



SCIENCE

Department of
Kinesiology

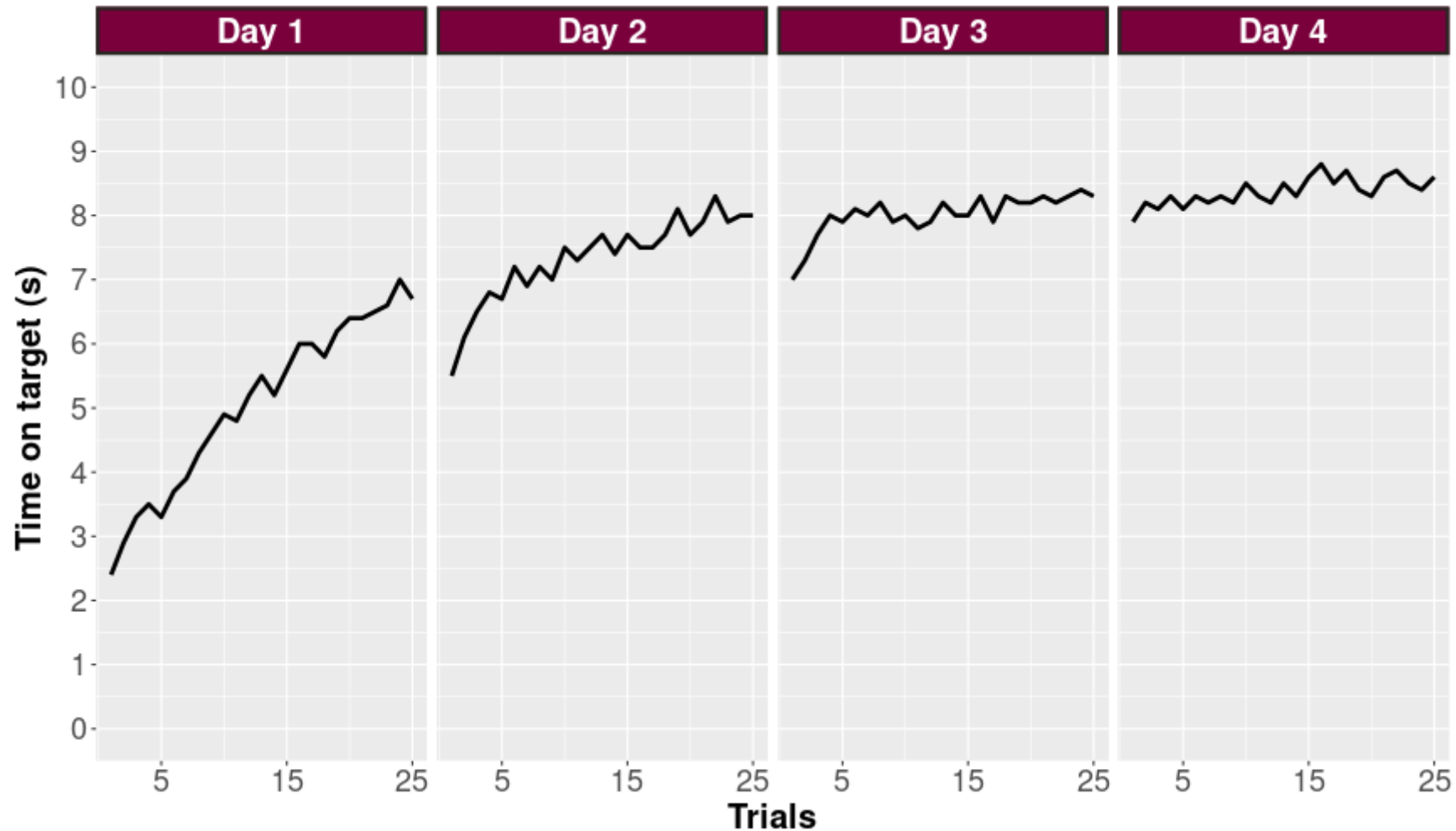
Feedback: Fundamentals

KINESIOL 1E03 - Motor control and learning

Laura St. Germain
Fall 2022 Week 8
Lecture 15

Review from last lecture

Recall this performance curve...

