Defining and Assessing Learning

KIN 377 - Motor Learning

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Overview

People who assess learning must make inferences from observing performance during practice and tests Magill & Anderson (2020).

Learning Objectives

- Define and distinguish between the terms performance and learning
- Identify six general performance characteristics typically observable as motor skill learning occurs
- Describe several different methods to assess motor skill learning
- Discuss two reasons performance during the practice of a motor skill may misrepresent the amount of learning that occurred during practice

How would you tell?

1. How do you determine whether performers are learning what you are teaching them?
2. How can progress be evaluated?

Watch the video below:

https://youtu.be/HCe0cs-qVF8

Concerning the video above

1. Do you think the performer has learned the backhand and forwhand skills?
2. How can you be certain that what you are observing is the result of `learning` and not just luck?

It is not possible to infer about learning by simply observing this performance.

Performance vs Learning

> **Note**
>
> Learning: A change in the capability to perform a skill that must be inferred from a relatively permanent improvement in performance as a result of practice or experience (Magill & Anderson, 2020)

- Performance
  - Execution of a skill at a specific time and in a specific location
  - This is the observable behavior
- Learning
  - Not directly observable
  - Must be inferred from observable behavior

Performance vs Learning, cont

Performance

- Observable behavior
- Temporary
- May not be due to practice
- May be influenced by performance variables

Learning

- Inferred from performance characteristics (discussed later)
- Relatively permanent
- Due to practice
- Not influenced by performance variables
  - e.g., fatigue may influence performance, but not impact learning

Performance vs Learning, cont

From the definition:

…the person has increased his/her capability, or potential, to perform a skill.

Whether or not the person performs the skill in a way that is consistent with this potential will depend on the presence of what are known as `PERFORMANCE VARIABLES`.

> Performance variables such as alertness, anxiety, fatigue, etc. can influence an individual's performance but not reflect their learning. These factors can distort the representation of learning and must be considered when evaluating learning to ensure accurate deductions are made. (Magill & Anderson, 2020, p. 263).

Performance characteristics of skill learning

`Improvement`

- Over a period of time, there has been improvement in the performance of the skill.
- This means that the person performs at a higher level of skill at some later time, then at some previous time.
- Performance may get worse as practice continues due to bad habits.
- Plateaus and regressions in performance are often seen during skill acquisition.
- Still improvements are apparent when learning is viewed over a longer time scale.

Performance characteristics of skill learning

`Consistency`

- As learning progresses, performance becomes increasingly more consistent.
- The performance is similar from one attempt to another
- Consistency is typically quite variable from one attempt to another early in learning
- It becomes more consistent as learning takes place

Performance characteristics of skill learning

`Stability`

- as learning progresses, performance stability increases
- stability refers to the influence on skill performance of perturbations, which are internal or external conditions that can disrupt performance
- stress is an example of internal perturbation
- the weather or an issue with the person's shoes are examples of external perturbations.

- there are limits to the amount of perturbation that can be overcome

Performance characteristics of skill learning

`Persistence`

- The improved performance capability is marked by an increasing amount of persistence
- As the person progresses in learning the skill, the improved performance capability lasts over increasing periods of time

Performance characteristics of skill learning

`Adaptability`

- the improved performance is adaptable to a variety of performance context characteristics
- something is different every time we perform a skill
- successful skill performance requires adaptability to changes in personal, task, and or environmental characteristics

> **Note**
>
> Stability and adaptability are both important, but for different reasons. Stability provides a reliable foundation for performance, while adaptability allows for flexibility and innovation.

