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THE TWO-WAY RELATIONSHIP BETWEEN LANGUAGE ACQUISITION AND SIMULATION THEORY[1]

abstract

In this paper, I try to draw a two-way connection between simulation theory and language acquisition. I argue that an individual with better simulation capabilities is at an advantage when it comes to foreign language acquisition, but this also works in the opposite direction in that exposure to many languages leads to better simulation capacities and more empathy. A number of studies relating to the subject of language and simulation will be presented in this paper. An evolutionary explanation and an analysis of the case of children with autism will also be presented to argue in favor of simulation theory over theory theory.

keywords

simulation theory, language acquisition, empathy

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1. Introduction

Interaction between humans is often theorized to be the result of a cognitive capacity that allows one to understand or predict the mental states of others. Such a capacity is called the *Theory of Mind*. Through attributing mental states to others, one is able to form predictions of the person's thoughts or feelings and act accordingly (Goldman, 2012). There are a few explanations as to how one comes to have a theory, one of them being *Simulation Theory*. Simulation theory basically claims that in order for humans to understand others and anticipate how they might think or act, they employ a kind of simulation where they put themselves in people's shoes. In other words, how they themselves would act or feel in certain situations would be the main criterion in determining how the person they are trying to understand would act. They would more or less project their own emotions onto others to determine how they feel or think. Goldman (2006) divided simulation capabilities within humans into two: high-level and low-level. In short, low-level simulation is the automatic response one does like mirroring someone's facial expressions without rationalizing it, while high-level simulation involves a bit of background information along with imagining of a scenario. In this paper, I will assess the question as to whether this form of cognitive activity is directly related to language learning and acquisition. I will tentatively describe the connection for both low-level and high-level simulation to language learning and acquisition. The first issue I will discuss is the possibility for people with stronger simulation capacities and those who display a higher degree of empathy towards others to have better language acquisition skills. Conversely, it is possible that exposure to different linguistic environments may increase one's ability to simulate other minds. I will argue that both ideas could be phenomena working simultaneously in that a child raised in a multilingual setting develops better communication skills and a more empathic character which in turn gives her/him an advantage to more accurately simulate other individual's intentions. This, consequently, makes her/him more skilled at foreign language acquisition. I support the hypothesis through examples of studies showing the connection between communication skills and empathy. An alternative explanation to these phenomena will be presented relying on theory-theory. Theory-theory is a contender to simulation theory. I will introduce it briefly, but argue against it by demonstrating that it falls short of accounting for the role empathy

1 I would like to thank Professor Lucas Thorpe whose guidance throughout his social cognition seminar has helped me immensely and where a precursor to this article was submitted as a term paper.

plays in human's lives. This idea will be supplemented through analyzing empathy from an evolutionary perspective. Finally, I will mention some studies conducted with children with autism spectrum disorder (ASD) pertaining to their learning skills. The results of these studies will show that a simulation theory of mind could account for empathy's effect on language acquisition and multilingualism's effect on empathy and simulation more so than theory-theory.

2. High-Level *vs.* Low-Level Simulation

The distinction between high-level and low-level simulation needs to be fully understood first. According to simulation theory, and specifically for high-level simulation, when one wants to guess what another person would do in a certain situation, the question they would ask themselves would normally be something like "what would I do in her/his place?" (Goldman, 2012). After this initial thought, acting upon that question would entail taking some background knowledge about both the situation and the person being simulated into consideration. What this means is that a fair amount of imagination would be required in order to get to a satisfying conclusion of what the simulated person might do. The person engaging in the simulation would have to pretend mental states: s/he would assume what beliefs or desires s/he would have if s/he were the simulated person. This of course has a big margin of error due to one's own desires and way of thinking coming into play, the biggest contributor for this error being the use of one's own possible reaction to a situation as the model for simulating the opposing person's reaction. To avoid this, some inhibition needs to be employed for the simulator to get to as accurate a simulation as possible (Goldman & Jordan, 2013, p. 452). As for low-level simulation, it is more about unintentional or automatic responses to stimuli from other people. These stimuli would mainly be reactions to pain or disgust, or maybe situations where something seemingly painful or disgusting in the eyes of the simulator has happened to the person whose actions are being simulated. It is more of a primitive type of simulation where the main actors are mirror neurons. These are essentially neurons that fire after a certain action from the individual as well as after observing that action by another individual (Goldman, 2006, p. 134). The simulating side is often unaware that a process of simulation is occurring, i.e. it is possible that there would be no knowledge of the matching of mental states between the simulator and the simulated. This could entail that mirroring is not proof of effective mind reading. It might, however, be the case that it is a basis for it (Goldman, 2006, p. 134). Both high and low-level simulation seem to have correlations with how subjects are effective in communicating with one another, making them worth studying in relation to language as both a factor in their shaping and a possible result in terms of how well it is utilized.

