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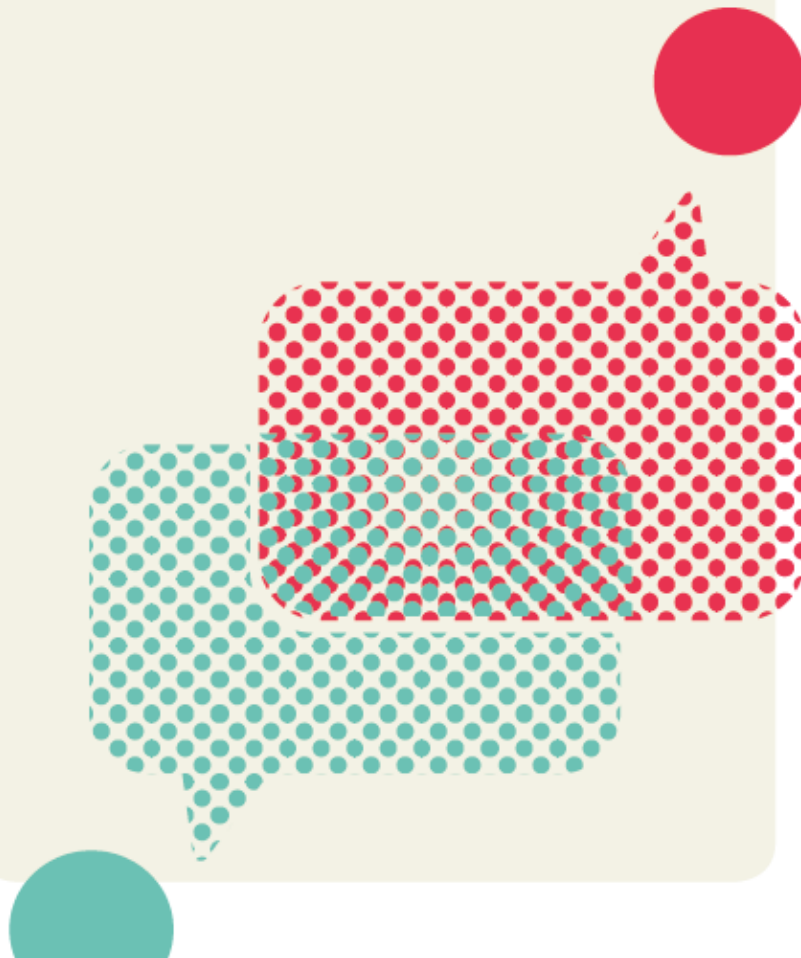
University Research Priority Program
Language and Space

Workshop on Accommodation in Speech Communication

Talks, discussions and poster session

Thursday, 13 December 2018
University of Zurich
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Abstract Booklet

The abstracts contained in this document were reviewed and accepted by the Organising Committee for presentation at the Workshop. The index is based on the order of presentations and can be used to navigate the document.

URPP Language and Space, University of Zurich

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Next steps towards understanding entrainment

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Entrainment is generally accepted to be an important and prevalent aspect of human-human and human-machine communication. However, there is a gap between accepted psycholinguistic models of entrainment and the body of empirical findings, which includes a large number of unexplained negative results. Furthermore, existing research does not provide insights specific enough to guide the implementation of entraining spoken dialogue systems or the interpretation of entrainment as a measure of quality. I will discuss recent negative findings which demonstrate the need for a more nuanced view of entrainment, and argue for an integrated entrainment model that looks for consistent explanations of entrainment behavior on specific features and how they interact with speaker, session, and utterance characteristics.

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Theme and variation in phonetic convergence

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Phonetic convergence involves changes that bring a talker's phonetic repertoire closer to that of another individual. This phenomenon has been examined extensively from multiple perspectives and likely relates to processes involved in dialect formation and change. This presentation will discuss recent studies in phonetic convergence with the aim of developing some broad conclusions and identifying areas for future research. In particular, previous research has revealed that phonetic convergence is subtle and highly variable. This variability is found across both interactive and non-interactive settings, and in acoustic, articulatory, and perceptual measures. Moreover, individuals vary both when producing phonetic convergence and as model/target talkers eliciting convergence. These findings reveal a rich phenomenon that reflects core processes in language use.

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Phonetic convergence in the wild - an elusive but social creature

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The phenomenon of phonetic convergence has most often been investigated in rather controlled scenarios, often using read speech and/or shadowing setups. Recent studies have taken up the challenge to look at much less controlled data from spontaneous dialogues. However the scenarios are still often dialogue settings in which participants have to solve some task that requires cooperation and a shared vocabulary. In this talk, I will present experience from investigating convergence of various phonetic parameters in even more free dialogues that basically consist of task-free small talk between strangers. The findings regarding convergence on these data are relatively complex, and convergence effects are very subtle. Importantly, results consistently indicate effects of participants' mutual social perception. Without accounting for such social aspects, convergence may be elusive in this kind of uncontrolled scenario.

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Trust towards machines that accommodate to humans: static avatars vs. embodied robots

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Accommodation in spoken human-human interactions, or speech entrainment, has been shown to correlate with various positive effects (e.g. Hirschberg 2011, Benus 2014, Michalsky & Schoormann 2017) but also to have a very complex and multi-dimensional nature where both entrainment and disentrainment can be found in various acoustic-prosodic features of speech side-by-side (Levitan et al. 2015, Perez et al. 2016, Reichel et al. 2018, etc.). In human-machine interactions, the picture is yet more complex as we begin to explore how humans entrain to machines (e.g. Bell 2003, Strupka et al. 2016) or how manipulating machines' entrainment behavior might affect user's experience (Oviatt et al. 2004, Lubold & PonBarry 2015) or trust (Levitan et al. 2016, Benus et al. 2018, Gauder et al. 2018).

