

Promoting Learning through Mental Practice and Embodied Simulation

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This article summarizes the theory of embodied simulation and how it underlies mental practice. Mental practice offers a way for people to learn virtually (without expensive VR equipment) using the basic machinery of our brains. An approach which gives learners a chance to mentally practice from both an observer and a participant perspective is advocated in order to promote deeper learning.

1. Embodied Simulation

About forty years ago, Lakoff and Johnson (1980) published the now classic book, *Metaphors We Live By*. This book changed the understanding of metaphor and its role in language and cognition within the fields of cognitive science, applied linguistics, criticism, art, language teaching, and much more. The authors suggest that metaphor is at the core of human language, a fundamental mechanism of mind that allows us to use what we know about our physical and social experience to provide understanding of other subjects. Because such metaphors structure our basic understanding of our experiences, the authors call them “metaphors we live by”, metaphors that can shape our perceptions and actions without our ever noticing them.

One of the simple examples given in the book is that of the word “love.” While “love” can be glossed by a dictionary definition, for example “a deep romantic or sexual attachment to someone,” this is not how we actually extract meaning from a linguistic utterance such as “I love you.” Instead, we understand it through metaphors. If we use the metaphor of “love is a physical force,” then we can understand love as being attracted or repulsed by another person, or love creating a strong force on our lives. If we use the alternative metaphor of “love is a fire,” then we can consider whether the subject of our desires is still “hot” or whether our passion has “cooled.”

While Lakoff and Johnson drew their evidence primarily from linguistic analysis, their findings have been supported by cognitive scientists and neuroscientists, particularly since the development of fMRI technology in 1991. For the first time, scientists were able to look into the human brain and see what was happening when a person hears or produces language.

In traditional models of how language is processed in the brain, evidence from brain lesion surgeries suggested that two particular areas of the brain were responsible for the human capability of language. Broca’s area in the frontal lobe of the dominant hemisphere was shown to have functions linked to speech production, and Wernicke’s area in the superior temporal lobe of the dominant cerebral hemisphere was shown to be involved in the comprehension of language. When fMRI revealed areas of the brain activated during speech comprehension and production, it did not negate the relevance of Broca and Wernicke areas, but it also demonstrated that language is distributed throughout the brain.

For example, when someone hears a word like “accordion,” the

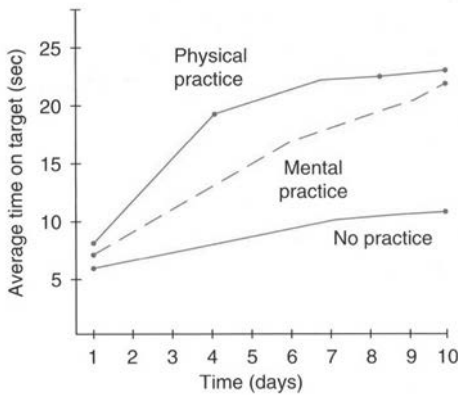
visual cortex, auditory cortex, and motor cortex all become activated. These areas of the brain were originally used primarily for perception of stimuli in the outside world, and they are shared with other primates and mammals. However, through the course of evolution, it appears that these older areas of the brain have also been repurposed to carry out the functions of language. When you hear that word, “accordion,” you are using the machinery of your visual cortex to recall or recreate a picture of an accordion. Similarly, you understand the word “accordion” by creating the sound of the instrument using your auditory cortex.

We can of course think of people who have never heard the sound of an accordion, so how are they able to “recreate” the sound in their auditory cortex? A more fantastical example is useful for considering this. In a book by cognitive linguist, Benjamin K. Bergen (2012), *Louder than Words*, the reader is asked to imagine a flying pig. Since a flying pig is generally considered to be a non-existent creature, the reader has no prior reference to simulate a picture or sound of a flying pig within the cortices of the brain. Yet, we are all able to somehow simulate an image. For most people, the flying pig has something like a set of angel wings attached to its back. For a small number of people, the flying pig has a cape like a superhero. Bergen calls these simulations “Pigasus” and “Superswine” respectively. Our brain machinery which was originally developed for perception has been repurposed to allow us to imagine things that we never perceived and of which we have had no real experience. This is known as *embodied simulation*. In other words, the human capacity of language allows us to simulate new experiences in our brain and bodies that we have never actually had in the real world.

2. Mental Practice

This phenomenon of embodied simulation has been comprehensively demonstrated in mental practice which has become very common in sports, business, and other areas. Figure 1 shows the results of an experiment in mental practice. Over a period of 10 days, participants in group A carried out physical practice on a soccer field, trying to improve their ability to score goals. Group C were a control group who were instructed not to do any practice. Group B were the mental practice group who were instructed to simply imagine that they were kicking the ball and scoring goals perfectly. Remarkably, the mental practice group achieve almost as well as the physical practice group, despite the lack of real-world feedback or any apparent practice of motor skills. Clearly, combining physical practice with mental practice will achieve better results.

Figure 1. The effect of mental practice



Similar results have been obtained in a wide range of studies in sports and business and other areas. From the discussion on embodied simulation above, it seems likely that mental practice is

effective because it taps into the natural human ability to simulate experiences using the same brain machinery that is used in perception. In other words, imagining that something is happening bears strong similarities to actually experiencing that thing.

3. Multiple Perspectives

Perspective 1: Imagine that you are about 100 meters from a rollercoaster. You can see the loops and turns of the rollercoaster and notice how it changes speed and goes up and down. Notice the people on the rollercoaster and see how they react to the ride.