3. Foreign Language Exposure and High-Level Simulation Skills

Starting with high-level simulation, research was done by Fan *et al.* (2015) to study the impact of exposure to multilingual environments on children's abilities to interpret a speaker's intentions. The procedure consisted in a setup where a set of objects are placed on shelves in front of the child with the instructor on the opposite side behind the shelves. The child is able to see all the objects, but some objects are hidden from the instructor by a barrier. There would be an object which the instructor would tell the child to pick and a distracting object similar to the intended one but hidden from the instructor's view. The instruction would be something along the lines of "I see such and such, can you pick it?" all while the instructor is wearing black matte sunglasses to prevent her/his gaze from affecting the child's judgement. Tests were conducted to measure the children's verbal ability, executive function, visual-spatial intelligence, and perspective taking, and it was concluded that all groups within this research had comparable levels of language understanding and could follow the instructor in the absence of a distractor. The researchers observed that children who had been exposed to

a multilingual environment were able to understand which object the instructor was pointing to more often than children who were brought up in a monolingual one. It was a 50% chance for the monolingual children to get the right answer, but those who were either bilingual or had been merely exposed to more than one language had 77% and 76% success rates respectively. They concluded that either exposure to a diverse linguistic environment at any time during one's life may help in the development of more effective communicative skills, or that a child needs to be exposed at a certain stage in their development for this to take effect (Fan *et al.*, 2015). But in both cases, I believe this reveals superior higher-level simulation capacities among bilingual children or children exposed to a multilingual environment. The correct interpretation of the instructor's intentions points to this since from a simulation theory perspective, the child would need to imagine her/himself in the instructor's shoes and interpret what they would be thinking if put in that situation given certain background knowledge. In this case, the placement of the objects and being able to see or not see them acts as background knowledge. Gordon corroborates this when he describes how in a close knit community, people do not require much imagination to predict what others within their community mean when they act or speak since there is a shared set of values and norms. On the other hand, someone placed in a foreign setting would need to do a lot of pretending in order to predict other's behaviors and understand their intentions (Gordon, 1986). We tend to experience this when we move abroad by trying to adjust to our new community's norms. Our behavior changes when we move and try to adjust to our new environment. Perhaps if we go to our home country for a visit we would shift to our old behavior to accommodate that temporary change. This ease in shifting between two methods of communication, similar to shifting between two languages, could mean that the individual has developed an efficient way of understanding others' intentions and predicting their behavior. And since infants start developing the ability to interpret others' intentions and actions through repeated exposure to certain types of actions from an early age (Goldman & Jordan, 2013, p. 448), I believe it is reasonable to hold that children brought up in a monolingual environment would have more difficulties in discerning others' intentions than those brought up in multilingual ones. Multilingual settings provide for a much wider variety of linguistic stimuli for the infant to be exposed to and interpret behaviors through trial and error, making her/him quicker at adapting to new experiences and better able to faithfully predict or imagine what people's actions mean.