We used the original design of Levitan et al. (2016), in which a subject plays the simple GoFish card game with two avatar helpers against a computer. Before each turn, the user asks one avatar for advice and the voice of one avatar-helper always entrains to the user and the other helper's voice always disentrains during the game. With this design we have previously found that subjects trusted the entraining avatar-helper more than the disentraining one. We ask if the change from the static avatars to humanoid embodied NAO robots affects the relationship between trust and speech entrainment.

The results show no significant main effect of the manipulation of NAO's voices (entrain/disentrain/stable) on the trust toward the avatars. I will discuss how this finding relates to other recent observations regarding the relationship between trust and speech entrainment, if the implicit behavior during the game differs from metacognitive evaluations of the subjects after the experiment, and if the personality of the subjects influences the relationship between speech entrainment and trust.

The Ventriloquist paradigm: studying phonetic accommodation with full control over phonetic input

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A major challenge for the study of phonetic accommodation is the intrinsic impossibility to control the phonetic input that participants are exposed to in dialogue. The number of times participants hear certain speech sounds, the phonetic contexts in which these sounds occur, and their specific realizations, which affect the extent to which participants accommodate to their interlocutor, thus vary across participants. The novel Ventriloquist paradigm (Felker, Troncoso-Ruiz, Ernestus, & Broersma, 2018) has been developed to tackle this problem. It enables the study of phonetic accommodation in dialogue, while allowing full control over the phonetic detail of the input that participants are exposed to. The Ventriloquist paradigm has been developed to investigate phonetic accommodation (as well as perceptual learning) in an ecologically valid yet maximally controlled way. Participants take part in a dialogue which they believe to be genuine; in fact, however, their real-life interlocutor is a confederate whose speech is not just 'scripted' (as in the confederate scripting task for the study of syntactic accommodation), but fully prerecorded. This guarantees control over all characteristics of the speech input, including the number of times the participant hears certain speech sounds, their phonetic contexts, and their phonetic realization. The set-up is fully tuned to upholding the illusion that the confederate is actually speaking with the participant. The confederate sits opposite the participant, face briefly hidden when (s)he "speaks". Participants hear the prerecorded speech over closed headphones. In addition to the standard input, to facilitate a smooth flow of the conversation, the confederate can play prerecorded non-verbal interaction markers and stop-gap replies to any unanticipated remarks or questions from the participant. The new paradigm thus reconciles ecological validity with experimental control for the study of phonetic accommodation in dialogue.

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Convergence is predicted by particular interlocutors and interactions, not speakers

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Do characteristics of individuals or conversations influence degree of convergence, such that some exhibit more convergence than others, across measures? There is evidence for measure-specific variability in convergence due to personal predictors (e.g. Natale 1975; Yu et al. 2013), and social predictors (e.g. Gregory and Webster 1996; Bane et al. 2010; Babel 2009), but little work testing whether degree of convergence is consistent for an individual or a pair of interlocutors across measures or across tasks (though cf. Sanker 2015, Pardo et al. 2018).

Extending Cohen Priva and Sanker (2018), we present data from the Switchboard corpus, providing natural speech from 464 speakers in ~4000 conversations. Convergence was compared by speaker and by conversation across ten measures: F1 and F2 of two vowels, F0 median, F0 variability, speech rate, filler choice (uh:um), lexical information rate, and sentence-initial conjunctions. Our main predictors in each measure were the speaker's baseline (performance in other conversations), and the interlocutor's baseline, which was the measure of *convergence* (cf. Cohen Priva et al. 2017). All measures except F1 exhibited convergence individually. Across measures, we fitted a single mixed effects model, with measure-specific intercepts for conversation and topic, and with speaker, interlocutor, conversation, measure, and topic random intercepts, and random slopes for interlocutor's baseline, which signify the consistency of these factors in eliciting convergence.

We found no effect for per-speaker or per-topic consistency in convergence, but found per-interlocutor (p=.0005) and per-conversation consistency (p=.019). That is, there is little evidence for individual tendencies in convergence across conversations or across measures, but there is consistency in convergence within a conversation and as elicited by particular interlocutors, indicating that context plays a larger role than speaker in influencing convergence and suggesting that it will be more fruitful to look for individuals who elicit convergence than individuals who exhibit convergence.

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Short-term accommodation can lead to long-term language change: a computational account

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We present a computational model of *rational* accommodation, in which an accommodating speaker estimates the linguistic system of their interlocutor and matches their interlocutor's language during interaction. We are particularly interested in settings in which interaction occurs between individuals with different exposure histories and therefore radically different linguistic systems, such as when non-native speakers interact with native speakers. In our model, we assume that native speakers have a (parameterised) tendency to accommodate to non-native interlocutors, and non-native speakers differ from native speakers due to having had less linguistic experience, and possibly also exposure to a different kind of language (for example, accommodated language).

On the dyadic level, we find that this model allows a speaker to infer their interlocutor's language system quickly and accurately, given some (vague) knowledge of quantity and quality of prior exposure; as a result, native speakers can rapidly accommodate to the language used by a non-native interlocutor, presumably resulting in easier communication. On a population level, the model shows that accommodation can lead to language change, and more specifically, language simplification. Adult learners who interact with accommodating native speakers are systematically exposed to a distorted variant of the language; this distortion is functional in the short term, since it facilitates moment-to-moment interaction, but over many interactions, accommodation prevents learners from acquiring the population's 'true' (non-accommodated) language. Over generations, the simplified linguistic system acquired by these individuals in interaction then spreads through the population.