Perspective 2: Now, imagine that you are on the rollercoaster, sitting in the front seat. And about five meters ahead of you is the first climb upwards. The car is moving very slowly. You grip the rail very tightly and listen to the sound of the car moving on the tracks. You feel the temperature of the air around you. Then you start going upwards very slowly. You reach the top, and then suddenly, without warning you are travelling downwards very fast. You hear the screams of the other people on the ride, and you feel your stomach jumping....

While both of these perspectives will cause embodied simulation, if you are like most people, these two perspectives/experiences felt very different. In the first, you were an *observer* and you were watching the rollercoaster from outside. In the second, you were a *participant* and you probably felt the physical sensations of movement. Of course, there wasn't actually any rollercoaster, so any effect that you felt was simply a result of embodied simulation. Yet, by engaging embodied simulation through these two perspectives, you were able to learn more about rollercoasters.

4. Deliberately Utilizing Mental Practice

How can we deliberately utilize mental practice and embodied simulation in our lessons to facilitate better student learning? Clearly, there are many possible answers. Every word that we say is going to cause our students to create embodied simulations and this can be used in many different ways. Below, I outline one possible approach which helps students to simulate a novel experience with multiple perspectives. This approach uses words/stories that send the story characters through the kind of experience (or parallel experience) that we want our students to eventually have.

For example, perhaps your English-learner students are going to go on a study abroad program. While study programs are very valuable experiences, many students are mentally unprepared for the realities of a homestay and living overseas, and many run into problems or are simply unprepared to gain as much benefit from the experience as they potentially could. Mental practice can be used to help them gain information and experience of the kinds of problems that can arise and how they can be resourceful in solving them.

As in the rollercoaster example above, a two-prong approach of observer and participant can be very useful:

1. Tell a story to help the students begin to imagine the situation. (observer)
2. Have the students imagine stepping into the situation and noticing what they see, hear, and feel. (participant)

Step 1: Tell a Story (observer perspective)

In your story, you want to provide information and possibilities about the situation that your students may not have considered. You can either tell a direct story or you can tell a more metaphoric story. Simple examples are given below.

Direct Story: Last year, Taro Suzuki, a student from this university went to British Columbia on a homestay. He was really excited, but when he got there, there were various problems that he had to solve. First, at his homestay, he discovered that the family was absent for most of the time and that he had very little opportunity to interact with them. They seemed to have little interest at all in him, and as a result he was not learning much English. After several days, he decided he had to do something, and he telephoned the coordinator of the homestay program. With some difficulty, he managed to explain the problem in English and finally after two more days, he was able to move to a new homestay where the family was much more welcoming and included him in all their activities. At his school, too, Taro had some problems. He didn't do so well in the placement test and he was placed in the bottom class. As a result, everything was much too easy. After a few days, he decided that he had to act and he talked to the coordinator. The coordinator was impressed by Taro's courage and willingness to learn and moved him into a higher class. In these ways, Taro learned so much from his homestay. There were problems, but he had the courage and made the effort to solve them.

Metaphoric Story (The Obstacle in the Road): Once upon a time, there were many travelers on a journey. One day, they came to a large rock in the road that blocked their way. Most of the travelers immediately gave up. Some waited for other people to do something.

But one person decided to do something herself. She went up to the rock and started to push. At first, other people laughed and said, “that’s impossible,” but soon others joined her, and after a few hours of hard work, they managed to move the rock. Underneath the rock, to her surprise, there was a purse full of gold and a letter from the king of the country which said: “this reward is for the person who has the courage and makes the effort to move the obstacle from the road.”

Because of the metaphoric nature of language and how we understand it, both kinds of story can achieve the same effect of reminding students that it is their own effort that can make a real difference. Both are offering an *observer* view of a homestay and of overcoming difficulties.

Step 2: Step into the Experience (participant perspective)

In this second step, students close their eyes and step into the experience as a *participant*, imagining that they are going through each step of the study abroad experience. For example:

You are leaving your house and going to the airport. Notice how you feel. Are you excited or nervous? When you get to the airport, you go to the check-in counter.... On the third day of your homestay, you realize that no-one in the family is really interested in you. You are expected to eat by yourself and nobody talks to you. You decide that you want to change homestay. Look through the documents of the homestay company until you find the telephone number of the coordinator. Now, you need to make a telephone call in English. What are you going to say? How do you feel?

5. Noticing What is Required

In the rollercoaster example above, some readers may have felt uncomfortable in the *participant* role. Likewise, your students may feel a lack of confidence or fear as they mentally go through the new experiences. This is a great opportunity for them to notice what they need to navigate that situation more successfully. In many cases, students will realize for the first time that they need to study more English before they travel, and it can be a great source of motivation. Students may also realize that they have never made a telephone call in English and that they need to practice. Mental practice offers a way for people to notice problems and to better prepare before the problems actually occur. Below, this two-step process is expanded to allow for these learnings, but you can of course adapt the process to whatever works best for your teaching situation.

Elicit or explain a situation in which students will be using English.

1. Tell a story to help the students begin to imagine the situation. (*observer*)
2. Have the students imagine stepping into the situation and noticing what they see, hear, and feel. (*participant*).
3. Have the students step out and consider: “what did you need in that situation? How can you get what you need?” (*observer*)
4. “Imagine that you have what you need and step back into the situation and carry out the task.” (*participant*)
5. “How was it different this time? What did you see, hear, and feel?”

6. Conclusion

This short article has summarized the theory of embodied simulation and how it underlies mental practice. Mental practice offers a way for your students to learn virtually (without expensive VR equipment) using the basic machinery of the human brain. Giving students a chance to mentally practice from both an observer and a participant perspective makes it a much richer learning opportunity that supports their actions in the external world.

References

- Bergen, B. K. (2012). *Louder than words: The new science of how the mind makes meaning*. Basic Books.
- Lakoff, G., & Johnson, M. (2008). *Metaphors we live by*. University of Chicago Press.