Performance characteristics of skill learning

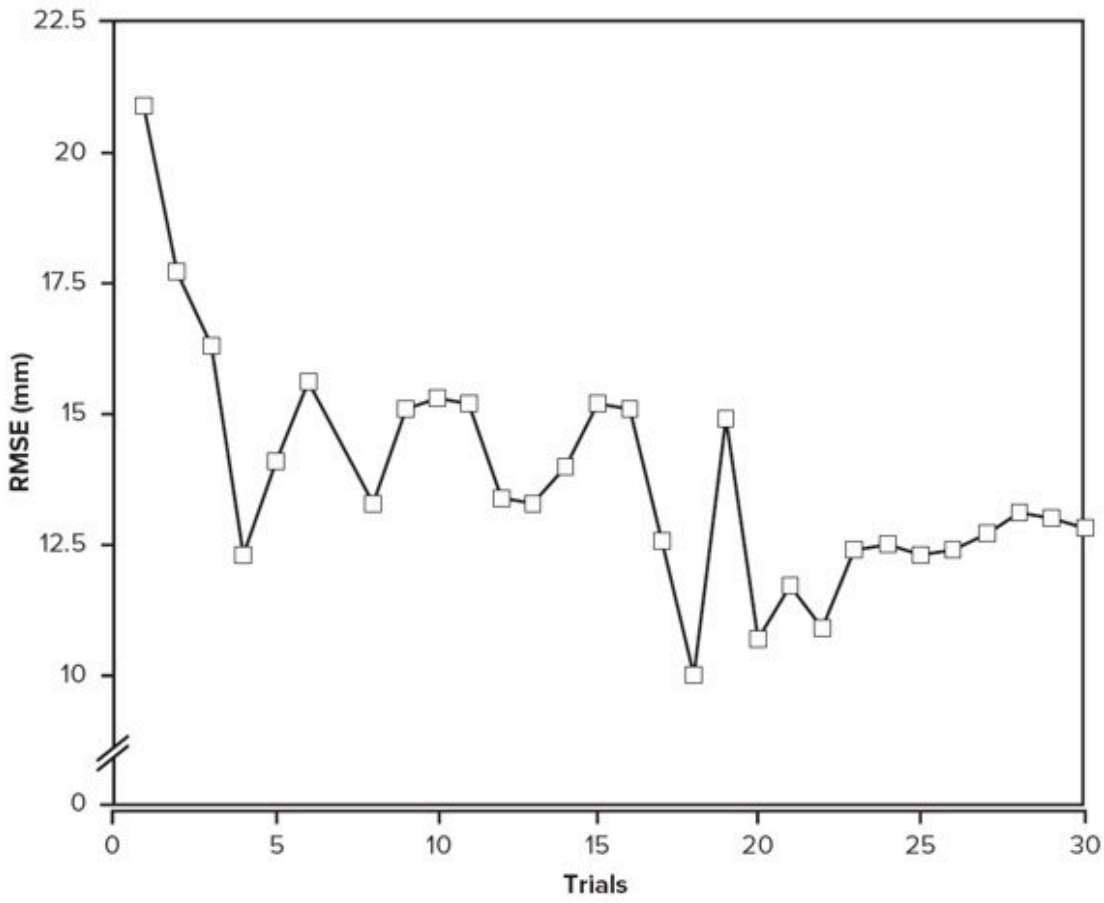
`Reduction in attention demands`

- Reduction in the amount of attention demanded to perform the skill
- As learning progresses, the learner can more easily perform another activity simultaneously