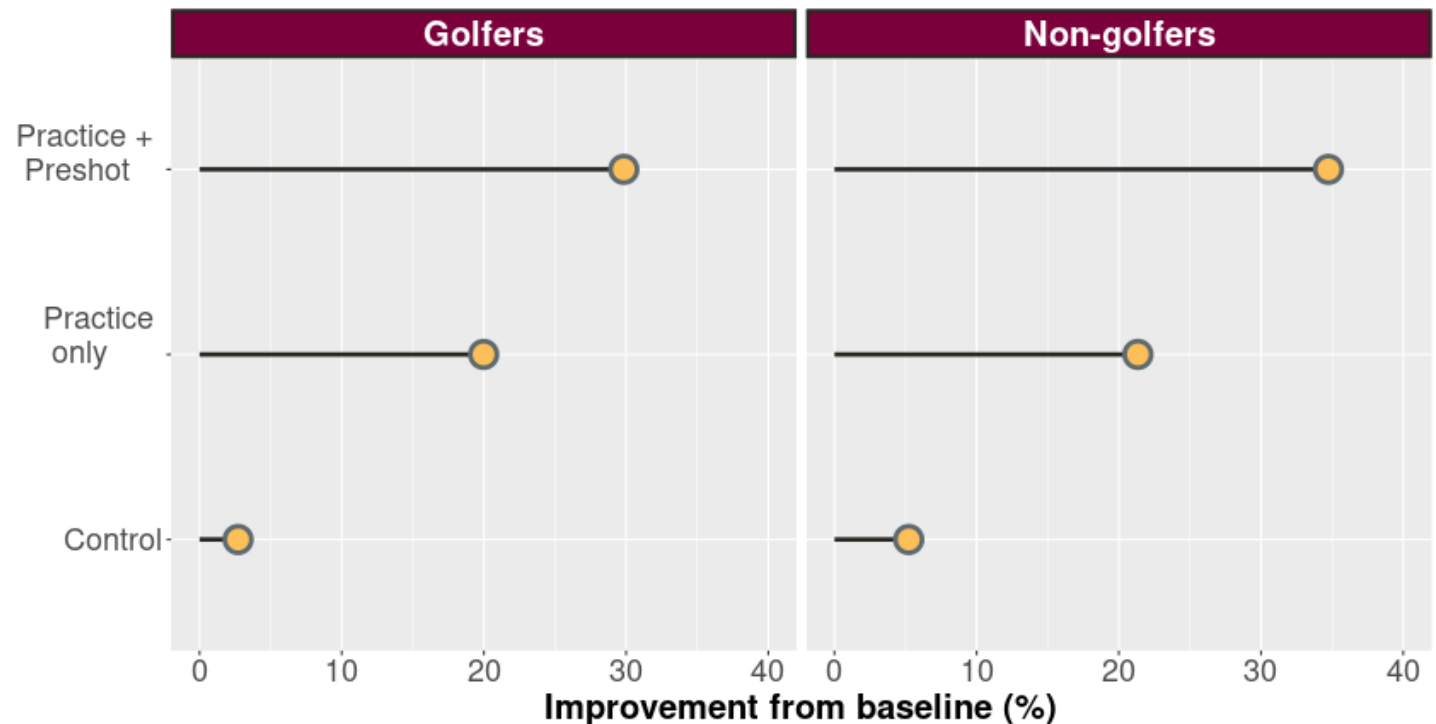


Establishing and using a pre-shot routine is advantageous for novice and experienced golfers

Task: Wedge shots from **43.75**, **54.68**, and **65.62** yards

Groups:

1. **Control** - no practice
2. **Practice** - 3-week training program
3. **Practice+Preshot** - same as Practice plus a 13 step preshot routine