Accommodation can thus act as a potential explanatory mechanism for the negative correlation found between languages with populations with higher numbers of non-native speakers (L2 learners) and the complexity of the language spoken by these populations (Lupyan & Dale, 2010; Bentz & Winter, 2013).

Phonetic convergence in human-computer interaction

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Phonetic convergence has been studied in many experiments, most of which concentrate on human-human interaction. A growing number of studies investigates the phenomenon in human-computer interaction (HCI). Our project examines phonetic convergence in HCI both from the perspective of the user and the system. The key research questions are: How are users changing their speech when talking to a computer, as opposed to a human interlocutor? How can these changes be integrated in the output of a spoken dialogue system (SDS) to optimize spoken interaction with computers? We focus on changes at the levels of segmental pronunciation and intonation events.

In a shadowing experiment with natural and synthetic stimuli, participants were exposed to sentences containing German pronunciation variations. We found that participants generally converge to both stimulus types (e.g., same degree of [ɪç] vs. [ɪk] convergence), but for certain features, are less responsive to the synthetic stimuli (e.g., lower degree of [ɛ:] vs. [e:] convergence). This might be partly due to the perceptibility of these features in the text-to-speech output. The degree of convergence to both types of stimuli also varies between participants. The experimental approach is currently being extended to a Wizard-of-Oz setting to achieve a more dynamic interaction between the user and the system.

To apply the empirical knowledge acquired in the experiments, a computational model able to capture and generate such convergence processes was developed. This model was integrated into an SDS module responsible for tracking the user's phonetic behavior, and accordingly changing the system's feature representation. In addition, the system can provide a visualization of these changes during an interaction.

Future work includes combining the computational model with statistical models, which will be trained on a large-scale corpus. This is expected to grant further flexibility to the system and make it more adaptable to different users.

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Accommodation in human-robot-interaction

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In daily interaction people often convey their attitudes and emotions about somebody or something in addition to the facts they exchange while talking. We assume that communication, which is perceived as successful, relies to some extent on accommodation or alignment. Alignment processes can be found on several verbal and non-verbal levels (e.g. syntactic structure, lexicon, facial expression, etc.). These adaptation processes are different in patients with communication disorders. In conversational analyses of interactions of patients with mild language disorders even more signs of nonverbal alignment can be seen compared to healthy persons. Our main research question is: Do people with language disorders align to a robotic interaction partner? Do the level and mode of accommodation influence the therapy effect?

We will present a study investigating the processes of accommodation of a person with a language disorder in a naming therapy situation interacting with the robot Flobi. We evaluated the influence of different levels of alignment on therapy effects. Results will be reported and discussed with reference to different models of alignment.

Towards a meta-analysis of phonetic convergence effects in non-interactive speech production tasks

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Since Goldinger's (1998) and Pardo's (2006) seminal studies, there has been strong interest in phonetic convergence between speakers in the production of speech. Considerable effort has been put into exploring the cerebral, sensorimotor and cognitive bases of phonetic convergence in both adults and children. However, it is yet far from clear along which dimensions in the speech signal speakers may converge towards each other. Pardo et al. (2013) pointed out that the available acoustic studies "present a bewildering array of patterns of convergence and divergence, with a great deal of variability and inconsistencies across measures." The degree of phonetic convergence across speakers has also been often assessed by means of perceptual judgments performed by listeners (e.g., Babel & Bulatov, 2012). However, it has proven highly difficult to identify the phonetic parameters on which these judgments may have relied. The objective of the present work is to perform a meta-analysis of a large sample of studies on phonetic convergence between speakers, using recently developed methods and tools (Borenstein et al., 2009; Lipsey & Wilson, 2001; Tsuji et al., 2014). We have focused on studies published in peer-reviewed journals over the last two decades, and in which convergence was perceptually and/or acoustically assessed in non-interactive situations (i.e., participants exposed to one or several model speakers' recorded speech). A Matlab graphical user interface was developed that has allowed us to aggregate the results of the selected studies in a systematic and homogeneous manner. Specific attention was paid to potential correlations between observations, as well as to the issue of unreported data in the case of non-significant comparisons. The data are being analyzed and preliminary results will be presented at the workshop.

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Corpus, Methods and Measures of Accommodation
at Zurich URPP Language and Space

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A sizeable body of research has show that during social interactions speakers accommodate to their interlocutors, either by becoming more similar (convergence) or by accentuating individual differences (divergence). With respect to existing evidence of rhythmic adjustments in response to the interlocutor's age and cognitive development, in the present study we test the hypothesis that rhythmic modifications are not only unidirectional but that interlocutors are likely to mutually adapt their rhythmic characteristics over the course of a conversation or after increased exposure to a dialogue partner.

One excellent testing ground for studying phonetics accommodation is represented by the linguistic situation of German-speaking Switzerland. Swiss German dialects, differ for segmental features, speech rate and intonation contours as well as for their rhythmic characteristics, measured acoustically in terms of the durational variability of consonantal and vocalic intervals. To study phonetic convergence in a dialect contact situation, we used a corpus composed of: 18 audio-recorded dialogues between Zurich and Grison German speakers while performing a diapix task, and pre- and post-dialogue recordings performed individually by the 18 Zurich and 18 Grison German speakers. To determine whether Grison and Zurich German speakers produce vowels and rhythmic contrasts more similarly after participating in the dialogue, we measured the Euclidean distance within a pair and within an individual.