Learning Assessment Techniques

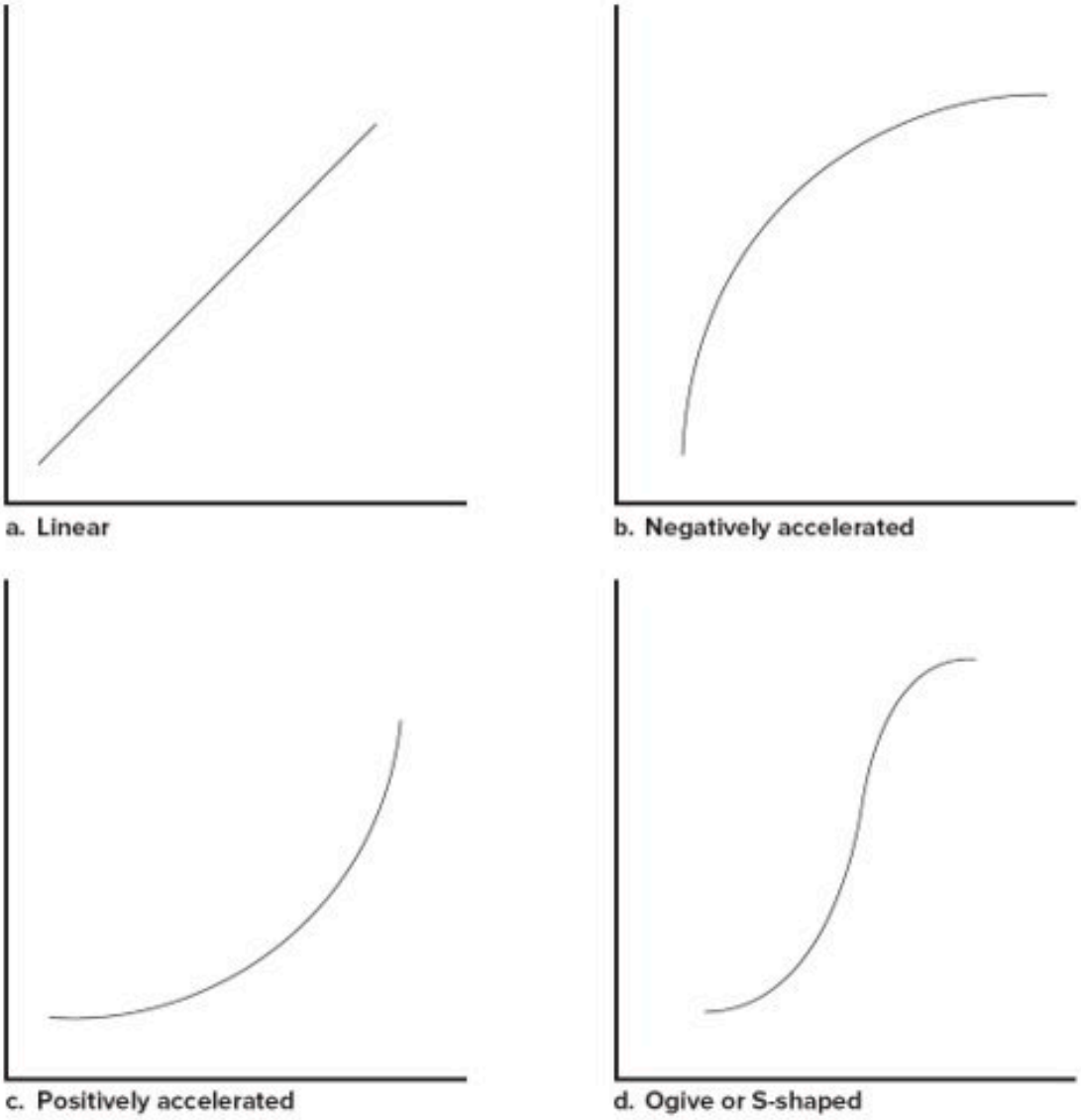
`Performance curves for outcome measures`

- provide a way to observe performance `improvement` and `consistency` over a period of time



