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Language stability and morphological complexity in situations of language contact. An experimental paradigm

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Language stability and morphological complexity in situations of language contact. An experimental paradigm

by Peeter Tinits

Abstract

Behavioural experiments with miniature artificial languages have provided a promising toolkit for typological research in linguistics. In contrast to the progress made on the role of individual learning in typological tendencies, so far the role of the dynamics in a communicative situation have been little explored. The current contribution combines paradigms from artificial language learning with ones from experimental pragmatics and experimental semiotics in order to develop an experimental framework that would allow biases in communication to be considered in the specific context of language typology. The study implemented in this paradigm addresses the hypothesis by which widespread morphological simplification has been related to particular social structures and hence the presence of certain kinds of interactions in the community. The study focusses on the impact of morphological complexity on the linguistic outcome of certain types of collaborative interactions in a situation of language contact with two very similar varieties and no prior history of bilingualism. Contrasting the morphological complexity of minority languages in small groups of three individuals, a trend is found for greater stability for the minority language when it is morphologically simpler than the majority. As groups with a minority language that is simpler than the majority establish communication by developing mutual understanding of the two varieties, groups with a minority that is equally complex refrain from using the minority very quickly into the interactions. The tendency for the groups with a simpler minority to be slower to establish communication indicates that this trend is due to some motivations of the minority speaker that are present in these interactions. The sample size in this study is however too small for any strong conclusions to be made and future contributions are invited to extend it. As a main aim of the conribution, the feasibility of the paradigm is investigated on various parameters and found to provide a solid platform for future studies.

Keywords: morphological complexity, morphological simplification, experimental linguistics, artifical language learning, experimental semiotics

1 Introduction

Linguistic typology, which traditionally has looked into patterns in the areal and genetic distribution of linguistic features, has in the recent times made substantial progress in connecting various types of social structures to the distribution of linguistic features as well (e.g. Trudgill, 2011). A particular hypothesis developed within this research area states that in particular kinds of intense contact situations languages undergo extensive morphological simplification (e.g. Trudgill, 1989, 2002, 2011; Kusters, 2003; McWhorter, 2001, 2007).

Connecting the distribution of linguistic structures to particular events that may have happened in the past of a linguistic community requires a dynamic approach that takes into consideration the way languages evolve in time and various factors that play a role in this. Drawing on the principle of uniformitarianism (Labov, 1994) or the principle of informational maximalism (Joseph & Janda, 2003), reconstruction of past linguistic communities is based on a variety of different sources of information for which theoretical models and the data need to be combined in a careful and delibrate manner (Nevalainen & Raumolin-Brumberg 2012).

Recent proposals have been in typological circles to complement typological research with experimental data which allows the mechanisms invoked in the theoretical models to be tested in controlled settings by manipulating some of the variables associated with them (e.g. Tily & Jaeger, 2011). This paper proposes an experimental paradigm by which the influence of particular structural features in situations of language contact could be investigated in order to allow more detailed modelling for the scenario of morphological simplification mentioned above.

1.1 Morphological simplification in contact situations

Situations of language contact, which are considered to take place when at least two speakers of different varieties interact with each other, provide a possibility for one participant in the interaction to adopt some means of expression from another participant (Thomason, 2010). While technically any speaker's idiolect can be considered different enough from any other to allow such a transfer, contact linguistics has been mostly concerned with circumstances in which the varieties involved can be considered separate dialects or languages (Ibid.). For any contact-induced change a complex pattern of various adoptions and their subsequent diffusions in different parts of a linguistic community need to be investigated to reconstruct the trajectory of the influence. The complexity of this problem warrants investigations from multiple perspectives on multiple levels of analysis that range from macro-social predictors to the mechanisms involved in micro-social interactions.

The trajectories of adoption for a linguistic community may also differ as to the nature of the linguistic feature. Simple elements such as lexical borrowings may often be accepted in the community independently of any other elements already present in the language. Many other borrowings that deal with syntax or morphology however deal with interrelations between many different elements of the language and thus may require a more complex path to follow. Linguistic complexity is such a notion that has been proposed as a very general measure for a structural make-up of a language with no ideological or evaluative statements assumed (Sampson, 2009). Morphological complexity is a feature that is considered as an element of overall complexity whose precise definition has been subject to some variation, but follows generally similar patterns.

1.1.1 Definition of morphological complexity

Defining complexity in a way that would be most useful to linguistics remains an active topic (see e.g. Karlsson et al. 2008 on recent discussions). A broad distinction among the definitions has been presented in Miestamo (2008) as a difference between absolute complexity and relative cost or difficulty (same terms have been used in Dahl, 2004, in a slightly different manner). An absolute complexity constitutes the term by the number of parts in a system - the more parts a system has, the more complex it is (e.g. as in McWhorter, 2001, 2007). The relative complexity of a system can be seen as the cost or difficulty in using the system for the required operation, such as language use or learning (e.g. as in Kusters, 2003, 2008).

Despite differences in the basic premises, both absolute and relative measures converge on rather similar estimations on which structural features a measure of morphological complexity should entail. As an absolute measure based on the number of rules in a system, McWhorter (2007) characterizes morphological complexity on three dimensions:

1) overspecification (the number of overt and obligatory semantic markers; includes agreement);

2) irregularity (inconsistency in paradigms; includes allomorphy and suppletion);

3) structural elaboration (the number of rules required to generate the surface forms; includes consistency of ordering).

At the same time Kusters (2003) bases his measure for morphological complexity on psycholinguistic data on the degree of difficulty involved in learning and use for a generalized outsider to the linguistic community, and presents three main parameters:

1) economy of form (number of semantic markers in the system; includes agreement);

2) transparency (predictability of meaning from form and vice versa; includes allomorphy and suppletion);

3) isomorphy (the order of morphological elements; includes consistency of affix ordering).

While a few of the particular features differed (e.g. Kusters defines some patterns of ordering more natural) and the dimensions were not defined exactly the same (e.g. Kusters's transparency includes aspects of McWhorter's irregularity and structural elaboration), the main features that make a language morphologically complex or simple were the same and would conclude that the same set of languages were more complex than the others.

Considering complexity as an evolving variable it can be noted that there are two main ways complexity can develop, by altering earlier layers of complexity or by adding an additional layer that does not interfere with earlier language structures. The first is referred to as non-additive complexity and the second as additive, and there may be a difference in the conditions that bring them about (Trudgill, 2009).

Following broadly the same lines the evolution of morphological complexity has become a subject of extensive investigation in the field of linguistic typology where it has also been connected to certain aspects of the communities involved. The current paper utilizes an absolute measure however similarities between the metrics on morphological complexity are kept in mind and the structural feature of that is used is in a similar role both absolute and relative measures.

