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Social network size can influence linguistic malleability and the propagation of linguistic change

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ABSTRACT

We learn language from our social environment, but the more sources we have, the less informative each source is, and therefore, the less weight we ascribe its input. According to this principle, people with larger social networks should give less weight to new incoming information, and should therefore be less susceptible to the influence of new speakers. This paper tests this prediction, and shows that speakers with smaller social networks indeed have more malleable linguistic representations. In particular, they are more likely to adjust their lexical boundary following exposure to a new speaker. Experiment 2 uses computational simulations to test whether this greater malleability could lead people with smaller social networks to be important for the propagation of linguistic change despite the fact that they interact with fewer people. The results indicate that when innovators were connected with people with smaller rather than larger social networks, the population exhibited greater and faster diffusion. Together these experiments show that the properties of people's social networks can influence individuals' learning and use as well as linguistic phenomena at the community level.

1. Introduction

Imagine that you are trying to come up with a name for your band, and you are debating between Karaoke Dentist and Popcorn Logic.[1] If you were to ask one of your friends which name they prefer and they responded Karaoke Dentist, this might tilt you towards choosing this name. In contrast, if you were to ask twenty-one of your friends, and ten of them were to prefer Popcorn Logic and eleven, including that friend, had preferred Karaoke Dentist, this friend's preference of Karaoke Dentist is likely to not influence you that much. In other words, there is an inverse relationship between how many sources one has and how informative each source is. This relationship between sample size and informativity is a general principle and likely extends to linguistic information as well. Therefore, people who are exposed to linguistic input from many sources should be less susceptible to the influence of new incoming linguistic input compared with people who only interact with few people. Throughout this paper, the number of people someone regularly interacts with would be referred to as the person's social network size, and similarly, people who interact with many people regularly would be referred to as people with large social networks. The hypothesis that this paper tests then is that the larger people's social network, the less they would be influenced by exposure to a new speaker. Such an argument has implications not only for our understanding of how people learn and update their knowledge, but also for language change, as it suggests that the spread of linguistic change might depend more on people with smaller rather than larger social networks. Study 1 test whether people's social network size influences the degree to which they are susceptible to the influence of a new speaker, and Study 2 describes simulations that test whether such differences in malleability could lead people with smaller social networks to be important for the propagation of linguistic change.

1.1. Communication accommodation

When people interact, their language tends to align across all linguistic levels (e.g., Giles, Coupland, & Coupland, 1991). For example, it has been found that during interaction people accommodate their pitch, speech rate, frequency and duration of pauses, standardness of speech, lexical choices, grammatical choices, and even nonverbal mannerisms, to those of their interlocutor (Branigan, Pickering, & Cleland, 2000; Brennan & Clark, 1996; Chartrand & Bargh, 1999; Coupland, 1980; Gregory & Webster, 1996; Jaffe & Feldstein, 1970; Street, 1982; Thakerar et al., 1982). In fact, even though social factors seem to modulate some of these effects (e.g., Babel, 2012; Giles et al., 1991;

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[1] Names generated by www.wordlab.com/name-generators/band-name-generator.

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Gregory & Webster, 1996), passive exposure without any interaction can also increases alignment (e.g., Bock, 1986; Goldinger, 1998). Such alignment has been theorized to reflect learning and thus lead to long-term convergence (Bock & Griffin, 2000; Chang, Dell, & Bock, 2006). For example, the speech of previously-unfamiliar college roommates has been shown to become more similar after living together (Pardo, Gibbons, Suppes, & Krauss, 2012). More generally, it has been argued that we use incoming input to update our priors, and thus, as the statistics of our environment change, so do our representations (Jaeger & Snider, 2013).

1.2. Majority learning

Language learning can be seen as a type of social learning. One typical characteristic of social learning is the conformity bias, that is, preferentially copying behaviors that are frequent in the population (e.g., Boyd & Richerson, 2005). Importantly, people are not simply sensitive to the raw frequency of a certain behavior, but also the number of sources that exhibit it. Having five different friends vote for Karaoke Dentist is more informative than having the same friend vote for Karaoke Dentist five times. Indeed, even chimpanzees (though not orangutans) are more likely to adopt a behavior when it is performed by two out of three demonstrators, than when it is similarly performed two thirds of the time, but always by the same demonstrator (Haun, Rekers, & Tomasello, 2012). Three to 6 year-old children have also been found to imitate an action more when it is performed by two demonstrators than when it is performed by a single demonstrator twice (Herrmann, Legare, Harris, & Whitehouse, 2013).