Preshot routines may be advantageous for multiple reasons



- Psychological explanations such as **increased confidence, self-efficacy, positive outlook**, etc
- **Attentional focus** on **external** factors important to successful performance

Focus of attention can be based on specific instructions or be self-adopted

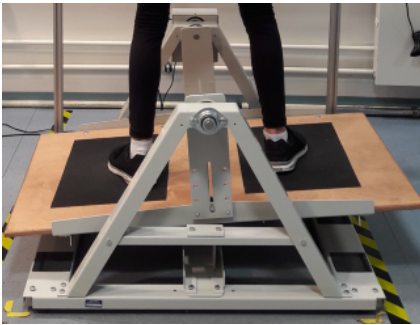
ATTENTIONAL FOCUS: The information that a performer's attention (or consciousness) is directed at

- **Internal** focus of attention: Focus on information associated with the performer's **body**
 - e.g., *"Think about the timing of your hip rotation"*
- **External** focus of attention: Focus on information that is **external** to the performer's body
 - e.g., *"Think about the tennis racquet hitting the ball"*

THIS IS **NOT** A VISUAL FOCUS...IT IS A **MENTAL FOCUS**

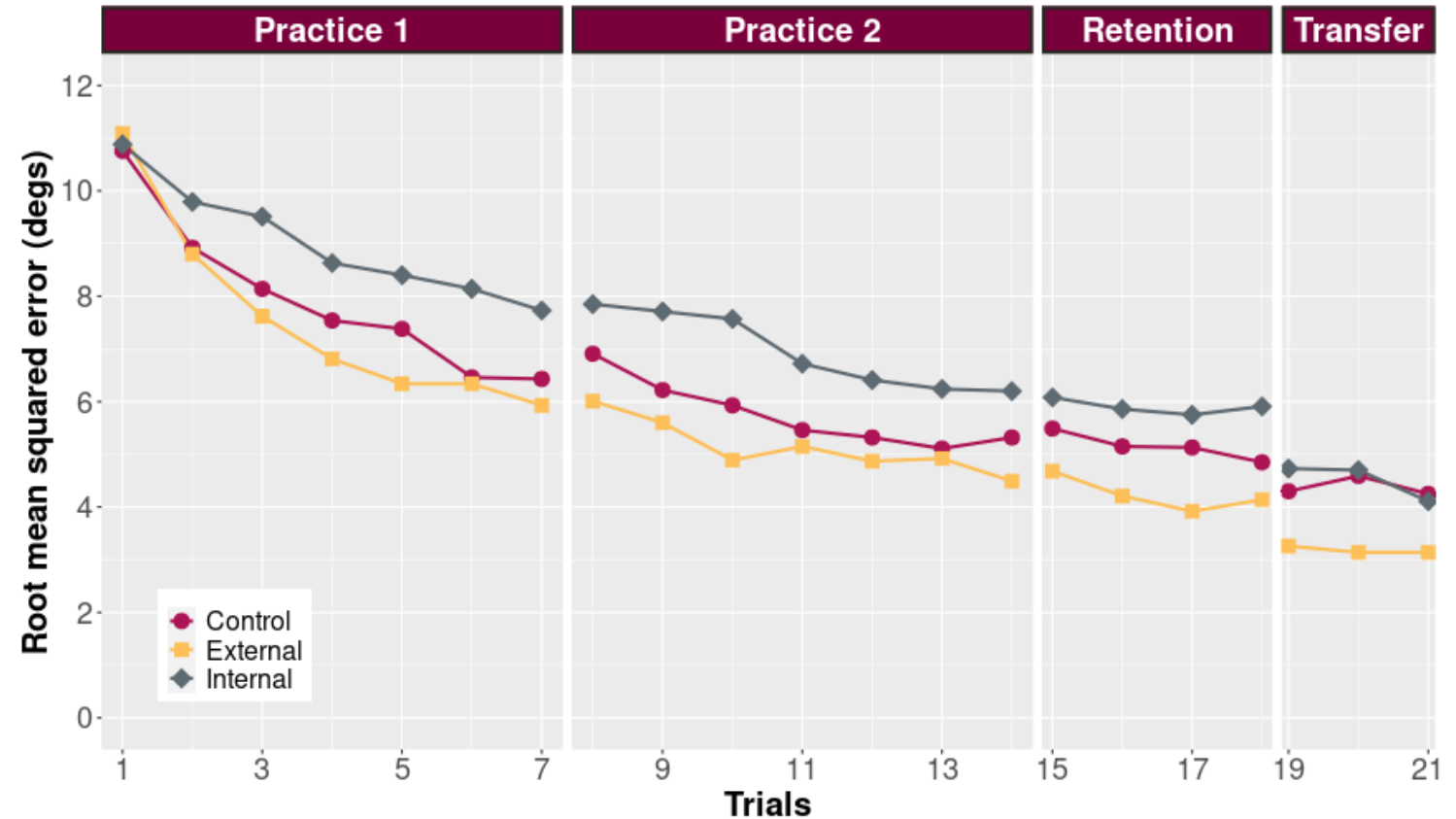
An external focus is more effective than an internal

