitation and language attitudes, at both the individual and group level). It drew samples from five regions within the Dutch language area and conducted experiments in a sound-attenuated booth at a university in the participants' own region. The study combined two sound changes in progress: the devoicing of initial labiodental fricatives and the devoicing of initial bilabial stops. The results of the production tasks, in which speech styles were varied and linguistic factors were controlled for, confirmed the patterns found in previous studies (e.g. Kissine et al. 2005) and provided additional insight into the regional and individual patterns of sound change. Second, regional perceptual patterns in fricative devoicing matched the differences in production: the perception of the contrast between /v/ and /f/ was

the most categorical in regions where the devoicing process is just starting, and the least categorical in regions where the process of devoicing is almost completed, showing a clear link between individual speech production and perception systems undergoing sound change.

If language variation and change are societal processes, then they must play out within the minds of the individuals who make up this society. Voeten (2020b) used a laboratory-sociolinguistic approach to study how these individuals adopt novel phonological variation: when do speakers and listeners restructure their grammars in response to an ongoing sound change? Drawing an analogy between the adoption of on-going sound change and second-dialect acquisition, Voeten investigated the production and perception of the Dutch tense mid vowels and diphthongs in sociolinguistic migrants from Flanders to The Netherlands. He showed that, while nine months is not enough time to adopt ambient variation (Voeten 2020b: 53–89, 2021), multiple years to decades are (Voeten 2020a, 2020b: 91–129). The latter result was subject to significant individual differences, which were revealed by means of analyses at the individual level through mixed-effects-regression coefficients. This corroborated findings by, among others, Van de Velde and van Hout (1998), who showed that aggregating individuals at the group level can be a methodological mistake when there are individual differences, as is common in sociolinguistics.

The combination of acoustic and electroglottography recordings (Herbst 2020) gives a good example of user-friendly and non-invasive instrumentation that can be applied in laboratory sociolinguistics. This technique was applied in a pilot study of variation in the pronunciation of Frisian. Our auditory perception of long vowels suggested that they were often produced in two phases, deviating from the monophthongal and slightly diphthongized realization observed in the literature (Visser 2020). To gain more insight into the phenomenon, EGG and sound recordings of several speakers were made, by means of the Laryngograph Speech Studio system (Laryngograph Ltd., UK). In addition to the microphone, the participants only had to wear a small neck strap holding two electrodes. The EGG data were analyzed with the software package, enabling a detailed phonetic description of the laryngalization features and the measurement of the closed quotient (Herbst 2020). The analyses (of six speakers) showed that there are at least two variants: (1) a modal vowel followed by a creaky vowel (e.g. [eę]); (2) two vowels separated by a glottal stricture (e.g. [eʔe]) (pressed voice). The abrupt change in the phonation type of long vowels is sometimes accompanied by a slight diphthongization, (e.g. [aʔɑ]). The changes in phonation type have never been observed before in Frisian and is strikingly parallel to *stød* in Danish (Grønnum and Basbøll 2001). This pilot exemplifies an accurate and advanced, yet

user- and participant-friendly, laboratory technique, that can be used for speech data collection in a natural setting and outside a traditional experimental lab. These techniques allow to describe and quantify subtle phenomena, (probably) operating below the level of consciousness, and reveal new insights in patterns of socio-geographical variation, mechanisms of language change and the relationship between individual and group differences.

The aforementioned studies certainly do not represent the only nor the first variationists following this path. There is a long tradition in studies of speech accommodation (e.g. Giles 1973; Boves 1992, Staum Casasanto et al. 2010), language attitudes (e.g. Giles and Powesland 1975;Van Bezooijen 1994; Campbell-Kibler 2007; Grondelaers et al. 2010; Prikhodkine and Preston 2015), mutual intelligibility (e.g. Impe et al. 2008; Heeringa et al. 2008). Grondelaers and Brysbaert (1996) is an early psycholinguistics study of syntactic variation. In 2010, a tri-annual conference series on experimental approaches to the perception and production of language variation was founded (ExAPP). Babel's (2019) volume on awareness and control is labeled as an elephant in the room of sociolinguistic research and is an excellent example of laboratory sociolinguistics.