One consequence of gathering information across many sources is that the weight ascribed to each source should decrease with the increase in number of sources. Consequently, the same input should be weighed differently by people who are exposed to different number of sources. Note that this argument doesn't necessitate that sources are given equal weight. Even if we assume that we ascribe greater weight to the input that we receive from some people than from others, it is still the case that, on average, sources should be assigned lower weight the more of them we have. This should lead people with smaller social networks to assign greater weight to each person they encounter, and therefore to be more susceptible to each person's influence.

Some initial evidence suggests that this is the case. In particular, one previous study found that the smaller the participants' social network, the more they shifted their phonological boundary between /d/ and /t/ following exposure to a speaker with atypical productions (Lev-Ari, 2017). Furthermore, a control condition which tested participants on their learning of the phonological boundary of the exposure speaker and not on the change in their own boundary, ensured that participants' ability and motivation to learn the speaker's speech pattern did not depend on their social network size. That is, participants with large and small social networks learned the speaker's speech patterns equally well, but those with larger social networks were less likely to generalize it and adjust their own general representation. This previous study thus suggests that social network size can influence how susceptible people are to the influence of new speakers. The current study goes beyond the previous findings in several ways. First, the previous study focused on perception. In order to link representational malleability to language change, it is important to examine the influence of social network size also on production. The current study tests the influence of social network size on both prediction and production. Additionally, the previous study focused on the phonological level, whereas this study focuses on the lexical level.

1.3. Language change

Languages constantly change. The word *douchebag*, the use of *because* to introduce a noun-phrase, a shift towards *more* constructions over *-er* constructions for comparatives, and speaking with a vocal fry are all instances of linguistic innovations that have gained popularity in recent years. In general, language is not a uniform phenomenon, but consists of great heterogeneity of variants and patterns. In many cases, however, this variation does not lead to linguistic change, as the variants do not propagate through the community (e.g., Weinreich, Labov, & Herzog, 1968). This paper proposes that people with smaller social network might play a particularly important role in propagating the diffusion of linguistic variants. This proposal might provide a partial solution to the threshold problem (Nettle, 1999) – the puzzle regarding how innovations, which are rare by definition, can spread through the community when speakers tend to use the most common variant they have encountered. One way of overcoming this problem is by assuming that speakers do not simply copy the most frequent variant, but that they hold some biases, leading them to be more likely to copy variants that are better in some way or that are used by more prestigious speakers (Nettle, 1999). The hypothesis tested in this paper adds that the threshold problem is also easier to overcome by speakers with small networks.

Previous research on linguistic diffusion tended to focus on identifying the innovators rather than those propagating the innovation (e.g., Fagyal, Swarup, Escobar, Gasser, & Lakkaraju, 2010; Labov, 2001; Milroy & Milroy, 1985). Interestingly, those who did investigate diffusion, especially diffusion of information and behavior, assigned a central role to diffusion via weak ties, that is, via relationships that are low in frequency and intensity (Bakshy, Rosenn, Marlow, & Adamic, 2012; Granovetter, 1973; Mühlenbernd & Franke, 2012; Weimann, 1982). This research thus shows that non-central members could be crucial for the diffusion of behavior, and suggests that people with small social networks could play an important role in diffusing linguistic change despite their non-central role in the community.

2. Experiment 1

The aim of Experiment 1 is to test whether individuals with smaller social networks have more malleable linguistic representations. The malleability of individuals' linguistic representations was measured by testing the degree to which their general lexical boundary between *some* and *many* has changed as a consequence of exposure to a speaker whose lexical boundary differs from their own. Yildirim, Degen, Tanenhaus, and Jaeger (2016) have shown that people can learn a speaker's boundary between *some* and *many*. The paradigm used in Experiment 1 was loosely based on their paradigm with some modifications to render it analogous to the perceptual learning paradigm used in Lev-Ari (2017). In addition, a production test was added. Participants were exposed to a speaker whose boundary between *sommige* and *veel* (*some* and *many* in Dutch, respectively) differed from theirs by two steps. Then participants estimated which label a new speaker would use to describe new scenarios. The hypothesis was that participants' social network size would modulate the degree to which they would generalize the speaker's boundary to a new speaker, such that having a larger network would lead to lower generalization.

One limitation of this design is that people are not randomly assigned into social network size, and therefore it could be that people of different social network sizes differ in the way they approach the task, in their motivation to do the task, or even in their ability to learn the speech patterns of the speaker. Therefore, the experiment included a control condition in which participants estimated how the speaker they were exposed to would describe new scenarios. Unlike the case of a novel speaker, this condition examines whether participants are able to learn the linguistic patterns of a specific speaker. The hypothesis is that participants' social network size would not influence this ability, as having more sources should not impair the ability to learn lexical boundaries per se, but should only influence the informativity of the input for the wider population. Therefore, as long as individuals are given the same amount of information about a particular speaker's linguistic patterns, their social network size should not influence their