Type of Performance Curves

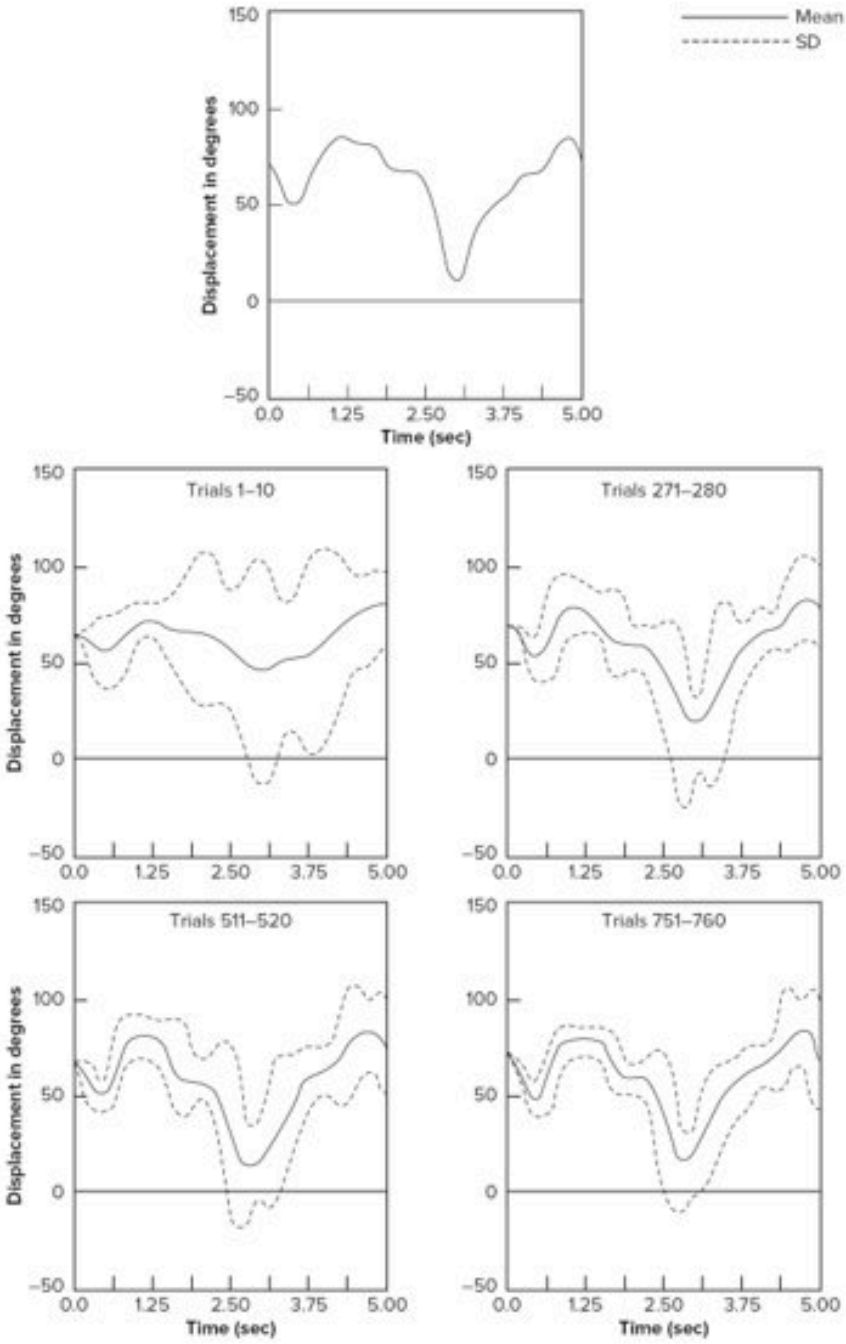
- Linear
  - Proportional performance increases over time.
- Negatively accelerated.
  - Large amount of improvement occurs early but slows later.
- Positively accelerated
  - Slight performance gain early in practice, but substantial improvement later.
- Ogive or S-shaped
  - Combination of A, B, and C curves.



Learning Assessment Techniques

`Performance curves for kinematic measures`

- Kinematic: study of the motion itself, without considering the forces
- Improvement: compare block trials 1-10 with 751-760
- Consistency: compare the SD block trials 1-10 with 751-760.

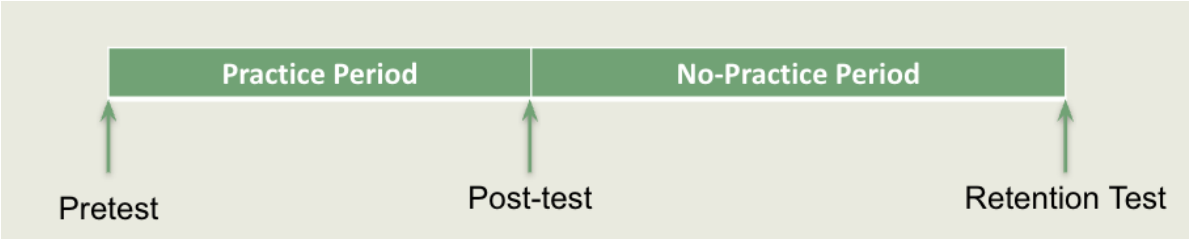


Source: From Marteniuk, R. G., & Romanow, S. K. E.(1983). Human movement organization and learning as revealed by variability of movement, use of kinematic information, and Fourier analysis. In R. A. Magill (Ed.), *Memory and control of action.*

Learning Assessment Techniques

`Retention tests`

- Assess `persistence` of an improved performance capability by requiring the performance of the practiced skill after a period of time during which the skill was not practiced
- **Length of time** between the end of practice and the test is arbitrary



