Does social structure modulate linguistic priming?

Phd Student: Kerime Eylul Eski

Tutor: Luca Onnis

Dottorato in Scienze Sociali. Curriculum Psicologia e Scienze Cognitive

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Abstract

This research project aims to reveal the possible social mechanisms of linguistic behavior. Recent research suggests that different types of human behavior, characterized as simple or complex, spread through different social mechanisms. Does human language spread primarily as a virus? Or as a form of complex behavioral contagion? This research project seeks an initial answer to this question by examining whether the type of social network in which individuals are placed influences specific syntactic uses. For this purpose, we conducted two pilot studies. Specifically, one mechanism of syntactic use was investigated: passive and active diathesis. There were two conditions: egonet-1 and egonet-6. In both conditions, participants interacted with 6 other (fake) people. In egonet-1 condition, the participants were primed with passives by one person while in egonet-6 condition, the participants were primed with passives by six people. No priming effect was found in our studies. The lack of significance may result from the design of the task. Our plan for this year is to tackle some of the challenges related to the design and examine the difference between two groups. This research question will establish a much needed connection between individual mechanisms of language use and social mechanisms of language diffusion in a community.

State of Art

Syntactic priming refers to a general tendency for language users to produce a syntactic structure following previous experience with that structure. At an individual level, it is rather uncontroversial that repetition of word forms boosts activation of the repeated word. In particular, hearing or producing a form makes it more likely that it would be produced again in the future (Bock, 1986; Burke et al., 2004; Ferreira & Griffin, 2003), and wordforms are articulated more quickly when they have been recently produced or heard (Shields & Balota, 1991). The effect of structural priming has been observed in adults (J. K. Bock, 1986), in children (Bencini & Valian, 2008), in comprehension (Arai et al., 2007), in production (Pickering & Branigan, 1998), and across different languages (Hartsuiker et al., 2016). Compared to language mechanisms that function at an individual level, we know much less about the mechanisms that allow linguistic forms to spread socially. Limited number of studies used syntactic priming paradigm to investigate language production in communicative environment. In 2000, Branigan et al. found that during language production, speakers are sensitive to the characteristics of the communicative situation, and in particular to the linguistic behaviour of other participants during a dialog, which resulted in the syntactic co-ordination in dialogue. (Branigan et al., 2000). Although co-ordinated behaviour at the syntactic level has been studied in dyadic relationships, how this behaviour spreads in a wider social context has not been studied.

Previous research extending a viral model to human behavior has suggested that, like simple viral contagion, the behavior spreads faster through a widely dispersed network. However, recent research suggests that different types of human behavior, characterized as simple or complex, spread through different social mechanisms. In particular, many human behaviors are considered to be complex rather than simple forms of contagion. Simple behavioral contagion is analogous to biological contagion of a virus, whereby a single contact is sufficient to induce the adoption/imitation of a given behavior. In contrast, complex behavioral contagion is the process in which multiple sources of exposure/contact are required before an individual adopts a given behavior (Centola, 2010). Does human language spread primarily as a virus? Or as a form of complex behavioral contagion? Our main goal is seeking an initial answer to this question by examining whether the type of social network in which individuals are placed influences specific syntactic uses (Lou-Magnuson & Onnis, 2018)

This research question will contribute to making more explicit the social mechanisms of language spread, and establish a much needed connection between individual mechanisms of language use (such as the well-known effects of syntactic priming) and social mechanisms of language diffusion in a community.

In light of the literature, we conducted two pilot experiments.

Objectives

Syntactic structure typically targeted in syntactic priming research are dative constructions (prepositional dative vs double-object dative) and transitive verbs (active vs passive construction) (e.g., Bock, 1986). In these experiments, specifically, one mechanism of syntactic use was investigated: passive and active diathesis. There were two conditions:

egonet-1 and egonet-6. In both conditions, participants interacted with 6 other (confederate bots, unbeknownst to them) people. In egonet-1 condition, the participants were primed with passives by one person while in egonet-6 condition, the participants were primed with passives by six people.

If the social structure in which participants (believe they) are embedded modulates their linguistic behavior, we expected to find a difference between the two egonet conditions in terms of the amount of priming, calculated as the proportion of sentences being produced by subjects in the passive voice choices over the total sum of active and passive choices produced when describing the action images. Specifically, the egonet-6 conditions should have promoted spontaneous priming, and produced a higher mean proportion of passive primed/target sentences across subjects, compared to the egonet-1 condition.