4. Empathy as a Precursor to Understanding Others

Regarding low-level simulation, I think there is a good chance that it is related to empathy in the sense that empathy requires response to minute emotional cues (Guiora *et al.,* 1968). The reactions to such cues are often quick. They don't require imagination from the receiver and come about with probably less need for background information to back them up. Perhaps those who are more empathic than others tend to react to more situations and to a more diverse range of stimuli from people of different cultures who would behave differently. It would be interesting if this has effects on acquiring foreign languages. One definition of empathy is

> a process of comprehending in which a temporary fusion of self-object boundaries, as in the earliest pattern of object relations, permits an immediate emotional apprehension of the affective experience of another, this sensing being used by the cognitive functions to gain understanding of the other (Guiora, 1965, p. 782).

On the assumption that this definition provides a correct picture of empathy, individuals who more accurately understand others' emotions and care to fruitfully interact with those they

deal with the most – albeit without necessarily giving it much thought – might have better motivation to communicate with the others more deeply and seriously than most people do. Having a pronunciation that is closer to that of native speakers facilitates communication within a certain linguistic community. So being more empathic would be the driving force for striving to sound more native-like. In other words, empathy pushes individuals to want to understand others, which in turn could drive their actions to achieve this understanding. In this particular case, having native-like pronunciation is a tool to push communication forward, and consequently to ensure mutual intelligibility. This road from empathy to desiring mutual intelligibility could also have a step in the middle where another action is required in order to be able to produce the correct pronunciation. Since empathy here is formed through a low-level mechanism, mirror neurons may be at play. Consequently, "mirroring" or imitating others would be an expected outcome of people who show high levels of empathy. As a result of imitating people's accents, the imitator would be able to understand those imitated more so than individuals who do not usually imitate a foreign accent while speaking (Adank *et al.*, 2010). Furthermore, I think the repeated imitation may also be an opportunity for training oneself in speaking the language which could give the imitator an advantage over non-imitators.

5. An Alternative Account Through Theory Theory

There could be, however, an alternative to simulation theory that would explain the apparent correlation. According to theory theory, a child predicts how someone is thinking by positing theories in her/his mind about others' emotions and putting those theories to the test. This requires much more background information than simulation. The information gets built up in the child's mind as a result of trial and error, i.e. the child tests out her/his theory in real life by observing if her/his predictions about the person being theorized about hold (Goldman & Jordan, 2013, p. 450). In the case of multilingual or "exposed-to-multiple-languages" children, it could be that what gives them an advantage are the years of dealing with multiple instances where there was a chance to test out many theories, rather than simulation itself. Differences in language sometimes entail differences in thinking about certain issues due to possible intricacies or grammatical features that are present in one language but not in another. One's culture, in addition, often influences how s/he thinks about many issues: the child, upon being exposed to more than one language, will be exposed to more than one way of thinking or viewing the world. This will give her/him the opportunity to test out the same theory on both cultures. If, for example, the theory held for one and not for the other, the child will be able to understand the differences between people's methods of analyzing and thinking about the world more so than a child brought up in a monolingual society. As mentioned earlier, a closely knit and homogeneous society would require less predictions since various situations are thought about the same way by many people. This is a way to account for high-level simulation in relation to knowledge of many languages. As for theory theory, rather than putting her/himself in the person's shoes, the child tests out theories known to be true in relation to a specific group of people and not necessarily to all groups.

6. Where Theory Theory Falls Short

But since theory theory requires one to have developed a way of thinking about others after much trial and error within her/his environment, it does not explain why there could be a difference in attitudes and beliefs between people with the same background. What could account for this is a phenomenon explaining individuals' behaviors that are not the result of conscious considerations and previous knowledge. Since empathy is more often than not acted upon automatically without much regard to background information (Sonnby-Borgström, 2002), it seems to fit the description of such a phenomenon, and according to a simulation theory model, this could be explained by appealing to low-level simulation. This means that empathy would not fit with theory theory

since being empathic would not always require conscious reasoning. For example, consider two individuals who have lived in the same place and encountered the same people their entire lives, yet one of them is prejudiced against a target group *G* while the other is not. The decisive factor may be that the prejudiced individual is less empathic than the other (Gutsell & Inzlicht, 2010). Without the need for a theory about other minds, and utilizing low-level simulation, one could be empathic of others and in turn be able to predict their genuine emotions and actions to a degree close enough to reality, and this is what most likely would be present in the non-prejudiced person. For this reason, I think that simulation theory provides a better account of human interaction and understanding of one another than theory theory.