Learning Assessment Techniques

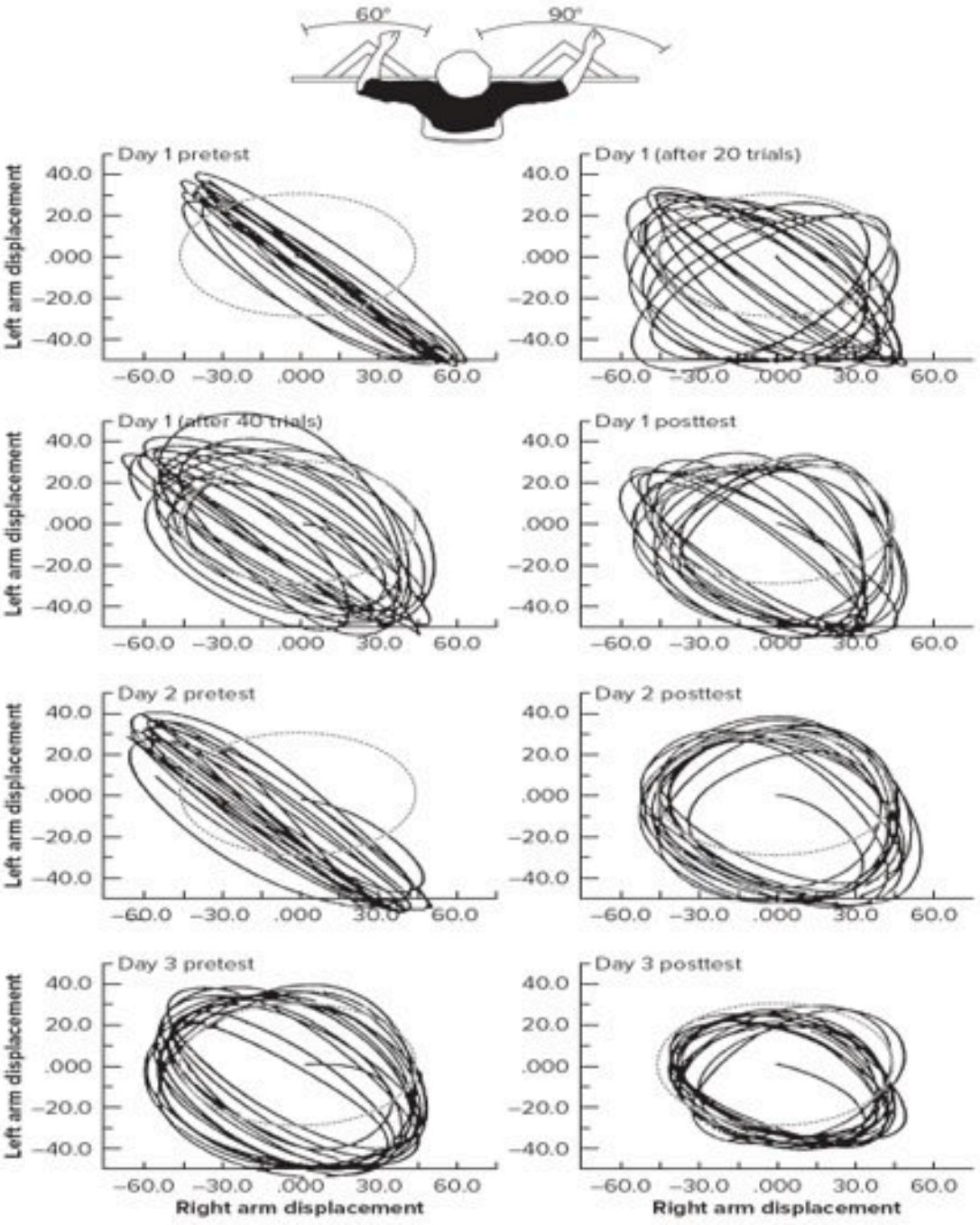
`Transfer tests`

- Assess the acquired capability to `adapt` to performance situations and contexts that were not experienced during practice
- Test usually involves performing the practiced skill **in a novel situation or context.**
  - Availability of augmented feedback
  - Physical environment
  - Personal characteristics of the test taker
- Performing a skill that is a **novel variation** of the practiced skill.
  - An aspect of adaptability.