1.1.2 Literature on morphological simplification

Investigations on the evolution morphological complexity in contact situations have primarily dealt with macro-social parameters as they are much easier to observe in typological works. Contact linguistics has proposed three main parameters that influence the linguistic results of a contact situation: 1) presence or absence of non-native speakers; 2) intensity of contact; and 3) speaker attitudes (Thomason, 2001, 2010). Trudgill (e.g. 2011, 2012) has developed a typology of language contacts as it relates to complexity of their linguistic results offering three prototypical situations:

1) intense long-term contacts with extensive childhood bilingualism leads to accumulation of additive complexity;

2) intense short-term contacts with a significant amount of adult non-native speakers lead to language simplification;

3) low contact situations with stable native populations lead to preservation of existing complexity and allow for the accumulation of non-additive complexity.

These broad cases have been supported by a number of empirical studies and theoretical justifications from a range of research domains pertaining to linguistics. Particularly for the context of this paper, the connection between morphological simplification and intense contacts with a strong non-native speaker presence has been made in the field of creole studies (McWhorter, 2001; De Graff, 2001; Parkvall, 2009), in dialect contact studies (Trudgill, 1987, 1997), in new dialect formation (Trudgill, 2004; Kerswill, 2010; Szmrecsanyi & Kortmann, 2009), in studies of demographic history and migrations when an influx of new speakers to a speech community has been indicated (Kusters, 2003; McWhorter, 2007; Trudgill, 2011), and in large-scale cross-linguistic correlational studies (Sinnemäki, 2009; Nichols, 2009; Lupyan & Dale, 2010).

The theoretical basis for the typological tendencies has also been conceptualized under the distinction between esoteric and exoteric communities as two ideal types (Thurston, 1987; Andersen 1988; Wray & Grace, 2007). An esoteric community can be seen as prototypically small, tightly-connected, conservative, with extensive shared background and little contacts with other communities. An exoteric community can then be seen as prototypically large, sparsely-connected, open to innovations, with little shared background between its members and extensive contacts with other communities. For practical comparisons, historical communities can be placed on a scale between these ideal types (Kusters, 2003). While many of the properties can covary, natural questions arise about the roles of these parameters when they don't, and about the precise mechanisms by which the system is bound together.

On a micro-level the social system of a linguistic community can be seen as consisting of utterances made by particular individuals in particular interactions (e.g. Lass, 1997; Croft, 2000). This allows the mechanisms of change and stability to be understood at the level of individual biases that can be connected to earlier research in psycholinguistics (e.g. as was done by Kusters, 2003). Most of the instances of language simplification have taken place in illiterate societies a long time ago, for which the observation of a community in any reasonable detail has proven difficult, leaving much of the discussion mostly speculative. It has even been proposed that illiteracy may be a characteristic that fundamentally amplifies simplification, leaving little opportunities to remedy the situation (e.g. McWhorter, 2007). More recent events of simplification, such as in new dialect formations have allowed researchers to gather more details as to the age-demographics of

the population or the amount of focussing in different stages for example (see e.g. Trudgill, 2004; Kerswill, 2010), however it remains an open point as to how much these conditions may be impacted by modern social structures (e.g. school systems) or linguistic practices (e.g. literacy).

The theoretical models that have been applied to describe language simplification have so far mostly remained on the macro-social level that is convenient for typological work. At the same time these macro-social variables have been interpreted by various characteristics (such as the proportion of non-native speakers, structures of the social networks) whose interrelations can be developed in much finer detail. The maintenance of a particular linguistic variety as well as a transition from one to another is formed through complex patterns of innovation and diffusion, which can, in principle, be monitored. While the multiplicity of the factors involved may mean that deterministic modelling of linguistic behaviour in any particular interaction may prove impossible, typological research has demonstrated that it is not unreasonable to speak of trends and tendencies that may have some probabilities attached to them (Thomason & Kaufman, 1988; Thomason, 2001).

1.2 Experimental studies and linguistic typology

The success of recent behavioral studies on typological trends and universals have prompted a suggestion that they should formulate a natural complement to regular typological research (e.g. Tily & Jaeger, 2011). While the materials available for traditional typological research into the mechanisms of language evolution can include both features that cooccur due to a historical accident as well as for functional reasons (see e.g. Comrie, 1992), an experimental approach can in principle design materials to test for particular functional biases present in particular in linguistic interactions. The way particular interactions or individuals may impact linguistic communities and thus the distribution of world languages presents a separate research question, however work with computational models indicates that under particular constraints this influence can be rather strong (Kirby et al., 2007).

The interaction between functional constraints and its impact on language evolution has been developed in a number of theoretical frameworks (e.g. Hurford 1990; Croft 2000; K. Smith et al., 2003; Christiansen & Chater, 2008; Beckner et al., 2009) which place language under the influence of numerous functional systems in physiology, cognition and the dynamics of cultural evolution. Empirical research dealing with the influence of individual interactions on the structure of language have made significant progress on the dimensions of learning and communication.

1.2.1 Dynamics of learning

The effects of individual learning biases on the evolution of the whole system have been explored by a number of computational (e.g. Kirby, 2001; Kirby et al., 2007; Reali & Griffiths, 2009) and experimental studies (e.g. Kirby et al. 2008., Cornish, 2010). The main theoretical model of the dynamics of language has been formulated in the frame of iterated learning which demonstrates that population effects may occur merely by individuals learning behaviours observed in others who have learned it the same way (Scott-Phillips & Kirby, 2010). Thus it has been shown that slight biases on individual learning (such as a tendency to make certain mistakes on learning or learn some materials more quickly than others) can significantly shape the evolution of a language as the dynamics of its transmission to new learners can accumulate and also amplify the preferences of individuals (Kirby et al., 2007). This results in the language adapting to learners' biases which leads the language itself to become better learnable and more in tune with the typical errors that a learner makes (Zuidema, 2003; Christiansen & Chater, 2008).

Experiments that investigate the connection between individual biases and structural features of languages have often used a platform of artificial language learning (ALL) where the research subjects are given a miniature artificial language to learn, after which their accuracy can be tested by a series of comprehension and production trials. The miniature language is most often designed with special structural parameters in mind, and the learning conditions are varied for particular purposes. Initially these studies have been composed for research in second language

learning (e.g. Esper, 1925, 1966; MacWhinney, 1983) where various presentations for the learning materials (e.g. DeKeyser, 2003, reviews implicit and explicit learning) and various learner types (e.g. Gomez & Gerken, 2000, reviews infant learning trials; DeKeyser, 2003, also reviews the impact of cognitive abilities on language learning) have been considered. The miniature language is meant to invoke the same mechanisms as are used for language processing in natural settings, however the success of this comparison remains an open issue. Recent neuroscientific research suggests that miniature languages utilize at least partially the same brain structures as regular language processing (Müller et al. 2009; Petersson et al. 2010).