1. Pilot Study I

In the first study, the main aim was to examine whether the syntactic priming task is working, and is able to prime participants with passive sentence structure. For this aim, we only tested egonet-6 condition.

1.1. Method

1.1.1. Participants

We recruited 20 participants from Prolific (www.prolific.co), an online crowdsourcing website. Two participants were excluded from study as they did not answer most question or answer the questions mostly in one word. One participant was excluded from the study because he/she completed the study at an unexpected time frame. All participants were native English speakers.

1.1.2. Task

We designed the experiment and presented it online using the PsyToolkit platform (Stoet, 2010, 2017). The task is modelled on Bock's (1986) image description task and adapted from Balcetis and Dale (2005). It involves a picture description game which is played in pairs, and in turns. The participants first read sentences that are the description of a picture written by other players (confederate bots). The sentences are either filler words that describe either an object or a scenery that do not involve action or they are primes that involve patient, agent and an action.

After reading the sentences that other players (bots) write, participants are presented with target and filler images to describe. The target images of interest include two actors and an action, so that each image can be described in the active or passive grammatical voice, e.g. Dog is chasing the detective and The detective is chased by a dog. The images were emotionally neutral in content and based on those used by Bock (1986), and do not appear to be annoying, stressful, physically or psychologically distressing, either during or after the conduct of the study.

In one block, there are 2 prime, 2 targets, and 2 filler sentences and pictures. First, 2 filler sentences and pictures where a sentence is followed by a picture are presented. Then, 2

primes and targets where a prime is followed by a target are presented. At the end of each block, there is a memory test which consists of 2 questions about the filler sentences and prime.

All prime and filler sentences that other players (bots) described were in written form.
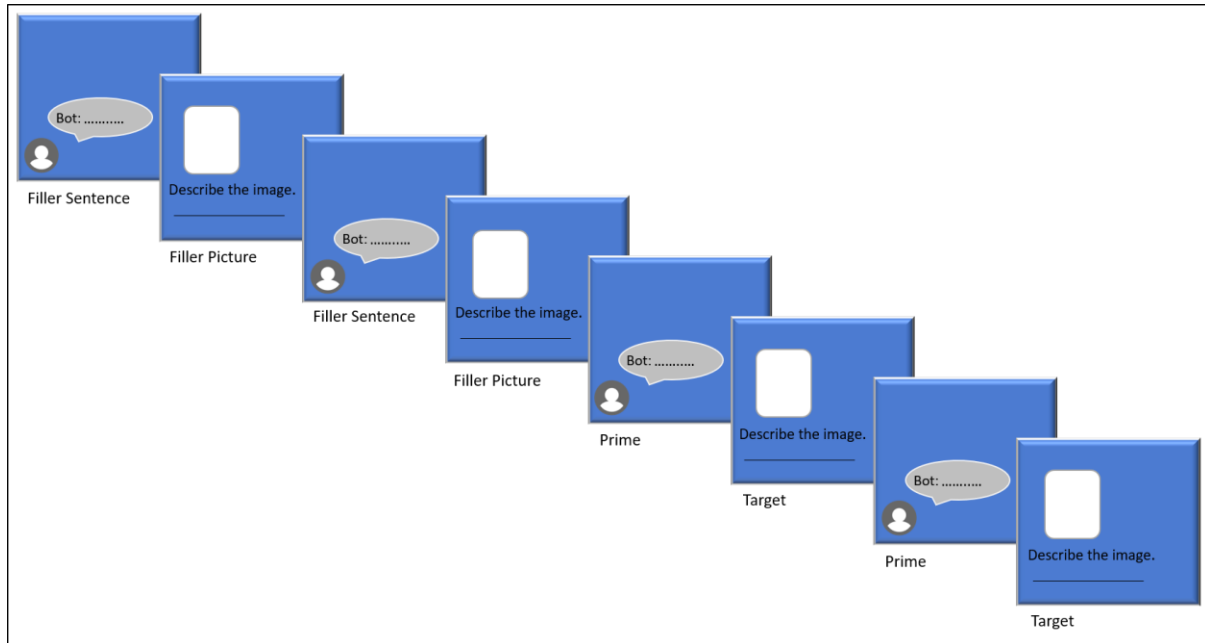
1.1.3. Procedure

After agreeing to participate in the study, participants were asked to read the instructions carefully. In the instructions, participants were told that the purpose of the study is to understand how we communicate ideas to each other and how well we retain information presented to us by a partner, and that they will be asked to play a game online with other players. It was explained that the game consists in describing, in turns, images that the player they are paired with cannot see. To create the illusion of a social game, they were told that they are playing as a team against other teams. They were also instructed to not to take breaks during the game as taking breaks may disrupt the structure of interactive study and result in an incomplete session. Finally, they were told that in no case is it obligatory to participate, it is completely voluntary participation and they can withdraw at any time, by closing the webpage.