Task: Stabilometer



Groups:

- **Internal** focus = feet
- **External** focus = markers on platform
- **Control** = no instructions given



Explaining the external focus advantage

CONSTRAINED ACTION HYPOTHESIS: **Consciously** controlling one's movements **constrains** the motor system, which **interferes** with **automatic** control process

- Focusing on the **movement effect** via an **external** focus allows the motor system to more **naturally self-organize**

Q: How could we test the predictions of the constrained action hypothesis?

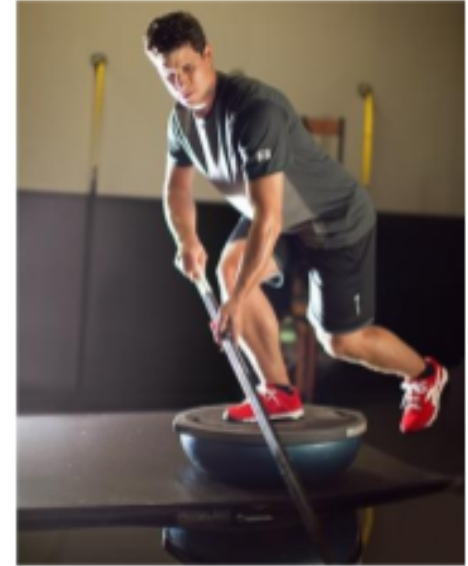
- "Consciously controlling..."
- "...constrains the motor system...interferes with automatic control processes"

Any questions?