Recently several experiments have used ALL to compare typological tendencies and universals to individual learning biases and have in some cases found a strong match (e.g. Christiansen, 2000; Culbertson & Smolensky, 2009; Fedzechkina et al., 2011; Tily et al., 2011). Morphological complexity has not been investigated as a separate issue, however a number of studies have investigated linguistic complexity and its relation to individual learning biases and their role in language dynamics which often includes aspects of morphological complexity. It must be noted that miniature language dynamics may differ from what was previously described under morphological simplification due to a very small vocabulary and a very evenly compositional meaning space used in miniature languages. As a result, the simplest variety that can communicate all meanings in a miniature language may be a perfectly compositional vocabulary while for a natural language that can rely often on context the simplest variety may be able to shed most of its morphological structure. Accordingly, the measurements in ALL studies find no way to reasonably distinguish word roots from morphemes, and count them as similar instances. This does not make a difference when considering morphological regularity or suppletion, however it may make a difference as to how the presence of morphology may influence language use.

Addressing linguistic complexity, an experiment with individual learners has shown that the ability for learners to acquire a language generally increases with the amount of regularity that is present, although the experiment also demonstrated noticable individual variation in behaviour (A. Smith et al., 2010). When a miniature language was allowed to change in a chain of learners, where each of the participants produced the language to the best of their ability, but learned from the production of the previous participant, a number of experiments have demonstrated that a fully non-systematic lexicon can be regularized into a fully compositional lexicon by the end of the iterated learning chain (Kirby et al., 2008; Cornish, 2010). Another study presented unconstrained variation in the form of semantic markers to represent irregularity to individual learners and demonstrated that child participants, but not the adults regularized the original language when attempting to faithfully reproduce it (Hudson Kam & Newport, 2005). An extension of this study that placed the individual learners in an iterated learning chain demonstrated that this effect can be found in adults as well (K. Smith and Wonnacott, 2010). These experiments indicate that a typological tendency to prefer form regularity in compositional structures can be explained merely due to biases on individual learning and their role in population level dynamics.

These learning effects can in theory take place in a number of different kinds of populations requiring only that a participant learns behaviours by observing these behaviours in others. A theoretical distinction between populations of linear transmission chains, replacement chains and closed groups has been proposed, where the individuals participate in different interactions (Whiten & Mesoudi, 2008). Linear transmission chain studies allow only information to be moved between participants, where they are allowed no direct contact with each other, which has been found most useful in investigating substantive biases in learning. Replacement chain studies gradually replace members in a group so that new members are allowed to interact with older members, which has been used to investigate the maintenance of conventions in a community. Closed group studies do not replace any group members, but just monitor the group behaviour in time, which has been very useful in investigating form diffusion. Interaction between the participants in the experiment brings in another dynamic to the shaping of conventional behaviour (such as language use) that may be

considered broadly under the notion of biases in communication.

1.2.2 Dynamics of communication

Biases in communicative settings have been experimentally explored in the domains of experimental pragmatics (EP, Noveck & Sperber, 2006) and experimental semiotics (ES, Galantucci & Garrod, 2011). While episodes of learning (i.e. when one participant learns a behaviour by observing the same behaviour on another) do take place also in interaction, an interactive setting allows also other considerations to be investigated experimentally. For the purposes of this paper three main functional biases can be distinguished: 1) a behaviour may be easier than others to use and thus resorted to with no consideration of its tradition of use (see many examples in Beckner et al., 2009); 2) a behaviour may be consciously or unconsciously selected due to the particular addressee in mind as an instance of audience design (Bell, 1984); 3) a behaviour may be guided by an accumulation of common ground (Clark & Brennan, 1991) which may be largely implicit (Pickering & Garrod, 2004) that makes the selection of a behaviour heavily dependent on prior interactions between particular individuals.

A main element in an EP or ES study is a communication game (CG) where participants are given a task which can reasonably be solved by communication through various means. EP studies have investigated the use of natural language in particular interactions and have for example demonstrated an accumulation of common ground can lead to more efficient use of words that minimizes the joint effort in a pair to solve the same problems in the future (Clark & Wilkes-Gibbs, 1986). ES studies have proposed that the biases that deal with structure of the communication systems can best be studies with unconventional media and have thus tried to replace natural language with various other means (Galantucci & Garrod, 2011). This allows the researchers to investigate the development of more abstract properties that may be already too intimately integrated to a modern natural language and control for participants' individual backgrounds that may vary quite a bit. A recent review has classified ES studies into three categories on the basis of the medium that is provided for them: 1) semiotic matching games investigate communication in the presence of a closed set of signals and a closed set of meanings, 2) semiotic referential games provide no obvious set of signals to communicate a closed set of meanigns, 3) semiotic coordination games provide no obvious signals or meanings that provide a solution to the communication problem (Ibid.).

Several studies that have implemented a graphic medium for communication have investigated the influence of particular interactions to very general properties of the communication system (e.g. transparency, compositionality, economy of form). For example an experiment that tasked participants to communicate a closed set of meanings via drawing in an instance of a referential game explored the influence of the variety of feedback to the established communication system. It was shown that the presence of feedback in a dyad of speakers allowed communication systems to become more economical in form and at the same time less transparent for outsiders, while for a participant with an imaginary partner repeated attempts at drawing led to more elaborate drawings that were equally or more transparent to an outside observer (Fay et al., 2007). The selection of forms can be understood at an intersection between economy of form, audience design and accumulation of common ground. Thus interaction within a pair allows common ground to be accumulated which allows for greater economy in form as the recipient is considered, however a participant who accumulates common ground with an imaginary participant will have no evidence to the partner's understanding and is led to design more elaborate and transparent forms. These results have been extended to demonstrate that sequential mixing of pairs within a group can lead to a selection of economical forms that also prove relatively transparent for the particular group (Fay et al, 2010). The design is further extended to demonstrate that uneven frequencies of meanings may encourage compositionality in signals (Theisen et al., 2010) and that allowing a pair to observe and learn from the signals of previous participants can amplify this tendency further (Theisen-White et al., 2011).

There seems to be a general tendency for repeated interactions to ground economy of form via an accumulation of common ground

that fits the typological patterns connected with morphological simplification where relative irregularity of forms is based on a stable shared background in a community. It is not clear however that a linguistic medium can be equated with a graphic one in its functional behaviour. Specifically a linguistic medium can establish transparency primarily due to interrelations between forms while a graphic medium can resort to various varieties of iconicity (see e.g. Sonesson, 1994). It is possible that this may cause significant differences in the possibilities for the evolution of a communication system and as it relates to the varieties of interaction, and for this reason the use of a linguistic medium is advocated in this paper until the relations between the media are also better understood through theoretical and experimental research.