Results on vowel convergence have shown that speakers from Zurich converged towards Grison German, and the degree of accommodation for both dialects was most marked in low vowels. Preliminary findings on rhythmic contrasts have shown that the Grison and Zurich German speakers articulate words and intervocalic sonorants gemination more similarly after the interaction, even though the effect of pair and item is also relevant.

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How do beliefs about the addressees' linguistic community affect speakers' lexical choices?

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During dialogue, speakers' lexical choices are affected by the conversational partner's choices. For instance, interlocutors tend to use the same lexical label to name objects which have both a high-frequency and a low-frequency label (*umbrella* vs *brolly*) (lexical entrainment). But are speakers' lexical choices affected by the partner's linguistic community? We explored whether individuals **lexically entrain** to the same extent with members of their own community versus another community and whether individuals are more likely to **use the same lexical label** across two partners who are from the same community versus different communities.

In two experiments, participants engaged in two sessions of an online picture-naming task. Participants alternated turns with a 'partner' (in fact, a computer) to select and name a target, encountering different 'partners' in each session. Experimental items comprised targets with both a high-frequency and a low-frequency label. In Session 1, the 'partner' named targets before the participant, using exclusively low-frequency labels. In Session 2, only participants named the targets. In each session, we manipulated participants' beliefs about whether the partner was from their own community. We measured **lexical entrainment** in Session 1 and **reuse of labels** across sessions. Experiment 1 used Spanish individuals (N=160) and Experiment 2 used Mexican individuals (N=160).

In both experiments, participants' tendency to entrain was above chance. We found no effect of addressee's linguistic community on either participants' tendency to entrain or to reuse a label. However, the tendency to reuse labels was mediated by an interaction between whether participants entrained in Session 1, whether the first partner was from their own community, and whether the second partner was from the same community as the first one. We are investigating an effect of linguistic attitudes on reusing a label across partners.

Does phonetic talent influence ability to accommodate?
Imitating unfamiliar accents vs. Languages

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Why is it so hard to shake the traces of your mother tongue in a new language? And why, despite this, do some people still manage to acquire a native-like accent in a non-native language? These questions have led some researchers to propose such a thing as "phonetic talent" and to investigate the cognitive and linguistic processes that underlie this ability. There is evidence that individual differences in phonetic talent could underlie differences in the extent and nature of phonetic convergence. If the construct of phonetic talent truly exists, however, one would expect that talented people would demonstrate an advantage with any new sound system they encounter. Previous studies have found that the ability to imitate an unknown language is related to pronunciation in a second language, but this leads to another question: is it the same to imitate non-native sounds in an entirely new language as it is to imitate non-native sounds in a language you speak? That is, do pre-existing word representations hinder or facilitate imitation? We tested both of these questions in the present study in which 40 native Dutch speakers were asked to imitate real words in an unfamiliar foreign language (Basque) and in an unfamiliar foreign accent in their native language (Greek-accented Dutch). Their target vowel sounds are currently undergoing formant and duration analysis in order to determine whether performance in these two tasks is indeed related (as expected from the phonetic talent claim), and whether it is easier to imitate non-native sounds in the native language or in an unfamiliar language. The results will shed light on the debate on phonetic talent, as well as address the new question: what role do pre-existing word representations play in the ability to imitate new sounds?

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Electroglottography as a method to analyse paralinguistic adaptation

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The term 'paralanguage' – and the corresponding adjective 'paralinguistic' – came into common use through the efforts of Trager (1958). It can be defined as "significant noises made by the non-articulated vocal tract" (Austin, 1965: 32). More precisely, paralanguage is divided into 'voice sets', 'voice qualities', and 'vocalizations' (Trager, 1958: 8). Here, we will discuss how it is possible to analyse adaptation of voice quality with an electroglottograph (EGG).

Speakers appear to have numerous different strategies for varying voice quality, a term used to refer to the various configurations of the larynx, velum, tongue and lips. As a result, all voice qualities (e.g. breathy, modal, vocal fry, falsetto...) appear not to have the same acoustic characteristics: the fundamental frequency (F_0), vocal intensity or the source spectral slope (tilt), for instance, differ more or less greatly (Childers & Lee; 1991: 2395). While the analysis of these parameters can allow to accurately discriminate different types of voice qualities, other methods have been proved to be beneficial for the analysis of vocal fold vibrations, such as electroglottography (see, for instance, Henrich, 2001). This method enables the gathering of information such as: the degree of contact between the vocal folds, the F_0, and the movements of glottal glottal closure/opening during phonation. EGG analyses have, for instance, demonstrated that speakers can manipulate glottal gap, change OQ (open quotient), vary F0, and alter the skewness of glottal pulses to produce different voice qualities (Kreiman *et al*., 2012).

Using this method, I will investigate several learner accommodation strategies across different tasks (reading/repetition tasks, spontaneous conversations) in their L1 (French) and L2 (English).

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Phonetic convergence of Hong Kong English towards native English accents

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Previous studies on phonetic convergence showed that native English speakers with different dialects were able to converge to each other after a short period of time (Babel 2010, 2012; Pardo 2006, Pardo, Gibbons, Suppes & Krauss 2012), however, convergence between native speakers and non-native speakers remains unclear (Kim, Horton & Bradlow, 2011). Present study aims to examine Hong Kong English (HKE) speakers' speech accommodation towards Received Pronunciation (RP) and General American English (GenAmE) after 1 hour's exposure to the native accents.