We witness an increasing number of studies including also neurolinguistic experiments and examining other patterns of variation than phonological ones. Schmidt (2017) and Lanwermeyer et al. (2016) for instance showed how neurolinguistic techniques such as electroencephalography (EEG) can contribute to the study of language variation. Voeten (2020a, 2020b: 91–129) also applied the laboratory-sociolinguistic approach to the (individual-level) adoption of sound change using neurolinguistic experiments. In short, diverse types of sociolinguistic research questions can be tackled within a laboratory approach.

4 Crossing and Connecting Disciplines

Laboratory sociolinguistics is at the heart of variationist sociolinguistics and builds on developments in this field and in linguistics in general. By including all linguistic units as objects of research (sounds, words, structures, conversations, texts, etc.), laboratory sociolinguistics can connect to many linguistic disciplines. While connections with linguistic (sub)fields such as, for instance, sociophonetics, psycholinguistics and experimental pragmatics may appear quite straightforward, other connections remain to be further developed or newly explored and can come from research areas out of sight today. Beyond linguistics, strengthening the collaboration with fields like psychology, sociology, and statistics are leading for this approach. Figure 2 visualizes the connections between laboratory

sociolinguistics and other disciplines without aiming to be exhaustive or all-embracing.

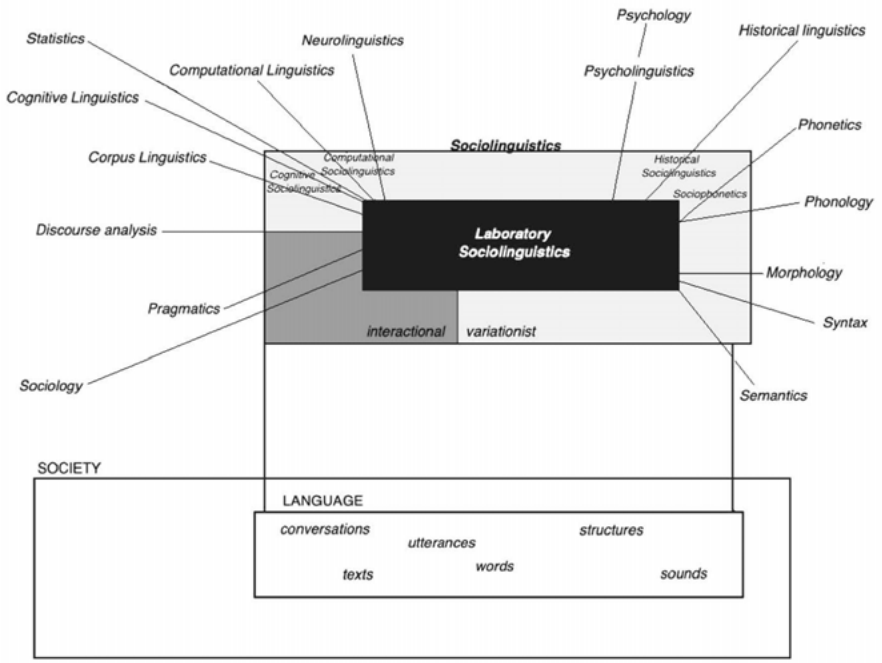

Fig. 2: Connections between laboratory sociolinguistics and other disciplines.

5 Conclusion

Laboratory sociolinguistics treats variation as the beating heart of the linguistic system, builds on developments within and outside sociolinguistics and is an attempt to address fundamental questions about language variation in a new methodological framework. Given the strive to answer fundamental theoretical questions and to generate new ones, it is more than bringing together existing approaches, methods, insights and theories. We reach out and connect to other types of sociolinguistic research such as interactional sociolinguistics and cognitive sociolinguistics. Connections with other disciplines are an intrinsic

characteristic of the proposed approach and we highly invite research that deepens and extends those links.

Several multi- and cross-disciplinary types of sociolinguistic research have seen the light in the past twenty years. Cognitive and historical sociolinguistics developed already into well-established research areas; computational sociolinguistics is a new loot on the branch. The success of laboratory phonology is a good example that successfully crossed the boundaries of phonetics and phonology. For laboratory sociolinguistics to be successful, a constructive interplay between the analysis of language in its communicative setting and (quasi)-experimental research will be necessary, as well as the development of laboratory techniques that have a weaker influence on language production and perception.

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