Strength



Balance/Agility



Game Performance



Practice



Health



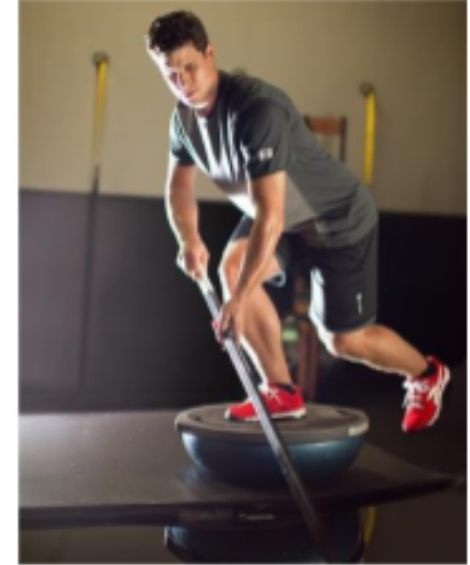
Strength



Game Performance



Balance/Agility



Practice



Augmented feedback



Health

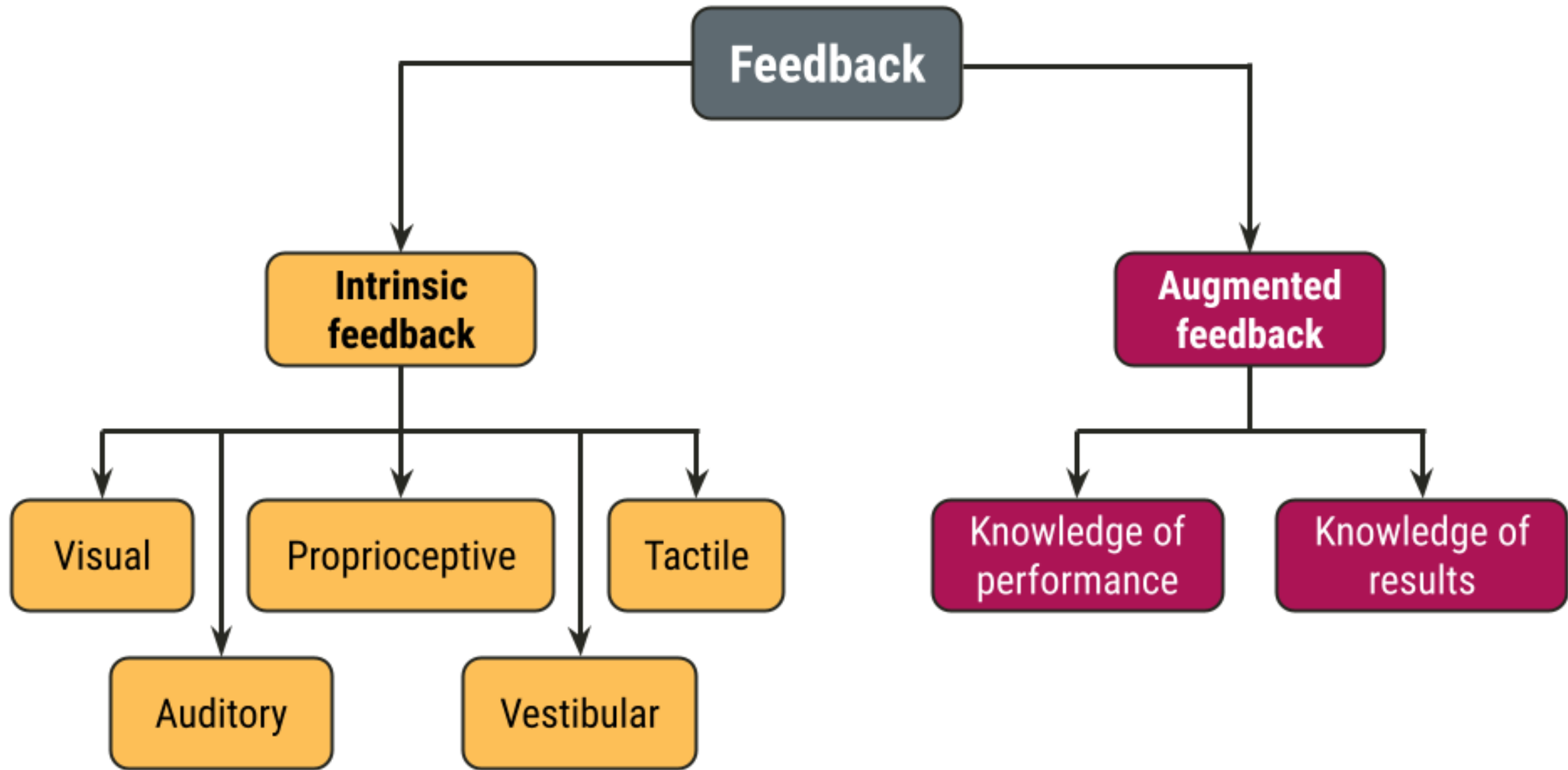


Learning objectives

1. Distinguish between **intrinsic** and **augmented** feedback.
2. Compare and contrast the **knowledge of performance** and **knowledge of results** feedback, and give examples of each.
3. Discuss the **roles** and **influence** of augmented feedback on motor learning.

Take-home message:

(Augmented) feedback plays a vital role in skill acquisition, retention, and transfer.