Nineteen HKE speakers conducted a Map Task with a native speaker of RP and a native speaker of GenAmE respectively. A pre-task and a post-task were also conducted to capture the changes in production. Two vowels (BATH and THOUGHT vowel) and three consonants (fricatives /z/, /θ/ and rhoticity) were chosen as target sounds. The whole experiment lasted one hour.

Results suggested that the HKE participants significantly diverged from the native speakers on the BATH vowel in both exposure conditions. A trend of convergence (statistically not significant) was found for the THOUGHT vowel in the RP condition. For consonants, a significant convergence was found on fricative /z/ and rhoticity, and a significant divergence was found on fricative /θ/.

The selectivity of phonetic convergence found in Babel (2010, 2012) was also observed in the present study. The reason might be that for the HKE speakers some target sounds are more salient than others. For example, phonetic differences between the native variant and the HKE's variant for fricative /z/ (i.e. [z] vs [s]) are larger than the differences for fricative/θ/ (i.e. [θ] vs [f]). Sounds with higher frequency are more likely to accommodate too. Analysis showed that the HKE participants received more native input on rhoticity and fricative /z/ than the two vowels and fricative /θ/ in average.

Accommodation strategies used by hearing speakers in spoken interactions with deaf people. A preliminary investigation

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This study explores the accommodation strategies used by a female hearing speaker, aged 32, in spoken interactions with two mild deaf woman (MD) and two profound deaf men (PD).

Four semi-spontaneous interactions were analysed applying the framework of conversational analysis and were also object of prosodic analysis using *Praat*. Articulation and speech rate (syll/s), fluency, average duration of silent and non-silent pauses, interaction composition in terms of articulation, silence and disfluency time, tonal range were computed for individual interactions and speakers.

The analysis of conversational strategies during semi-spontaneous spoken interactions shows how the hearing speaker reacts to the different intelligibility levels and dialogue strategies of the deaf interlocutors in terms of speech flow and utterance segmentation. The hearing speaker tries to preserve the conversation exchange using a word by word segmentation strategy of the utterance when she addresses profound deaf interactants, as well as in the repair sequences that take place in all the analyzed interactions. Data display the difference in the hearing speaker's SR while addressing PD interactants with respect to what happens in the conversations with MD: 33% of the total speech time is spent in silent pauses while conversing with the first type of speakers, 21% with the others. A more refined analysis of the pause time composition displays longer pauses when the hearing speaker needs to introduce a new topic (1.8 s. with PD and 1.1 s. with MD), with respect to the other intra-turn pauses (ranging from 0.1 e 0.5 s.). Other significant data on pause duration reveal a 'tolerance threshold' (2.2 s.) of response time on behalf of the hearing speaker when the deaf interlocutor remains silent. These pauses are located near the transition relevance place, thus mark the avoidance of turn taking.

Examining phonetic accommodation in the West Yorkshire FACE vowel

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This paper examines the variability in 30 speakers' FACE productions over three spontaneous speaking tasks that utilise different interlocutors, in order to consider the extent to which West Yorkshire speakers may accommodate. FACE is of particular interest as it is said to have some of the highest levels of variation in West Yorkshire English (Petyt, 1985; Hughes et al., 2012). The data is from the West Yorkshire Regional English Database (WYRED) (Gold et al., 2018) and all speakers are male, aged 18-30, have English as their first and only language and grew up in one of three boroughs of West Yorkshire: Bradford, Kirklees and Wakefield. Tasks include a mock police interview, a casual paired conversation and a short exercise where speakers had to leave a voicemail message. For each speaker and their interlocutor, up to 35 FACE tokens were manually segmented from all three tasks in Praat and F1~F3 midpoints were automatically measured, using a modified Praat script (Lennes, 2017).

To determine if and how the speakers accommodated to their interlocutor, three assessments were made. First, standard deviations of each speaker's formant values were calculated to establish the stability of FACE realisations within tasks. Two thirds of speakers had higher levels of variation in the police interview and paired conversation than the voicemail message. Therefore, in these cases FACE productions were less stable when an interlocutor was present, indicating that speech accommodation may have occurred during these tasks. Secondly, the midpoint formant values of all speakers were compared across tasks, using a linear mixed effects analysis, to determine the influence of the task on their realisations. Significant differences were found across tasks for F3 in Bradford, F2 in Wakefield and F1~F3 in Kirklees. Finally, Euclidean distances between interlocutors were measured to quantify the degree of convergence or divergence present in each speaker's FACE productions. The results of this investigation reveal the extent to which phonetic accommodation takes place at a segmental level in British English.

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Accommodation of articulation rate to two different confederates

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Accommodation, the phenomenon of speakers adapting their way of speaking to each other during an interaction, is seen on many levels (e.g. phonetic, syntactic). However, we do not know how long the effects of accommodation last and how fast accommodation happens when speaking to an interlocutor we have interacted with before.

We investigated these questions by focussing on articulation rate. It has previously been shown people align their articulation rate to another interlocutor. Twenty-six native Dutch speakers participated in a sentence completion experiment followed by a questionnaire. Each participant produced a total of 268 Dutch sentences. Participants first completed sentences by themselves (pre-test), followed by Round 1, where they completed sentences alternating with Confederate 1 (pre-recorded speech). After round 1, they did the same task with Confederate 2 (pre-recorded speech) in Round 2, and again with Confederate 1 in Round 3. Lastly, they completed sentences by themselves again (post-test). The questionnaire consisted of demographics questions, participants' liking of the confederates, their voices and their accents and their liking of their own accent.