Learning Assessment Techniques

`Coordination dynamics`

- graphical representations of movement coordination patterns during practice and tests provide a means of assessing the `consistency` and `stability` of coordination characteristics associated with performing a motor skill

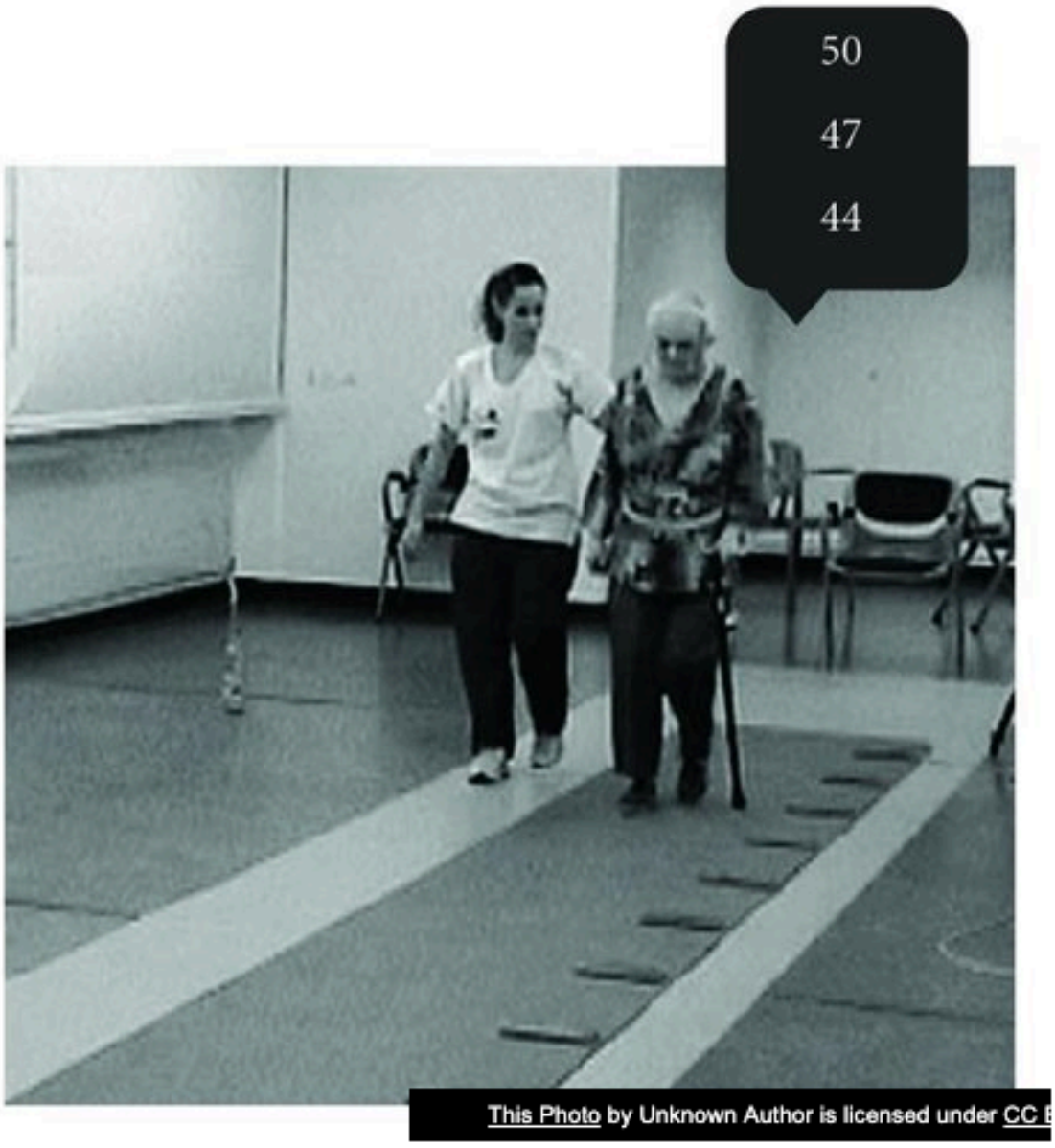


Source: From Lee, T. D., et al. (1995). Relative phase alterations during bimanual skill acquisition. *Journal of Motor Behavior, 27,* 263–274.