7. The Evolutionary Benefit of Empathy as a Facilitator of Effective Communication

An evolutionary analysis of a mother's interaction with her child[2] may also be in favor of adopting simulation theory over theory theory. Rather than a theory theory based interaction, empathy, being involuntary and not needing much prediction and effort, would facilitate keeping the mother alert when caring for her child. We see this in human mothers where the slightest potential harm to their children automatically triggers a response to attend to them and try to shield them from danger. Perhaps mirror neurons in mothers are very similar to those of their children to facilitate this. The mother having to breastfeed would put the male in a position to have to be the main hunter in the family which would give the mother more time with her child than the father. The change from hunter-gatherer societies to agriculture and a more sedentary lifestyle wasn't made so long ago on the evolutionary calendar (Whyte, 1977), so much of these traits should normally be seen in humans today, and we would expect females to generally show higher levels of empathy than males. This is indeed what we see according to Olivares-Cuhat in a study conducted to "investigate possible relationships between empathy and foreign language learning performance on the one hand, and between emotional empathy and academic achievement, on the other hand" (Olivares-Cuhat, 2012, p. 62). Although the study was mainly to figure out if differing levels of empathy had anything to do with differing levels of achievement in education in general and foreign language learning in specific, they found that females were significantly more empathic than males (Olivares-Cuhat, 2012, p. 67). Females generally score better academically as well (Conger & Long, 2010, p. 184; Whalen *et al.*, 2003) and have higher foreign language performance (Gu, 2002, p. 35). This quote from that study summarizes what I was saying earlier:

> "a desire, willingness, or affective ability to adopt features of another cultural community and make them part of one's own behavioral repertoire ... can serve as an important influence on the individual's motivation to learn a second language" (Gardner, 2010, p. 114). From this, it follows that students endowed with positive empathic characteristics could be more able to recognize and identify with cultural differences that would, at first, promote their interest and motivation to learn a target language and, subsequently, help them become better language learners (Olivares-Cuhat, 2012, p. 69).

The method to test the participants' empathy was that developed by Caruso and Mayer (1998) in which items pertaining to certain empathy related concepts are rated by the participants.

2 I am discussing the mother-child interaction rather than the parents-child one for two reasons: (i) the research I discuss regrettably focused on mother-child interaction only (Sullivan, 2011), and (ii) female subjects were found to be more empathic than male subjects in one study (Olivares-Cuhat, 2012). However, it is difficult to assess, from these studies alone, whether having empathic characteristics is evolutionarily convenient only for mothers or for parents in general.

For example, the participant would rate something like: "Suffering: I get very upset when I see a young child being treated meanly". The participant's score would then be calculated by taking the mean of her/his ratings. The study showcases the results as showing a correlation between academic scores and the level of empathy (Olivares-Cuhat, 2012, p. 69). This discussion of the evolutionary basis of empathy is, in my opinion, adequate to make sense of why we have developed empathy as a mechanism to understand and deal with others, and I believe that it presents a stronger case than theory theory in explaining human-human interaction and mind reading.