Preliminary analysis of the articulation rates per round showed that participants aligned to the confederates' articulation rates. Confederate 1 produced an overall articulation rate of 5.28 versus 4.95 for Confederate 2. Exploring the data visually suggests that the articulation rate alignment to the last heard confederate lasts in the post test, which suggests that articulation rate alignment does not only result from immediate priming, but that there may also be another mechanism underlying alignment. Before the workshop, we will have completed analyses of the articulation rate by sentence as well.

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Developmental aspects of accommodation in Chintang
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In everyday interactions, speakers tend to accommodate to the speech of their conversation partners. There are many studies which measure the acoustic and phonetic prosperities of accommodation phenomena in different adult communication situations (e.g. interactions between speakers from different dialects or languages). However, few studies have examined the development of linguistic accommodation in early language acquisition.

The current study is work-in-progress in which we investigate the longitudinal development of linguistic and phonetic accommodation in interactions of children and adults. We analyze data from Chintang, a Tibeto-Burman language (Kiranti subgroup) spoken in Nepal. Children learning Chintang are typically simultaneously bi- or tri-lingual in Nepali (Indo-Aryan) and/or the closely related language Bantawa (Kiranti). Our data come from the Chintang Language Corpus (Stoll et al. 2015), a part of the larger ACQDIV database (Moran et al. 2016). It includes videos of six children, aged 0.6 to 4.4 years old. The videos capture natural interactions between the six target children and adults, as well as other children from a wide range of ages.

As accommodation phenomena are not limited to phonetic features, we conduct a multimodal analysis. The analysis includes acoustic features (F0, formants, segment duration, speaking rate), linguistic features (morphological and syntactic features), and body language (body posture and eye contact). These various features are correlated with social features (e.g., gender) and tracked across development. The relationships between the variables are further compared across two types of interaction (adult-child vs. child-child).

F0 accommodation and turn competition in overlapping talk

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To date, little is known about prosodic accommodation and its conversational functions in instances of overlapping talk in conversation. A major conversational action that happens in overlapping talk is turn competition.

Participants seem to have two options when accommodating each other's prosodic parameters. (Zellers & Schweitzer, 2017). They can either accommodate prosodic parameters locally (initialisation) or access a repertoire of prosodic patterns that refer to general prosodic parameter norms (normalisation). The question is whether this also applies when competing for the turn in overlap.

This work investigates the initialisation and normalisation of fundamental frequency (f0) and assesses its role as a resource for turn competition in overlap. We drew instances of overlapping talk from a corpus of conversational multi-party interactions in British English (Kurtić, Wells, Brown, Kempton & Aker, 2012).

We annotated the overlaps on a scale of competitiveness following French and Local (1983) and the overlap onset position according to Jefferson (1983). We automatically extracted f0 parameters from the speech signal, in in-overlap and in pre-overlap context. We processed them into f0 accommodation features that represent the normalising or the initialising use of f0. The features include standard measures like f0-height, min, max, standard deviation and a similarity measure based on a direct computation of f0-similarity using dynamic programming (cf. Gorisch, Wells & Brown, 2012).

Using decision tree classification we found that f0 accommodation is only relevant as a turn competitive resource in overlaps that start clearly before a speaker transition. In this turn context, we found that normalising and initialising f0 features can both be relevant turn competitive resources. Their deployment depends on the conversational function of overlap. These findings imply that the interactional meaning in conversation is achieved by general prosodic patterns mutually interpretable by speakers that are additionally accommodated to prosodic events in the local context.

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Accommodation may depend on perceived linguistic knowledge: experimental evidence from interaction with native and nonnative speakers

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Speakers tend to adjust their speech to that of their interlocutor. One reason for such accommodation is to facilitate communication (Beebe & Giles, 1984). This goal may be particularly relevant in conversations between native and nonnative speakers, where mutual intelligibility may be affected by differing linguistic knowledge, increasing the pressure on native speakers to adapt their speech.

We used a confederate scripting paradigm (Branigan et al., 2000) with ditransitive sentences to investigate the extent to which speakers accommodate to a conversation partner, comparing interaction in English between a native speaker and a confederate who was either a native or nonnative speaker.

In Experiment 1, participants (*n=40*) heard a confederate describe pictures using both prepositional-object and double-object sentences. When it was their turn to describe a picture, participants tended to produce the construction the confederate previously used. Similar levels of accommodation were observed in participants interacting with native and nonnative confederates, suggesting that our participants did not adapt their speech more when interacting with a nonnative speaker. However, our participants had clear evidence that their interlocutor was familiar with both prepositional and double-object constructions, since the confederates used both equally frequently. In Experiment 2, we explored the effect of interacting with a less flexible interlocutor, and tested whether accommodation would extend to producing ungrammatical utterances. Participants (*n=40*) heard a confederate who only used the double-object construction; on some trials the confederate produced ungrammatical constructions (e.g., The knight donates the wizard the cake). We found low levels of accommodation following ungrammatical constructions, but participants interacting with a nonnative confederate were overall more likely to accommodate to their partner than those interacting with a native confederate.

These results suggest that the extent to which speakers accommodate to their conversation partner may depend on their perception of their partner's linguistic capabilities.

