



HOW YOU GET TO CARNEGIE HALL

What is the best way to measure progress in motor learning?

The old joke goes something like this: A visitor to New York City was hurriedly trying to find his way to Carnegie Hall to see the symphony. After a period of fruitless search, and fearing that he might miss the start of the concert, the visitor finally stopped a local resident and asked him, “How do I get to Carnegie Hall?” Without skipping a beat, the New Yorker replied, simply, “Practice, practice, practice.”

The local resident was either joking with the visitor or had taken a course in motor learning, because nothing is more effective for improving motor skill than practice. But, not all forms of practice are created equal. We will see later that there are many ways to structure practice that will greatly influence the learning process. In general, however, the amount of practice is the single most important factor in the improvement of motor skills.

You may think that this is simply stating the obvious. But, the relationship between practice and the level of skill attained is not always one-to-one. Improvements in skill are sometimes quick. At other times, skill levels appear to stagnate, with no appreciable improvements, and indeed, may even seem to degrade for a period of time. And, sooner or later, learning may appear to have ended, with no more gains seemingly possible.

As an example, consider someone who is using chopsticks for the first time. With some helpful words of advice, or by watching others use their chopsticks, or both, the hungry learner can progress from complete novice to a very rudimentary level of skill proficiency in just one meal. This simple example illustrates that the most obvious and rapid improvements often occur in the earliest practice period when learning a new skill. Many of these performance improvements occur because of the acquisition of some fundamental techniques. In the case of using chopsticks, it may be because the learner has acquired information regarding which techniques of holding the chopsticks are effective and which are ineffective.

One way to quantify the gains in performance would be to measure the amount of food eaten in successive minutes. What we likely will find is that the novice chopsticks user eats very little in the first few minutes of a meal, but starts to enjoy the meal relatively quickly after these initial struggles. The classic shape of the performance acquisition graph is a negatively accelerating curve, as illustrated in figure 8.1. It is called negatively accelerating because the rapid gains in performance seen in the initial portions of the curve decelerate over time. Although the scores increase relative to the y -axis, the rate of change of these increases declines over time.

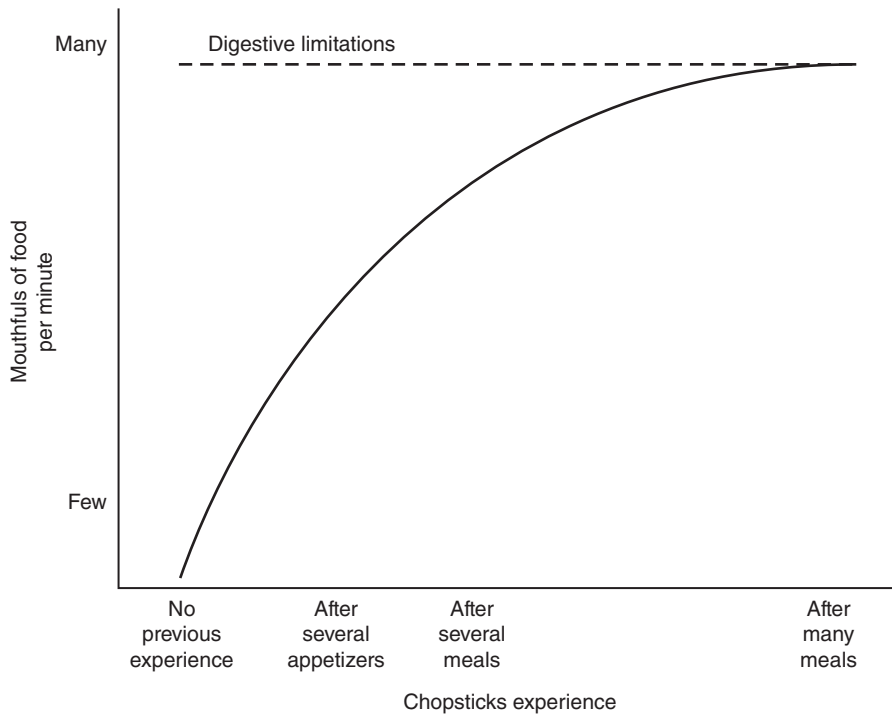


Figure 8.1 Sample performance curve that plots the improvement in performance in using chopsticks (as measured in mouthfuls of food eaten per minute) as a function of the amount of practice.

After some practice, perhaps a few meals or a few dozen meals later, the learner might have approached a maximum eating speed (because digestive factors limit how fast we can eat). In other words, the curve has leveled off, or reached a plateau. However, the leveling of the curve presents an interpretive problem. Does it mean that there is no room for further improvements in using chopsticks so that the learning is complete? The answer, of course, is no. Instead, the leveling of the curve simply means that our measure of skill (the amount of food eaten per minute) is no longer sensitive or appropriate for indexing further improvements in skill. This illustrates one of the important concepts in motor learning research—that the absence of further observable (or obvious) changes in performance does not mean that other aspects of performance are not continuing to improve. Most certainly, the dexterity and efficiency of using chopsticks continue to improve over the course of many, many meals.

But, how long might skills continue to improve? A study reported in Crossman (1959) suggests that, in fact, motor learning may never end. Crossman tracked the performance of cigar rollers over a seven-year period. His finding was that performance time continued to improve for years and only leveled off when the operational constraints of the machinery prevented

further reductions in performance time (similar to the digestive limits in our chopsticks example).

In learning even relatively simple motor skills, such as using chopsticks, the observable actions reveal only some of the changes in the central nervous system that underlie the skill itself. Movement efficiency, repeatability, transferability of the skill to novel situations or objects, and the ability to perform the skill while multitasking are all examples of ways motor skills continue to improve. Regardless of what represents your Carnegie Hall, getting there is a matter of practice, practice, practice.

SELF-DIRECTED LEARNING ACTIVITIES

1. Define *motor learning* in your own words.
2. Look at figure 8.1 once again. How would the curve look if improvements in the measure of performance were revealed by a decreasing score (such as a smaller reaction time or a reduced error score)?
3. Figure 8.1 was described as a negatively accelerating curve. What would you call the curve that you conceptualized in question 2?
4. In the chopsticks example described in the story, the measure of performance (mouthfuls of food eaten) quickly became an inappropriate measure of learning. Suggest another measure of performance that would be more appropriate and sensitive to longer-term changes in the acquisition of chopsticks skill.

NOTE

- Directions to Carnegie Hall:
www.tinyurl.com/directionscarnegie

SUGGESTED READINGS

- Crossman, E.R.F.W. (1959). A theory of the acquisition of speed skill. *Ergonomics*, 2, 153-166.
- Schmidt, R.A., & Lee, T.D. (2011). Motor learning concepts and research methods. In *Motor control and learning: A behavioral emphasis* (5th ed., pp. 327-346). Champaign, IL: Human Kinetics.