Feedback can arise from within the performer or come from an external source

INTRINSIC FEEDBACK: Sensory information that arises as a **natural consequence** of performing an action

- e.g., vision, proprioception, haptic, etc
- also called **response-produced** feedback, **inherent** feedback, and **task**-intrinsic feedback

AUGMENTED FEEDBACK: Information about performing an action that is **fed back** to the learner by an **external** source to **supplement** (i.e., augment) the use of intrinsic feedback

- e.g., from a coach, therapist, video-replay, etc

Knowledge of results gives information about the outcome of a performance attempt

Knowledge of results is **redundant** with the outcome



Source: <http://talkhockey.ca/wp-content/uploads/Skills-0666.gif>

Knowledge of results is **not redundant** with the outcome



Source: <https://gifimage.net/wp-content/uploads/2017/10/chinese-divers-gif.gif>

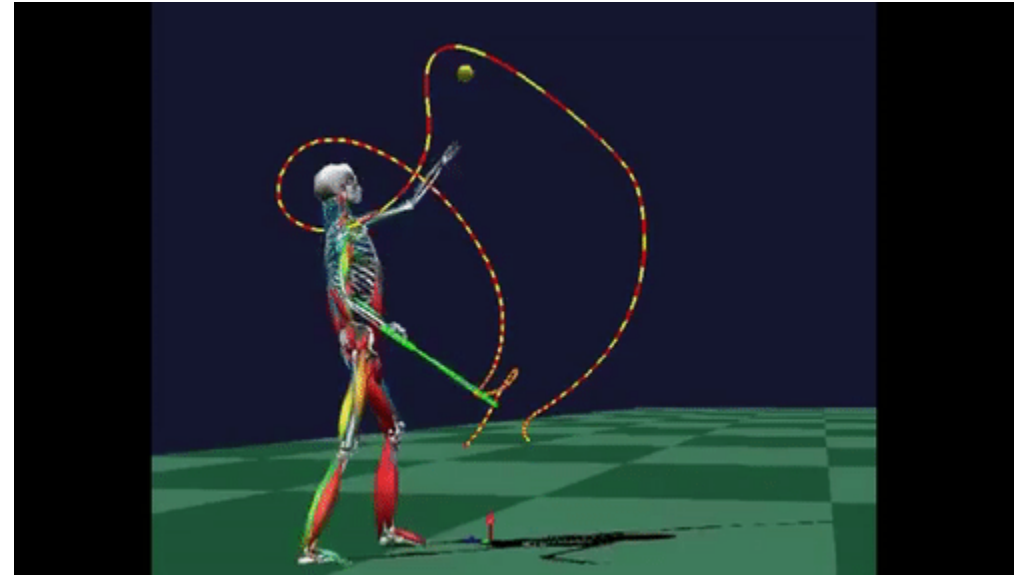
Knowledge of performance gives information about movement characteristics of a performance

See **gait** cycle



Source: <https://www.sciencefriday.com/wp-content/uploads/2017/09/giphy-68.gif>

See **trajectory** of tennis racquet during serve



Source: https://thumbs.gfycat.com/GlaringWickedBarasinga-size_restricted.gif

Augmented feedback: Similarities and differences

Knowledge of results

Knowledge of performance

Similarities

Verbal (or verbalizable)

Verbal (or verbalizable)

Augmented

Augmented

Provided after movement (usually)

Provided after movement (usually)

Differences

Information about goal outcome

Information about movement pattern

Often redundant with intrinsic feedback

Usually distinct from intrinsic feedback

Usually provided as a score

Usually kinematic information

Often used in laboratory research

Often provided in everyday activities

Paradoxical properties of augmented feedback

- Augmented feedback **can be essential** for motor learning

BUT...

- Augmented feedback **may not be essential** for motor learning

- Augmented feedback **can enhance** motor learning

BUT...