The implications of speech recognition technology for phonological errors by German learners of English: Testing audience design

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Audience design and affiliated theories attempt to explain why human speech varies depending on the addressee(s) of the speaker (Bell, 1984; Giles, 1973). Such hypotheses have also been employed to understand variability in second language (L2) learners (Beebe & Giles, 1984; Zuengler, 1991), with recent trends towards their application to L2 phonology (Lewandowski, 2012; Zając, 2015). Audience design has also been used to examine the linguistic changes made in L1 speaker communication with artificial communication partners. Until now, there has been a lack of investigation regarding phonological accommodation in L2 learner interactions with these machines and how this compares to L2-L1 speaker interactions. To investigate these questions, this study relies on an experiment conducted on 18 German L2 learners of English at a German university. Specifically, learners were put in experimental contexts featuring interactions with a native speaker of English (human modality) and a speech recognition system (machine modality) to test the extent to which participants converged to a more target-like pronunciation. The experiment employed three typically problematic phonological variables for German speakers of English, namely [g] in syllable- or word-final position, [θ], and [dʒ]. Further extralinguistic variables potentially contributing to accommodation (e.g., age, sex, etc.) were also included in the analysis. Results indicate that communication with both modalities promoted convergence significantly more than the control modality (i.e., absence of interaction), while the extralinguistic variables did not. Additionally, statistically significant interactions were established between the modality and the phonological variable converged upon, with learners significantly more likely to converge to target-like pronunciation of [dʒ] with the human but [g] with the machine. We take these results to suggest that L2 learner accommodation in interactions with machines and humans may result in convergence, albeit the degree to which different types of phonological variables are accommodated by different modalities is dependent on the phonemic status of the sound in question in the L1 of the learner.

What about synchrony? Measuring and visualizing synchronous entrainment of f0

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In recent entrainment research it has become clear that we have to distinguish between two categorically distinct types of entrainment: The actual increase in similarity between the values of a given linguistic feature commonly referred to as *convergence* or *proximity* and the relative imitation of movements of the values of a linguistic feature called *synchrony* (cf. Edlund et al. 2009, Levitan 2014). While measuring convergence in f0 as the distance between absolute values has its own challenges, measuring and visualizing synchrony proves especially difficult. Synchrony itself can be simplified to the linear correlation between f0 values of a turn giving and a turn taking speaker. However, investigating how synchrony is both effected by and effecting a third continuous variable (e.g. conversational quality) remains challenging due to it involving the interpretation of an interaction term of two continuous variables on a third continuous variable. After arguing for the use of z-transformed f0 scores when investigating synchrony, we propose two different approaches to interpret these complex interactions. First, we introduce the use of *heatmaps* as a visualization tool. This keeps the interaction term and thus the possibility of complex interactions between f0 values but facilitates interpretation. Secondly, we reduce model complexity by collapsing the two f0 values into a single variable capturing their linear relationship within every single conversation in the form of *correlation coefficients*. Thus we interpret the degree of synchrony as the effect size of the correlation between giver f0 and taker f0 which can be correlated with a third variable. Exemplified with data from a previous dating study (cf. Michalsky, Schoormann & Niebuhr 2018) we show that the results are compatible with more complex models while highly improving interpretability.

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Morphological difficulties in people with Attention Deficit Hyperactivity Disorder (ADHD)

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One of the great difficulties of people with Attention Deficit Hyperactivity Disorder (ADHD) lies in the use of morphology. Although some types of morphology have been studied in this group (such as flexive or verbal), it has not been possible to determine or to elaborate a concrete profile in terms of the most common morphological errors, in order to be able to base linguistic intervention on them. Therefore, the objective of this research is to know how people with ADHD use the different types of morphology and to what degree it is altered. The participants were 45 people diagnosed with SLI between 5 and 17 years who were evaluated in the area of morphology through the BLOC-C test. The following areas were measured: plural formation, adjectives, regular and irregular verbs, participles, comparative and superlatives, derivative nouns, derived adjectives, personal pronouns, reflective and possessive. The results indicate that people with ADHD present difficulties in all morphology areas. These data support the need for specific linguistic intervention in the morphological area. Therefore, we believe it is necessary to expose and adapt people with ADHD to people without language pathology in order to improve their morphological abilities.

Prosodic convergence toward the native model: the effect of explicit training in L2-Italian

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This paper aims at investigating the extent to which Hiberno-English learners of Italian converge more to the native speaker model in terms of lexical stress and intonation patters, after receiving an explicit prosodic training on the production of broad and contrastive focus, yes/no and wh-questions in Italian. From a group of 10 elementary learners of Italian, attending the same language course at National University of Ireland in Galway, 6 undertook a 6-week explicit intonation training (experimental group) and 4 were engaged in conversation classes (control group). Both control and experimental groups were exposed to the same native Italian teacher.

The prosodic training consisted of both theoretical and practical sessions:

a) explicit instruction on the phonology of Italian intonation, using Autosegmental Metrical analyses and on the main correlates of prosody shown in PRAAT;
b) three imitations tasks of audio examples
c) visual comparison of prosodic pattern produced by the native speakers and learners aimed at identifying possible deviation
d) Repetition of imitation tasks (b)

In pre- and post-training recording sessions, learners were asked to read silently 28 utterances (7 for each category: yes/no questions, wh-questions, broad and narrow focus) including 3 proparoxytone, 3 paroxytone and 1 oxytone words and then to record their speech productions. The same sentences were recorded by the teacher. The realization of lexical stress and the intonation pattern by native and non-native speakers were analyzed using the Autosegmental Metrics framework. Syllables duration, F0 targets timing, with respect to segment boundaries and scaling were also calculated. Preliminary comparisons between the experimental and control groups show that only the former was able to converge towards the native speaker. Only trained subjects, indeed, performed stress and intonation patterns according to the expected phonological pattern (H+L* LH%). They also show a change in pitch span in the final syllable, as it was done by the teacher.