So far linguistic media have been used in few studies with communicative settings. Roberts (2008) demonstrated that groups of participants can quickly diverge in their varieties in a competitive task, as the accumulation of common ground allows the participants to deceive the competing groups with novel forms. Kalnins (2010) extended a previous iterated ALL study (Kirby et al., 2008) into a replacement chain with spoken interaction and replicated a tendency to develop a compositional vocabulary out of a non-compositional one also in these settings. The interactions within the group allowed for semantic distinctions to be preserved, which in earlier studies had been accomplished only by applying certain filters on the transmission of information. The study also demonstrated that the earlier research in investigating biases for regularity and compositionality with ALL which had been done almost exclusively with written media could also be replicated in spoken interactions.

In contrast to biases in learning, biases in communication that would address particular typological issues have so far not been experimentally investigated. At the same time it is reasonable to suppose that any general biases present in communicative settings could greatly impact the patterns of linguistic diffusion and innovation in any community, and it is plausible that the computational models on the impact of individual learning on the evolution of the whole system can be extrapolated to the influence of particular types of interaction to the community. Experiments that would address the issues of linguistic typology that relate to communicative settings have so far not really been developed, while a combination of ALL and CG research paradigms may offer an option that is in accordance with earlier tradition in applications of behavioural experiments and also the specific requirements that linguistic typology might set for the experiments.

1.3 The study

The current study proposes an experimental paradigm by which biases in communication that can be relevant for typological studies in contact linguistics could be investigated. Particularly the study addresses the role of morphological complexity in contact situations, and whether the complexity of a variety may influence the linguistic results of a contact situation between two varieties. The paradigm proposed relies on the tradition of ALL studies to represent naturalistic language processing in laboratory conditions via miniature artificial languages and the concept of a CG established in EP and ES as a paradigm to study problem solving in communication.

The study seeks to replicate in laboratory settings a limited contact situation where the participants have some problems in mutual understanding due to differences in their dialects. As it is in the interest of both parties to communicate, they try to establish an understanding through various trials and errors. While each of the participants is free in their contributions to the process, the shape of the solution depends on the interrelations between all the participants that may be sensitive to the sequence of particular actions taken. Large-scale language contacts can be modelled to contain a number of this kind of interactions with various group sizes and purposes. Due to the lack of bilingualism at the start of the task, this situation may most closely resemble early stages in new dialect or pidgin formation.

The adaption of ALL methods to communicative purposes relies on a simple alteration to the method. Instead of utilizing settings insufficient for learning the entire language to bring out the differences between different languages or learning conditions,

all participants are provided with enough familiarity with the stimuli to accomplish an expected level of high competence. The participants are then joined into a closed group where they are instructed to play a CG using verbal means but not any language they knew before the experiment.

The participants then play an open-ended matching game in a collaborative setting where they can use the learned language for communication but which doesn't solve all their problems. The groups are competing against other groups and it is reasonable to suppose that they will try to find the quickest way to establish communication. The paradigm can then investigate whether there are visible tendencies in how they established communication that may be experimentally manipulated.

The experimental manipulation is introduced into the structure of the original languages. While languages in both conditions provide similar problems in communication, in Condition 1, one of the languages will be morphologically simpler than the other, and in Condition 2, the languages in contact will be of equal complexity. The research question can then be answered by looking at the difference in the behaviour of the two groups.

As a novel paradigm some exploratory analyses need to be performed before the research question can be addressed. Particularly three questions need a positive answer in order for any further analysis to be possible:

Q1: Did the participants learn the language to a required level of competence during the learning session?

Q2: Did the participants manage to communicate successfully on the items that did not differ within the varieties?

Q3: Did the conflicting items in the varieties present a communicative problem, and if yes, were the groups able to solve this problem?

If the preconditions for the experiment are met then the question of the influence of morphological complexity can be approached and the solutions in the two conditions will be explored on several parameters. While there is a typological tendency for languages to simplify in similar naturalistic contact situations, prior research has not explicitly connected it to interactions in communicative settings that may differ as to structural properties of the linguistic varieties used, and the question will be formulated in a neutral way to look for any differences between the groups.

Q4: Did the groups in different conditions differ as to their solution to the communicative problem?

Finally the qualitative analysis provides some room to look at the possible mechanisms involved, and see if for example any possible reasons could be excluded.

Q5: What are the possible reasons for these differences if any? Could any of them excluded on the basis of the data?

2 Method

The experiment thus constitutes an open-ended matching game in closed groups with prelearned linguistic materials of different complexity. The experiment is conducted in two parts, where the participants first are taken through a solitary learning session, and second they are presented with a communication game where they have to coordinate between references known from the learning session by using verbal media but no other languages they had known before the experiment.

In each group of three participants there are two languages, one is learned by two participants (henceforth termed 'the majority language') and another by only one participant (henceforth termed the minority language). The problem in communication is formed by a minor difference between the two languages present where two words out of nine have no similarity to each other between the languages. The participants are unaware of a difference between languages at the beginning and throughout the game strategies employed to solve this problem will be monitored.

The experiment is formed by as pairs between two conditions which differ in the form of the word for the two items in the minority language that differ from the majority language. In Condition 1 the two items constitute a fully compositional language in relation to the rest of the items, in Condition 2 the two items introduce irregularity into the system exactly as the majority language, thus introducing varying amounts of irregularity

which allows the languages to be compared on the parameter of morphological complexity. According to the extent of morphological complexity of the minority language, Condition 1 is referred to as the simple minority condition and Condition 2 as the complex minority condition, and according to their role the minority speakers are referred to directly as simple minority speakers or complex minority speakers. The items that differ between languages in each pair of groups are referred to as test items according to their function in testing the experimental hypothesis of a difference in their use between conditions. The items that match between languages in each pair of groups are referred to as control items as they can be used to test whether the languages were learned properly and whether the participants understand the game and want to use their training to play it.

2.1 Participants

18 participants (8 females, 10 males) were recruited through the Student and Graduate Employment service at Edinburgh University (SAGE) and were reimbursed 10 GBP for their time. The participants were randomly allocated between six groups of three individuals which was thereafter randomly presented with one of two conditions. All participants were native English speakers with no reading disorders and normal or corrected to normal vision. None of the participants in each group had met each other before, and for incentive 5 GBP extra payment was announced and awarded for each member in the group with highest points.

2.2 Materials

2.2.1 Images

A set of nine images (Figure 1) was selected as a domain of reference for the artificial language from an earlier ALL experiment with permission (Tamariz et al., 2012). These images vary systematically by shape and filling and form a perfectly compositional three by three meaning space. Additionally each image also contained a unique appendage that distinguished them from the rest.