Learning Assessment Techniques

`Dual-task procedure`

- Means of determining if **changes in attention demands** for a skill change as a learner **becomes more skillful**
- Assesses the `attention demands` associated with performing a skill
- Attention demands are expected to decrease as amount of learning increases
- According to Kahneman's theory, this **change is predicted as a characteristic of learning**
  - The procedure involves **assessing the effect on a primary task** when it is performed **concurrently with a secondary task**



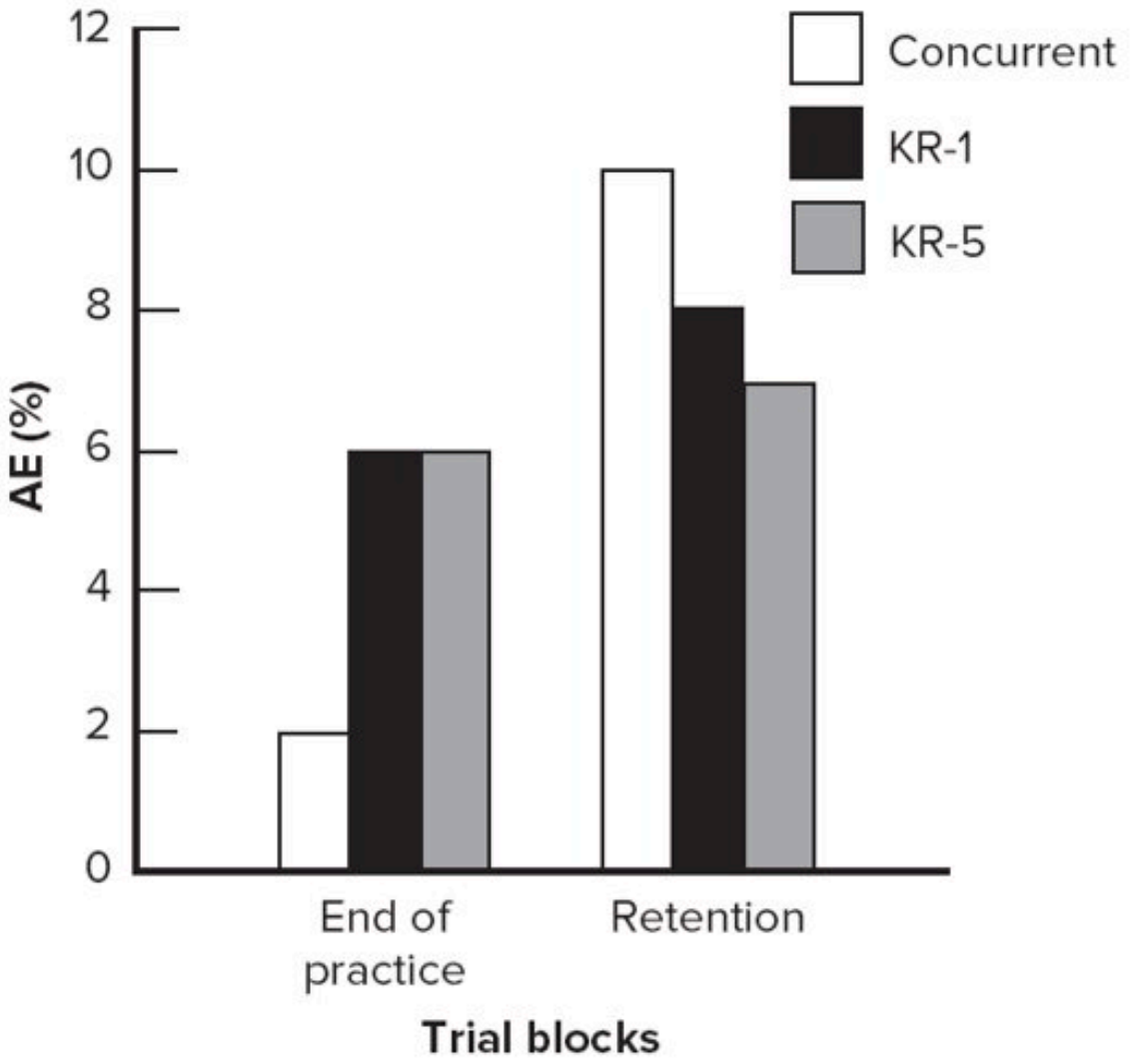
Practice Performance May Misrepresent Learning