After participants completed the experiment, they were provided with a link to verify their completion.

1.1.4. Coding

Sentences were coded as active, passive or neither. To be scored as passive, a description had to involve a patient of the picture as the subject of the sentence, a verb in passive voice, a by phrase following the verb, and the agent of the action as the object of by. Descriptions scored as actives contained the agent as subject, a verb in active voice, and the patient as direct object. Neither category included truncated passives, adjectival passives and active sentences with intransitive verbs (K. Bock & Loebell, 1990).

1.2. Results

Out of 306 items, 112 items were classified as "neither" and excluded. Of the remaining responses, 43.3% of sentences were constructed in passive form while 56.7% were constructed in active form. Bock and Griffin (2000), collected description norms for passive and active use. Within the set of transitive descriptions, the mean proportions of passives and actives were .42 and .58, respectively (Bock & Griffin, 2000). As the percentages of passives and actives in our study are nearly the same with the norm percentages of passives and actives, there was no priming effect.

1.3. Discussion

Results showed that our task failed to prime the participants. The proportion of the passives to actives were almost the same as the norm base. There may be several reasons for this. One of our challenge was to create the illusion that participants are playing with real people as a team. To increase this effect, we decided to change half of the stimuli's modality from written to audio. Six English native speakers recorded our stimuli. Half of the prime sentences and half of the filler sentences were presented as audio instead of written. Another problem was the high number of sentences that are scored as "neither". Nearly half of our data was not usable. Moreover, some items elicited particularly high number of "active". For this reason, we changed the target items that elicited "neither" or "active" for more than half of the participants. The choice between active and passive sentences is sensitive to the conceptual characteristics of messages, with the occurrence of passives strongly associated with inanimate or nonhuman agents (Clark, 1965; Clark & Begun, 1971). Consistent with this statement, items that elicited most "neither" and "active" were pictures with human agents and nonhuman patients. Therefore, we replaced half of our target pictures with pictures that involve either nonhuman agent and human patient or nonhuman agent and nonhuman patient.

2. Pilot Study II

After renewing our task, our main goal for the second study was to investigate the difference between egonet-1 and egonet-6. In line with our main hypothesis, and in relation to the distinction between simple and complex behavioral contagions, we expected subjects to adopt more of a specific linguistic behavior - using a syntactic form (e.g., passive diathesis) more frequently in egonet-6 condition compared to egonet-1. This would support our hypothesis that the adoption of a linguistic behavior occurs through a complex, and not simple, contagion mechanism in which multiple sources of exposure are required.

Manipulation: In both conditions, participants are asked to play with 6 other players (bots). The difference is by how many players the subject is primed. In the egonet-6 condition, participants play with a different player in each block. Therefore, they read the prime sentences from 6 different players throughout the whole experiment. In the egonet-1 condition, participants hear the filler sentences from 5 other players and hear the prime sentences only from one player. In other words, they are primed by one player during the whole experiment. The other five players in the egonet-1 condition write only the filler sentences.

2.1. Method

2.1.1. Participants

We recruited 61 participants from Prolific (www.prolific.co). Five participants were excluded from the study due to either incomplete session or time-out. Each participant was randomly assigned to one of the two groups by a function of the Psytoolkit program. There were 34 participants in egonet-6 condition and 22 participants in egonet-1 condition. All participants were native English speakers.

2.1.2. Task

The renewed version of our priming task was used in Study II. The main alterations were the modality of the half of the stimuli and the target pictures. Modality of the half of the written sentences were changed to audio. Therefore, participants were hearing the stimuli instead of reading. Also, 9 new target pictures were introduced instead of old ones.

2.1.3. Procedure

We followed the same procedure as Study I.

2.1.4. Coding

The coding procedure was almost the same as Study II. Additionally, truncated passives were also accepted as passives as it can be particularly hard to prime participants in online and written production task (Mahowald et al., 2016).