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The role of proficiency in L2-L1 phonetic accommodation: evidence from Dutch speakers accommodating to British English

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Alignment in L2-L1 conversations has been argued to be effortful, but little is known about its underlying mechanisms. This study investigates the role of proficiency in L2-L1 alignment: do less proficient speakers (who have more room for improvement) accommodate more than more proficient speakers?

Twenty-five Dutch speakers interacted with a confederate, using the Ventriloquist Paradigm which gives complete control over the phonetic input by covertly using pre-recorded speech (recorded by a speaker of British English). We analysed their pre and post-interaction production of English /æ-ɛ/, a problematic contrast for Dutch speakers who tend to merge these vowels. We hypothesised participants to accommodate to the native speaker by undoing the merger.

To compare pre and post-interaction pronunciation, for each participant we calculated to what extent the two vowels differed (*differentiation score*), using Pillai-Barlet Statistics, and approached native speaker productions (*nativelikeness score*), using Montreal Forced Aligner. Degree of accommodation was defined as the differences between the pre and post-interaction productions for each score.

As hypothesised we found moderate negative correlations between the degree of accommodation and the baseline, both for the differentiation scores ($r(23) = -0.54$, p-value = 0.005) and for the nativelikeness scores ($r(23) = -0.50$, p-value = 0.0105). These results suggest that the lower the baseline is, the more L2 speakers accommodate to the speech of a native speaker. Thus, low L2 proficiency does not imply that L2 speakers accommodate less in dialogues with native speakers (e.g. as a result of higher cognitive load) but rather that they accommodate more than more proficient speakers, presumably because there is more room for improvement.

Intonational alignment in second language acquisition

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Even though in the 1980s Gumperz (1982) already mentions the importance of the compliance to cultural linguistic norms in communication, such as where to put emphasis and how to use intonation, the suprasegmental level of speech has rarely been considered in the scientific debate concerning speech accommodation. However, it is well know that prosodic characteristics of speech contribute to foreign accentedness (Ulbrich & Mennen, 2016) and can impair comprehensibility (Trofimovich & Baker, 2006). The aim of the study was the investigation of intonation convergence in second language acquisition. Convergence of phonetic and phonological representations of intonation have been evidenced in the investigation of pitch accent patterns and pitch levels in varieties of Italian by D'Imperio et al. (2014). However, there is no study investigating the immediate modification of pitch accent patterns in a cross-linguistic conversational task. Starting point is an observation that native speakers of Belfast English (BE) use a rising pitch pattern in declaratives in German. This often leads native Germans to misinterpret declaratives as utterances indicating continuation or even questions (depending on the context). This was confirmed in a perception test with 30 native speakers of Northern Standard German (NSG). In declaratives speakers of BE realise nuclear accents with rising intonation (Lowry, 2002) and speakers of NSG with falling pitch (Ulbrich, 2005).

In our experiment, we paired up 30 female speakers of BE with 30 female NSG speakers. They had to complete a map-task in which the BE speaker was to be guided by a NSG speaker through the map. During the task, BE speakers also had answer questions regarding films, dishes on menus etc. in order to collect segmentally comparable data. Declarative utterances were extracted and annotated. We also measured peak alignment, pitch level and range.

Our results show:

1. BE speakers increase in their production of falling pitch patterns in declaratives
2. phonetic realisation (pitch range) of falling pitch patterns in declaratives differs systematically between non-native and native speakers
3. peak alignment (or in this case the begin of the falling contour) shows very little variation between NSG speakers, but varies considerably between BE speakers

Contrary to cross-varietal data analysed by D'Imperio et al. (2014), our data suggest tonal specification of nuclear pitch accents can be modified whereas the implementation of phonetic detail appears to be more difficult for learners of a second language.

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The role of incipient modal want as directive strategy in out-group interactions

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This study looks at accommodation in pragmatic variables, visualizing how the incipient modal *want* construction (Verplaetse 2003) is employed by younger speakers of American English to signal politeness in potentially face-threatening communication settings with out-group interlocutors.

Want to is considered a modal verb of necessity with weak obligative meaning (Krug 2000), with the obligation being internally-motivated, i.e. "for the agent's (or "doer's") own sake" (Smith 2003: 244). Constructions with second person subject (see Examples 1–4 below) might be interpreted as a commands; this construction has been noted to be growing in popularity in American English (Krug 2000; Mair and Leech 2006).

Interactive speech data was collected from two different age cohorts of second-generation American Chinese speakers, through customized map task elicitation experiments. Speakers were asked to give directive instructions in two comparable map tasks, each with an in-group and an out-group interlocutor. Results showed that while both cohorts of speakers modify their strategies of expressing instructive speech acts to signal upward convergence in an intergroup situation (Giles and Ogay 2007), younger speakers prefer the use of *want* as a politeness strategy to soften the imposition in constructions like:

(1) so then you want to make an L from start
(2) so you want to be in-between the two houses
(3) you want your line to go in between the pointy trees and the broad trees
(4) you don't wanna go under haystack, you wanna go the other way

This poster presentation will visualize cohort- and gender-based distributions as well as idiosyncratic patterns of intergroup accommodation.

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