Two reasons:

- **Practice** may involve a performance variable that artificially **inflates** or **depresses performance**
- Practice may involve **performance plateaus**

Reason 1

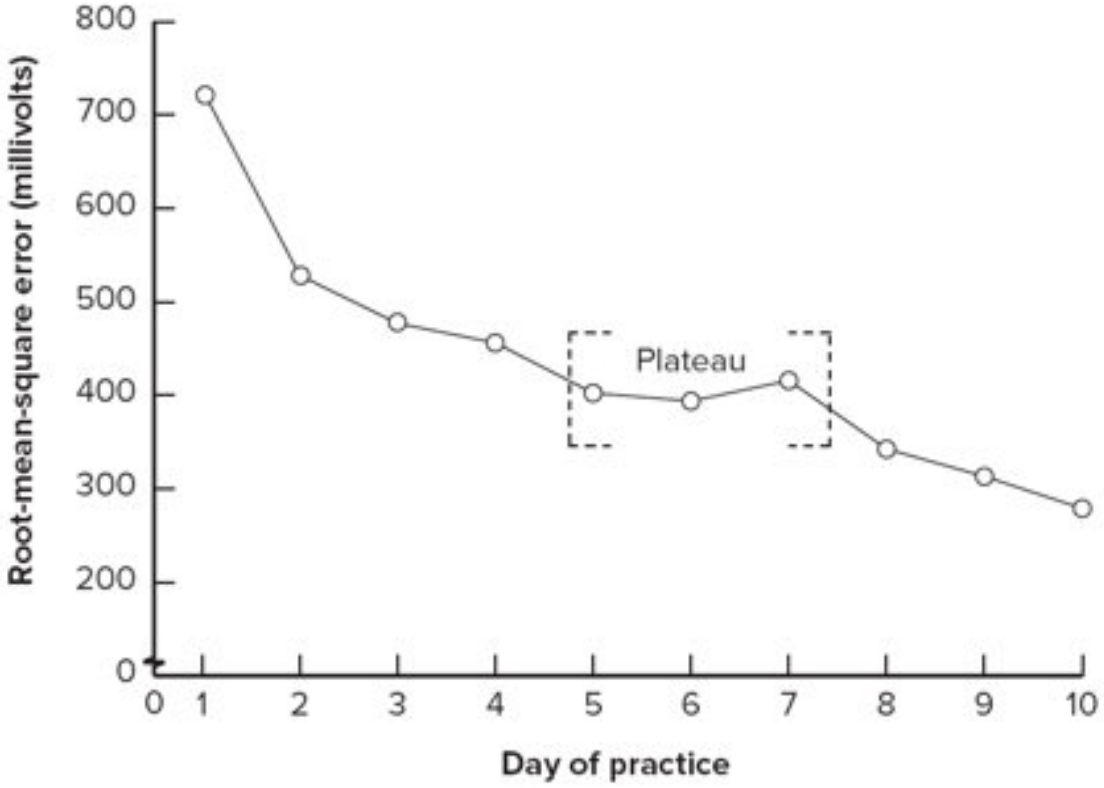
- Certain performance variables can artificially inflate or depress practice performance so that the observed performance during practice over or underestimates the amount a person has learned during practice.



Source: From Winstein, C. J. et al. (1996). Learning a partial-weight-bearing skill: Effectiveness of two forms of feedback. *Physical Therapy, 76,* 985–993.

Reason 2

- Periods of time during which performance does not improve give the appearance that learning has stopped even though it has not.
- Providing additional practice trials can establish a means of determining whether learning continued during a performance plateau"



Source: From Franks, I. M., & Wilberg, R. B. (1982). The generation of movement patterns during the acquisition of a pursuit tracking task. *Human Movement Science, 1,* 251–272.

References

Magill, R. A., & Anderson, D. (2020). *Motor learning and control: concepts and applications*. McGraw-Hill Education. https://www.bkstr.com/csunorthridgestore/product/motor-learning-and-control--concepts-and-applications-147614-1