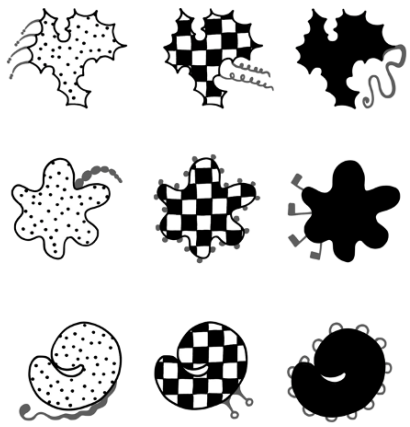

Figure 1. The set of images used in the trial in the layout used throughout the experiment.

2.2.2 Languages

Groups were paired across conditions to implement three sets of languages that were designed in triplets following the same principles. Each triplet contained one language that was fully compositional, and two languages where two words (the test items) out of nine were scrambled so as not to contain any of the same sounds in the same places as the morphological paradigms with the same shape or filling. In the two scrambled languages these words denoted the same image and were also designed not to share any of the same sounds in same places with each other.

All words consisted of three-syllables following a strict consonant-vowel structure (CVCVCV) where the first two syllables shared all the sounds with words denoting the images with the same shape and the last two syllables with the words denoting the images with the same filling. The inventory of sounds chosen to allow maximal distinctiveness and robust pronouncability for native English speakers (/k/, /p/, /t/, /s/, /m/, /n/, /l/, /f/, /w/, /a/, /o/, /u/) was allocated into the syllables randomly for each triplet and the scrambled words in two languages of the triplet. Languages which formed words that were largely similar known English or international words (e.g. *humani* cf. *human* or *mamuta* cf. *mammoth*) were excluded if discovered.

One of the scrambled languages was used as a majority language in both trials of a pair across conditions, and either of the remaining two was used as a minority language, constituting either the Simple-Minority Condition if the language was

fully compositional or the Complex Minority Condition if the language contained the two scrambled words. The exact languages used are given in Appendix A Table A1.

2.2.3 Learning script

A learning script was designed with E-Prime that presented a learning sequence following the principles of implicit or incidental learning (De Keyser, 2003) that has been predominant in earlier ALL studies. Another option was used by Roberts (2008) where the researcher provided the languages fully in the paper beforehand where the participants could explicitly learn the whole system, however it was decided that this kind of learning may significantly change the dynamics of use as compared to earlier ALL studies (e.g. the structure of the language and the role of irregularity would be very clear and obvious for all of the participants, which would not be a reasonable assumption for ALL studies or naturalistic circumstances). The learning script was designed to resemble the communicative interactions as closely as possible in its sequence and setup to allow the participants also to learn the rules of the game while learning the language, and to make the memory constraints on learning novel items as similar as possible in both cases.

The learning session was designed as an interactive slide show which presented first the whole set of images with their names in the given languages twice in a random order, followed by eight rounds of composite sets of learning events. These sets depicted of alien figures depicted as communicating about the images in a gift-giving game with each other and with the participant via pointing and words presented in speech bubbles. The presentation of each word was accompanied by the same word uttered by a speech synthesizer through the participant's headphones. Speech synthesis was performed with an an English native voice "Prudence" implemented through a Hidden Semi-Markov Model (HSMM) on OpenMARY (version 5.0). The participant was provided with three kinds of events: observation, perception and production. Observation presented a single slide which depicted one alien figure presenting an image to another with the accompanying word in a speech bubble. Perception presented three slides, the first slide presented an alien looking towards the participant with a word inside a speech bubble, the second slide presented the whole set of images from which the participant had to select what the alien had meant by the word, and the third slide presented feedback by thanking the participant if the choice is correct or showing the correct choice if it is wrong. The whole set of images was always displayed following the same spatial formation. Production presented the participant with an image with an empty speech bubble underneath it, into which they are required to type in the correct word, after which they are presented with feedback showing the given image and a satisfied alien in case of a correct response, and the image with the correct response in case the answer is incorrect.

These sets consisted of two events of each observation, perception and production in the first four rounds, and the same setup with only perception and production in the last four rounds. The order of events in each set was observation-observation-perception-production-production-perception. The script thus provided each participant with 18 events of demonstration, 72 events of observation, 144 events of production and 144 events of perception, which the pilot studies had indicated to be a sufficient for an expected level of competence (for more details on the pilot studies Tinits, 2012, can be consulted). The script recorded the input of the participants given in the perception and production trials and was later used to analyse an acquired level of competence.

2.2.4 Playing cards

The images chosen for the experiment were pasted to two regular sets of playing cards so that the original image could not be seen. The sets had different background images which helped the individuals to distinguish the question set from the answer set. The answer set included each of the nine items for each of the participants and the question set included each of the items four times. The question set was distributed into six decks of cards with six cards each. The decks were arranged into pairs so that each pair would contain at least one of each items, and three additional items by random. The circulation of the six decks of cards allowed the game to progress without stop and was meant to keep the participants unaware of any sure sequence of cards in the decks.

2.3 Procedure

2.3.1 Learning sequence

On arrival the members of the group were randomly allocated to learn either a majority or a minority language and were directed into a cubicle where they completed the learning script alone. The participants used a regular keyboard and mouse to complete the script and wore headphones by which they heard their training language not of the other members the group.

2.3.2 Communication game

After completing the training session the participants were guided around a table, where each of them had in front them the whole set of images laid out on the cards face up constituting the answer set, and a deck of cards laid next to it face down forming the first part of the question set. The answer set followed the same spatial formation as during the training session and was kept in the same arrangement throughout the game. The participants were handed instructions on paper which explained the proceedings of the game and were debriefed by the experimenter on the most important points once again.

The game constitutes an open-ended matching game, where participants have to try to communicate a closed set of images to each other with the help of spoken word (following the lead of Kalnins, 2010). The instructions forbid them from using any language they knew prior to the experiment however the possibility to deviate from the training items is not mentioned or forbidden. At the start of the game the participants are unaware that one of them was provided with a language that is slightly different from the other two to learn.

During the game each participant will take turns in playing a master or an addressee. The master will take the top card from their question set and try to communicate the meaning to the addressee by uttering a word. The addressee will have one chance to try to guess the correct item by selecting an image from the answer set and placing it in the center of the table. The master will then place their question card next to it as the only allowed form of feedback to the addressee. If the cards match then a point is added to the group score and if the cards do not match then no points are added.

The game progresses in a clockwise fashion starting with the speaker of the minority language. After the first run, each of the masters will then first address the previous master and then the next one. This forms a sequence similar to the training sessions of observation-observation-perception-production-production-perception for each player. Each player is able to monitor all of the communications within the group.

During the game each participant played eight decks of six cards each. The decks were arranged into a sequence so that by each two decks, all participants had played each image at least once, and three of the items twice. At the end of six decks each participant had played each item exactly four times and by the end of the game each participant had played each image at least five times and three of the images six times. The cards were spread unevenly between decks in order to restrict the participants to intentionally or unintentionally predict the correct answer just on the basis of the cards that had not been played recently. It was assumed that the amount of six decks or 36 cards was too long for them to do it accidentally.