8. Autism Spectrum Disorder and Deficiencies in Simulation and Foreign Language Learning

The last point I would like to discuss is whether we could learn something from the case of children with ASD in regards to the topic of language and its relation to empathy. Children with ASD typically don't show a response to their caregivers' faces different than that to the faces of strangers (Powell, 2004, p. 1055). Reasoning from an evolutionary point of view, it is in the infant's interest to have a unique reaction to her/his caregivers' faces. The survival advantage of this may be that the child would be able to inform her/his caregivers when s/he is hungry (Sullivan *et al.*, 2011).[3] Perhaps the lack of a unique child-to-caregiver reaction in children with ASD is an indication of an indifference rather than an inability to tell faces apart. In addition to this, children with ASD mainly keep to themselves, and don't engage much in verbal communication, and it has been observed that foreign language learning is more difficult for children with ASD than it is for non-ASD children (Wire, 2005). This is merely speculation, but it is possible that a correlation may be found between not being socially connected to people on a scale found in non-ASD children and exhibiting weaknesses in learning a language. If, for children with ASD, the deficit to recognize minute cues and signals from others, including from the child's caregiver, leads to a lack of overall empathy on the long run, then according to what I have argued in this paper, these children should have a significantly harder time in learning a foreign language than their non-ASD peers. The longstanding notion about autism – which is one of the autism spectrum disorders – is that those who suffer from it have a lack of empathy. There has been some research, however, suggesting that the opposite may be true in that people on the autism disorder spectrum may in fact have heightened sensitivity, making it difficult to phase out the unimportant cues and process what is necessary in order to understand others (Favre *et al.*, 2015). I believe that in either case, there would likely be a deficiency in simulation capabilities. In the first case, assuming that ASD would result in a lack of empathic feelings, the person suffering from ASD could have a deficiency in her/his mirror neuron activity if we were to analyze this from a low-level simulation perspective. Such a deficiency has been observed experimentally (Dapretto *et al.*, 2005). For high-level simulation, being unable to put oneself in someone else's position would result in such indifference. On the assumption that people with ASD have heightened concentration and can pick up things non-ASD people would normally ignore, this could also lead to overwhelming the receiver with stimuli to the point that s/he would not be able to adequately analyze people around her/him both on the low and high-level. For the former, her/his mirror neurons would react to unnecessary stimuli in certain situations, and as for the latter, not understanding what's important in imagining someone's situation might lead to wrong predictions. Language is known to be generally deficient in people with ASD, which supports the hypothesis that having more accurate capacities of simulation allows

3 Regrettably, this study did not investigate the parents-child attachment and bonding, only mother-child. There was only a brief mention of the possibility of the father providing the necessary bonding relationship and sensory stimulation for normal development, as opposed to mothers.

for better language learning. Also, a study showed that bilingual children suffering from ASD "were more likely to vocalize and utilize gestures" (Valicenti-McDermott *et al*., 2012, p. 945). And although this study didn't show significant advantages in expressive language for bilingual children over their monolingual peers, there was more pointing and pretend-play activity from bilinguals (Valicenti-McDermott *et al.*, 2012). I think this shows that there is a high chance that there might be a connection going both ways in that individuals with better than average simulation capacities are generally capable of grasping a foreign language more easily than others, and those who have had previous experience or exposure to a foreign language are able to understand people more than those who have not.

9. Conclusion

I have attempted to show in this paper that there could be a connection between both low-level and high-level simulation on the one hand and language learning and acquisition on the other hand. On the low-level side, being able to mirror others' emotions could give an advantage to the person mirroring them in that s/he will be able to learn a foreign language and reproduce its pronunciation in a more native-like fashion. Moreover, being more empathic could make her/him more open to accept different norms and cultures which in turn provides some motivation for mutual understanding. Being more empathic encourages subjects to look for what facilitates understanding: a native-like pronunciation on the one hand, and a near native language proficiency on the other. For high-level simulation, I have shown that exposure to more than one language can provide the individual with more opportunities and experiences to refine her/his notions and ideas of others. This in turn may be the reason for better simulation capabilities since the simulator, through her/his many different experiences, will be more likely to put her/himself in others' shoes and try to understand them from different perspectives. Through reasoning and analyzing how humans may have most likely evolved, I believe that simulation theory provides a better overall picture of human social cognition than theory theory. The data concerning children with ASD support the hypothesis that having communication problems could lead to a harder time in learning languages, and that being bilingual leads to a higher possibility of communication albeit not necessarily verbal. This seems to be a good account of why simulation and language learning and acquisition may be related.

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