2.2. Results

Table 1 shows the proportions of active, passive and neither categories in both conditions. Focusing on the results for descriptions, the mean use of passive structure for each participant in egonet-1 condition was .56 (SD=0.2), and in egonet-6 condition, the mean was .47 (SD=0.25). A considerable number of the answers was categorized as neither for both conditions (see breakdown by subject in Figure 1 at the end, and Table 1).

Table 1

Percentages of Passive and Active Utterances Used

Priming Condition	Utterance form		
	Active	Passive	Neither
Egonet-1	30.5	38.2	31.3
Egonet-6	32.9	32	35.1

Table 2

Descriptive statistics of passive production of participants by group

group: egonet1

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
primed	3	22	0.56	0.2	0.52	0.55	0.16	0.17	0.94	0.77	0.29	-0.62	0.04

group: egonet6

	vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
primed	3	34	0.47	0.25	0.5	0.48	0.31	0	0.92	0.92	-0.14	-1	0.04

To investigate the difference between two groups, we used linear mixed effect logistic regression with random intercepts for subject and item, and Egonet condition (1 vs 6) as fixed effect. The R code is:

Full_model <- glmer (passive choice ~ condition + (1 | participants) + (1 + Egonet | items) data = data, family = binomial).

Table 3

Fixed effects:

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.1273	0.2651	0.48	0.631
condition1	-0.2015	0.1528	-1.318	0.187

Table 4

Random effects:

Groups	Name	Varience	Std.Dev.
participants	(Intercept)	0.7537	0.8681
questions	(Intercept)	0.7714	0.8783

As seen in Table 2, there was no significant difference between the two groups. Moreover, the variance between participants and questions were quite high (Table 3).

2.3. Discussion

Our study showed that there was no significant difference between egonet-1 and egonet-6 condition. The lack of significance may be related to the design of our task. Our renewed task required participants to listen or read the prime sentences which may make the task relatively more complicated than our first task. In fact, more participants were unable to complete the task or completed it wrong. Although we replaced the items, the percentage of "neither" category did not significantly decrease. Since the study was online, participants were not

under the observation of the experimenter. This might cause for some participants to put less effort. Variance across participants may have arisen from these factors.

In spite of these challenges, our design showed a significant improvement. The percentage of priming increased from 43% to 49% and 56% (when "neither" category excluded). Further improvements are needed to test our hypothesis in a more reliable way.

3. Future Studies

There are several ways to test our hypothesis. Our plan for this year is using a similar task to examine the difference between two groups.

The task will differ from earlier ones in 4 main ways: modality of the stimuli, the modality of the production, content of our stimuli, and how the game is played. Instead of using audio and written sentences, we are planning to use videos to present participants with our stimuli. Participants will also record their answer as a video. By using video recordings, we are hoping to increase the interactivity of the game and make the task more engaging for participants. Also, it is easier to prime participants in spoken production compared to written production (Mahowald et al., 2016).

In previous tasks, we used filler sentences as half our stimuli. To increase the number of targets, we are planning to replace fillers with dative sentences that could be described with either a prepositional or a double-object dative sentence. The dative and transitive structures will act as a filler to each other. Finally, the way participants play the game will be slightly different. To reduce the number of "neither", target pictures will be presented with a verb that participants are asked to use to describe the picture. This way participants are encouraged to form a sentence either in a passive or active form. Moreover, after other participants (confederates) say the prime sentences, participants will have to choose between two pictures that the confederates described. We expect that this will increase the interactivity of the task, which is an essential element of our study.

Moreover, our only criteria for participants was to be a native English speaker. As plasticity is age dependent and effect language abilities (Nieto-Sampedro & Nieto-Díaz, 2005), we consider to limit the age range in our next study.

Depending on the results of the next study, implementing eye tracking to the priming task in the future can also be informative for our hypothesis.

Conclusion

Our main goal is examining whether the type of social network in which individuals are placed influences specific syntactic uses. So far, we have conducted two pilot studies. Although we could not find a significant effect, were able to overcome some of the challenges, and increased the priming effect in our second experiment. Our future goal is to keep making a progress on the way of testing our hypothesis and trying answer fundamental questions such as "Does human language spread primarily as a virus? Or as a form of complex behavioral contagion?".

To gain a deeper understanding in language acquisition, and to establish the crucial connection between individual mechanisms of language use and social mechanisms of language diffusion in a community, this research question is essential.

Figure 1

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