The participants were reminded again of the restrictions against the use of any language they knew before or any non-verbal means of communication and that they had to work together to get the highest points with the extra financial reward at the start.

Once the experiment was concluded all participants were explained of the deception involved in training one of the group members a different language than others, and provided with a small debrief note about the rationale of the experiment.

Video and audio recordings were made of the game which were later used to code the data.

2.4 Analysis

The video recordings of each game were coded for the cards drawn from the deck, the cards played in answer and the corresponding utterance to each interaction. The learning sequence was logged for subjects' performance throughout and the content of their mistakes. Both on learning and during the communication game the percentage of correct answers or successful communications were calculated as a measure of success. To

assess competence at the end of the learning session, the scores from last two rounds of learning which contained four interactions of each type for each image were averaged. For the communication game success rates for each of the four subsequent rounds were calculated separately over relevant images.

The forms in the utterances were compared via Hamming distance (HD) similarity metric (Hamming, 1950) against various alternatives. HD counts the number of replacements that need to be made in a string to transform it into another string with no changes in the position of each letter. Thus for example to transform *tufinu* to *kalufi*, all six letters need to be replaced, however to transform *fumaku* to *fumuku* only one letter needs to be replaced. For analysis the number of replaced letters was normalized over word length and averaged over tokens in a set of words to construct a measure of average lexical distance (henceforth LD).

$$\mathrm{LD} = \frac{1}{n} \times \sum_{i=1}^{n} \frac{\text{number of replaced letters in the word}_i}{\text{number of total letters in the word}_i}$$

Thus for example LD of a two-word language consisting of *tufinu* denoting meaning 1 and *fumaku* denoting meaning 2 compared to *kalufi* and *fumuku* in corresponding positions is $\mathrm{LD} = \frac{1+\frac{1}{6}}{2} = \frac{7}{12} = 0.58(3)$. LD was used to compare the words used in particular interactions to their counterparts in experimentally relevant languages.

3 Results

Q1: In the last two rounds of the learning session the subjects attained on average a very high success rate in both production (M= 91.2%, SD= 13.4%) and comprehension (M= 97.6%, SD= 4.0%), and kept high fidelity to the training materials in their utterances (M_{LD} = 0.028, SD_{LD} = 0.054). There was one strong outlier on learning in the role of a minority in the complex minority condition who scored only 44.4% in production (with LD = 0.231) and 83.3% in comprehension in the last two rounds. As the outlier performed deviantly also during the trial, the result is considered in a qualitative analysis in the next paragraphs. The means corrected to exclude the outlier ($M_{\mathrm{production}}$ = 93.3%, $SD_{\mathrm{production}}$ = 6.8%, M_{LD} = .015, SD_{LD}=.017, $M_{\mathrm{comprehension}}$ =98.5%, $SD_{\mathrm{comprehension}}$ = 2.0%) demonstrate very high level of competence by the end of the training. The learning sequence took on average 32.9 minutes to complete (min = 22.7, max = 41.8).

While the simpler variety is acquired slightly quicker as could be expected, the mean scores for the last round do not provide a significant advantage to the learners of the simpler language. A one-tailed Welch's t-test for unequal samples performed to compare the distributions of production scores among the individuals between the simple and complex learners in either role finds no significant difference between the groups for the last two learning rounds, t (5.07) = 0.84, p = 0.21, nor for the overall means of individual learning (M_{simple} = 79.2%, SD_{simple} = 17.7%, M_{complex} = 74.0%, SD_{complex} = 13.1%),t (2.46) = 0.48, p = 0.33). These results provide a firm ground to explain differences in the communicative interactions through the dynamics of communication rather than differences in the learnability of the varieties.

Q2: On the control items all groups demonstrated very high communicative success in the first round (between groups M_{success} = 97.5, SD_{success} = 3.0) and throughout the game (between groups M_{success} = 97.0, SD_{success} = 2.0). They were maintained at a high fidelity to the training language through the trial ($\mathrm{M_{LD}}$ = 0.04, $\mathrm{SD_{LD}}$ = 0.03), with the exception of the outlier who kept an average fidelity to training items at 0.230 LD which translates to an average of a bit more than one phoneme per word. The communicative success for the control items however was not noticeably different in that group.

Q3: On the test items all groups had difficulties in the first round (between groups $\mathrm{M_{success}}$ = 57.0, $\mathrm{SD_{success}}$ = 23.3) while all groups had established 100% success rate by the last round. The test items do show a trend towards increasing success, which Page's trend test among all groups shows to be significant (L = 172, n = 6, m = 4, $p < .01$). The entire game took on average 31.6 minutes to complete (min = 28.5, max = 36.1).

Q4: In analysing the ways each group solved the problem, the utterances produced by each participant on the test items were compared to all languages in each triplet: the simple minority language, the complex minority language, and the complex majority language. Additionally each participant's

utterances on the test items were compared to the languages they were trained on which was one of the three languages.

Since the test items differed their counterparts in all phonemes constituting an LD of 1, the lexical choices of each of the participants can be plotted on a ternary graph where each of the corners is a language that was learned and movement towards the other corners constitutes accommodation comparable to the distance covered. Figure 2 depicts average LD from each of the varieties over all the rounds of CG per participant. The participants are colour coded according to their role as the simple minority (red), the complex minority (green), the complex majority with the simple minority (black), and the complex majority with the complex minority (blue).

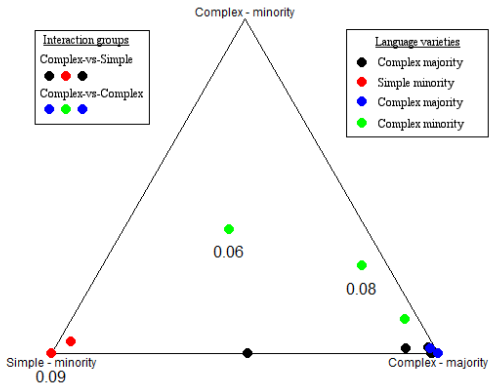

Figure 2. Ternary graph of relative distances from each of the stimuli. Distance from any variety is depicted as a distance from the particular corner. The points depict individual learners with the color code indicated on the legend. Distance from the plane is depicted as a numeral under a point, if LD > 0.05

When compared to the distance of any of the languages in the triplet the utterances demonstrated a very high fidelity to the available languages and to the phoneme set present in the language ($M_{\text{LD}} = .038$, $SD_{\text{LD}} = .050$, $\max_{\text{LD}} = .090$, $\min_{\text{LD}} = .000$). Figure 2 demonstrates a clear pattern of divergence in the behaviour of participants in different roles. It is visible that simple minority stayed almost completely faithful to their training language while the the complex minority decisively moved away from it during the four rounds. The complex majority speakers mostly stayed faithful to training as well, although one complex majority speaker accommodated quite significantly to a simple minority speaker.