- Augmented feedback **can hinder** motor learning

Augmented feedback can be essential for motor learning

- Some performance contexts **do not make critical sensory feedback available** to the performer or learner
- **Injury or disease** can affect the **integrity of the sensory pathways** needed to detect intrinsic feedback
- Although the necessary **intrinsic feedback is available** and the individual's sensory system is **capable** of detecting it, the individual is **unable to use** the intrinsic feedback

Augmented feedback may not be essential for motor learning

- Some motor skills inherently provide **sufficient** intrinsic feedback, rendering augmented feedback **redundant**
- Some performance contexts provide a detectable **external referent** that the performer or learner can use to evaluate the appropriateness of an action
- When learners are able to **observe fellow learners** that **are also beginners** practice a new motor skill

Augmented feedback can enhance motor learning

- Some skills do not require augmented feedback to learn them, **but** receiving augmented feedback can:
 - **accelerate** the learning or skill acquisition process
 - result in a **higher level of proficiency**
- In these situations, augmented feedback is **neither** essential or redundant
- E.g., learning a **difficult coordination** pattern like the 90 degree bimanual coordination pattern
 - Use of Lissajous augmented feedback

Augmented feedback can hinder motor learning

- Augmented feedback can result in a **dependence** on its provision
- This has a **negative impact** when that same augmented feedback is **not available** in a **test** situation
- The dependency is likely when there is **minimal** intrinsic feedback available or it is **difficult** to interpret and use
- The dependence is **likely** (but not guaranteed) when a learner receives:
 - **Erroneous** augmented feedback
 - **Concurrent** augmented feedback
 - **Frequent** augmented feedback

The roles of augmented feedback in motor learning

Informational role

- **Guide** the learner to an appropriate movement solution
- Facilitate **achievement** the action goal of the skill
- Emphasized in the **Guidance** hypothesis¹
 - Feedback is both a **performance** and **learning** variable

Motivational role

- **Encourage** the learner to continue striving toward a goal through continued practice
- Secondary or a **by-product** of informational role
- Emphasized in the **"OPTIMAL"** theory³
 - Practice context can put learners into a **virtuous** or a **vicious** cycle

¹Salmoni et al 1984 (<https://doi.org/10.1037/0033-2909.95.3.355>); ²Wulf and Lewthwaite 2016 (<https://doi.org/10.3758/s13423-015-0999-9>)

Conditions best suited for knowledge of results and knowledge of performance

Knowledge of results

1. To **confirm** own interpretation of intrinsic feedback
2. **Unable** to determine the outcome from intrinsic feedback alone
3. **Motivate** oneself to continue practicing
4. Encourage **discovery learning** through **trial-and-error** problem solving
5. May promote an **external focus** of attention

Knowledge of performance

1. When skills **must be** performed according to **specified** movement characteristics
2. Specific movement components that require **precise coordination** must be improved or corrected
3. The goal of the action is to produce a specific **kinematic, kinetic, or muscle activity** profile
4. Knowledge of results is **redundant** with intrinsic feedback

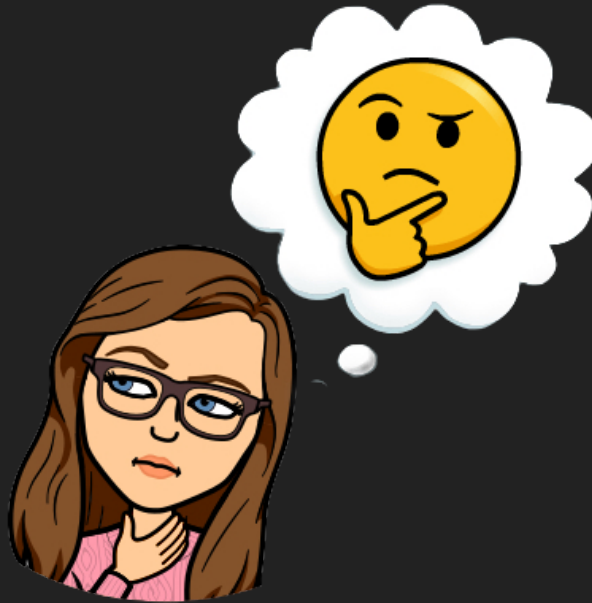
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What questions do you have?



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