The temporal dimension of each participant's utterances is plotted into Figures 3-5. Figures 3-4 demonstrate most clearly the sequence of actions by the complex minority speakers. In the first round they were partially faithful to the training materials, however already showed some accommodation to the majority. By round two two of them accommodated to the majority fully continuing the trend until the end of the game with a small fluctuation for one that did not constitute a return to the training materials. The participant who behaves different from this trend is the same participant who performed poorly in the learning session which may explain the difference. Similarly to other complex minority speakers also the outlier deviates from the training materials noticeably however on average stays midway between the all three languages in a triplet, thus demonstrating some spontaneous innovation towards compositionality as well as the simpler variety was not present in the group. The poor scores on learning probably change the situation that a minority speaker would be in however the outlier does seem to attempt some accommodation and demonstrates deviation from the learning materials and will be included in the comparison on these parameters.

Figure 5 demonstrates how one of the majority speakers makes significant accommodations towards the minority speaker from rounds 2-4 and another speaker in the same group makes a small effort towards accommodation in the final round.

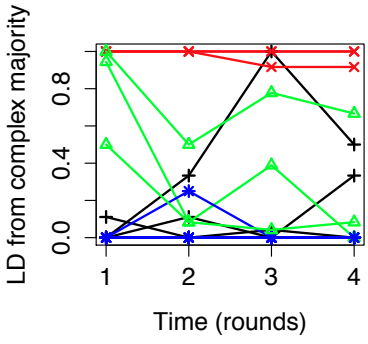

Figure 3. Mean distance from the training input of the complex majority language in the triplet. Colours follow the same pattern as Figure 2.

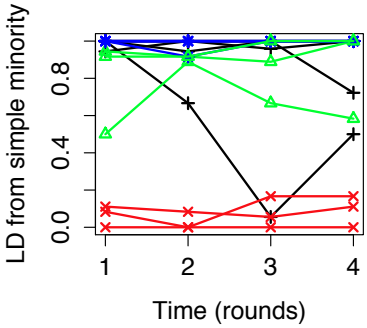

Figure 4. Mean distance from the training input of the complex minority language in the triplet (was not taught in the simple minority condition). Colours follow the same pattern as Figure 2.

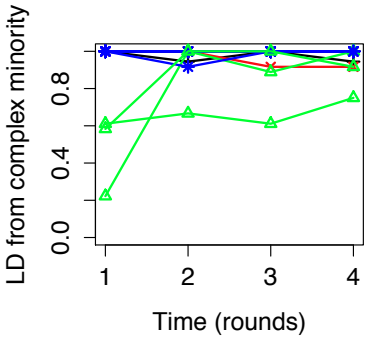

Figure 5. Mean distance from the training input of the simple minority language in the triplet (was not taught in the complex minority condition). Colours follow the same pattern as Figure 2.

There is some issue with the variation between the sequence of cards received for participants in particular roles. Given a random distribution as was chosen for this experiment the participants differed on exposure to alternative utterance variants before they could utter their own variant for the first time. As a result the complex minority speakers on a few utterances accommodated or attempted to accommodate before they had uttered their variant even once, while for some utterances they could theoretically have spoken their minority variant twice before they had even heard any alternatives. In a large enough group this randomness may balance out, however in a small sample which may be very sensitive to the sequence of events, perhaps better control should be established in further studies, as elaborated on in the discussion.

Although the outlier disturbs the result somewhat, the differences between the minority speakers per condition can be tested in a pairwise (per language triplet) two-tailed t-test demonstrates a significant difference in the distance from the original training materials ($t(2)$ = -13.50, p $<$ 0.01 on averages over all rounds, $t(2)$ = -17.19, p $<$ 0.01 on averages in the last round). The tendency to accommodate does not prove significant in a pairwise two-tailed t-test ($t(2)$ = -3.45, p = 0.07 on averages over all rounds, $t(2)$ = 3.60, p $<$ 0.07 on averages in the last round) as the outlier did not accommodate to a similar extent as the other two.

Q5: Some insight to the dynamics involved in the conversation can be found in comparing the lexical distances to the success rates. Namely, it is interesting to note that while the simple minority speakers did not accommodate, and their group was able to establish communicative success of 100% by last round as all groups, the scores for the earlier rounds remained robustly lower than for the groups where the complex minority had accommodated. Comparing the success of the first three rounds in a two-tailed paired (per language triplet) t-test shows a significant difference ($t(2)$ = 4.88, p $<$ 0.05) between conditions. This indicates that the reason for the stability of the simple language lies in the difference between the conditions for the minority to make the decision to accommodate. It was not the case that the simple language merely proved the easiest solution to the communicative problem as the groups with the simple minority robustly lost the game.

4 Discussion

Viability of the paradigm: The aim of the study was to develop a novel experimental platform which would allow one to study certain biases due to structural properties of languages in situations of language or dialect contact by a simple communication game. The case of morphological simplification was selected as a theoretical basis and implemented in the form of a comparison between languages with a different amount of irregularity in the morphological system. The novel setup can

allow the biases in communicative interactions to be experimentally investigated both as to their linguistic results and proximal mechanisms.

A necessary precondition for communication games to be used in such an experiment is the feasibility to teach a miniature language to a competence level within the experimental time-frame. Prior studies with ALL had used various incidental or implicit learning setups only in the conditions of impoverished learning, that is, where the lack of time to fully learn the language presented was an integrative part of the experiment. The current study had manipulated the size of the language as well as the amount of the learning input to ensure that the participants would learn the language in the short time available for the experiment.

In the current study, the miniature language was acquired to a very high confidence level by all except one participant. It remains unsure as to the reasons of this outlier to acquire the language equally well, earlier studies in ALL do indicate a possibility for significant variation between individuals due to various factors (see e.g. DeKeyser, 2003, for review). The participant's performance in establishing communicative success did not differ significantly from other participants. The main difference remained in the choice of forms where this participant showed generally little confidence, and innovated noticeably on the materials given, but in the main trend to accommodate to the majority the participant conformed to the pattern of other participants in her role.

The results of the game indicate that on items that were the same in both contact varieties, the success was almost complete, while the forms used for communication differed very little from the acquired forms. At the same time the items that differed did present a communicative problem to begin with and all groups were able to solve it by the end, almost exclusively keeping to the phoneme inventory of the original language and utilizing mainly the varieties observed in the contact situation with some attempts at spontaneous simplification by the participant with learning difficulties.

The experimental setup with pre-learned languages is thus fairly well able to depict a contact between two very similar varieties or languages where a competition between linguistic forms of two established varieties can be seen to take place. The experiment limits the possible interactions and the forms available to provide a clear functional contrast, however the communicative situation still leaves a range of behaviours and motivations for any participant for any particular interaction, as is also the case in analysing naturalistic data.

The limited time spent on acquisition and prior familiarization as well as the miniature scale of the language naturally may allow for different motivational and functional pressures for the participants, however prior experiments with miniature languages demonstrate a strong convergence between the models based on typological observations and the biases in linguistic processing that are visible in these experiments. The experiment may provide a way to significantly increase control and precision in linguistic modelling, however further theoretical and empirical studies need to be conducted to justify extrapolation to naturalistic circumstances.

The role of morphological simplicity: The results of the current experiment indicate that in situations of language contact, the functionally motivated interactions in small groups can provide greater stability for a variety that is morphologically simpler. If this is the case then one would expect a simpler variety to be relatively more successful than a complex variety given the same dominance relation in contact situations.

The results in this case concern only the minority varieties under a very specific circumstance when there is only one speaker of the variety present (the minority can not establish a separate functional variety in this situation). The experiment should be naturally extended to situations where there are more than one minority speakers present (e.g. 2 minority speakers vs 4 majority speakers), however these experiments will be more resource-extensive and can perhaps be done in future work.

The minority status may also be significant here, as this bias for stability may be tied to defending a lesser position, and thus another series of experiments can be performed with equal amounts of speakers for both varieties to see whether a simple variety can tend to take over. The minority status does not allow well for the question of how a simpler variety can take over a community to be addressed,

however it does point to a tendency for simpler varieties to gain a significant hold within a larger community.

Motivations in interaction: The possible motivations in each interaction have a range of possibilities that depend on complex parameters as in any linguistic act (cf. e.g. Thomason, 2001). The experiment has been designed to provide a collaborative setup where the choice in linguistic forms should primarily be designed facilitate communication in the quickest way possible. This should encourage a neutral attitude towards any variety and keep the participants focussed on functional goals. A naturalistic situation with similar motivations could be a multilingual bazaar where all participants are motivated primarily by quick communicative success to secure the right use of their finances.

The motivations for each participant in each interaction are difficult if not possible to ascertain also in experimental circumstances. The minority speaker could have been motivated to minimize a personal effort in sticking to the acquired variety or sticking to a relatively simpler variety or even accommodating to the majority variety. The minority speaker could have had just an absolute preference for a simpler or a majority variety in any situations. The minority speaker could have also strategically been planning for the quickest route to solve the communicative problem via an instance of audience, which for the complex minority seemed via accommodation and for the simple minority seemed via preservation of the known variety.

What can be said however about this issue is that the simple minority groups would not have obtained significantly lower success scores if the preservation of the simple language was only due to it being most easily recognizable in communicative settings by which more complex varieties naturally fall out of use. A scenario based on feedback having a decisive role in the choice of the forms in communication such as in some studies with graphic media can in this situation of interaction be excluded. The majority speakers had no choice in the matter and the linguistic and the communicative results of each contact situation were decided by the choices of the minority where an equally complex minority decided to accommodate or a simpler minority decided to not to accommodate.

Independent of the particular motivations behind the interactions of each individual this experiment can demonstrate a tendency for these contact situations to preferentially preserve a simple variety even if the competing complex variety is in the majority. In each population the proportion of particular types of interactions can be counted in the same way as the proportion of particular individual motivations, and in this particular interactions, were these trends for example be supported by further trials, a simpler variety would be more likely to be preserved than its more complex competitors in a minority situation. Thus in a population with these kinds of interactions and an equal rate of innovation towards new simple and complex minority varieties, in time the simple minority would be able to establish a stronger hold in the population due to its resilience to these kinds of contacts.

Recommended improvements on the current design: The current design is based on a number of earlier pilot studies with similar materials (presented in Tinits, 2012), however it is still a novel design and the exploratory data analysis indicated a few ways it can be significantly improved.

In the current setup, the decks were distributed among the participants randomly, and it was kept in mind that they would each present each item at least once in the period of one round. This presented an issue in the data analysis as the sequence of cards in each group was not exactly the same and differed to the extent that the minority or the majority variants had been heard before any accommodation was possible. This can be corrected by strictly controlling for the sequence of cards in play, thus controlling the timing of who says which item to whom. This can be included in the experimental design, where for example it can be guaranteed that the minority will first hear a successful communication of a test item between two majority speakers and that the minority will also speak their own variety before hearing the majority version for the other test item.

This sequence can also be used to control against chance cooccurences of two of the test items in sequence. When the same item is asked for in sequence this increases the chance of accommodation as repeating the same utterance will almost guarantee success of communication. While the random sequence will allow them to be distributed

more or less evenly in a large sample, in the relatively small number of interactions between the participants, these chance cooccurrences can bias the data to a significant extent. Setting the precise sequence can also allow for control over the number of control items are communicated between the test items which may have some implications to the working memory constraints involved for learning that is required for accommodation. At the same time this sequence will have to tackle the potential for predictability if the test items are presented in too regular intervals. Additional control over this sequence would improve comparability of group performance even in very small samples.

5 Conclusion

Biases for certain linguistic structures in communicative interactions have so far been investigated very little by experimental methods, which has been partly as there has been no very good research paradigm by which this could be done. The current study presents one such a paradigm that could be extended in various directions (e.g. use different population structures, different linguistic features, differential rewards in communication) that allows one to study the dynamics of form competition and diffusion in contact situations. The study implemented two very similar varieties which allowed the possibility to test for both the functionality of communication and the role of linguistic forms in presenting communicative difficulties.

The impact of particular conditions to the linguistic outcome of the experiment allows both a quantitative and qualitative analyses of its results. In the current study, the quantitative analysis shows a tendency for a morphologically simpler variety to prove more stable in communicative interactions and the qualitative analysis of the particular forms chosen demonstrates that the motivation for this preference was based at least initially in the individual speaker and not in the dynamics of interaction, as could be the case if the simple form was so easy to understand by anyone that no accommodation would be required. This result indicates a bias in communicative interactions that would impact the distribution of world languages as they are influenced by language contacts.

The current study is limited in its power to provide reliable interpretations and must be replicated with a greater sample in the near future. The exploratory analyses presented here are mainly performed to to assess the viability of the research paradigm and to provide a useful point of reference for further research. The comparability of the relevant processes in constrained experimental settings and naturalistic circumstances remains an open question, however progress can be made here primarily with further theoretical and empirical studies.

Miniature artificial languages have so far found little use in communicative interactions and had not yet been used in these circumstances to investigate particular typological tendencies, where the progress with the experimental paradigms has mostly been based on biases that become visible on language learning under impoverished conditions. The current paradigm presents a possibility by which the tradition of artificial language learning could be adapted to communicative situations which potentially opens a broad range of biases that influence language dynamics to be studied that could not be done with earlier methods.

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