

BRITISH
JUDO



1st4sport
Qualifications

1st4sport Level 3 in Coaching Judo

Module 17: Motor Learning & Skill
Acquisition



Module 17: Motor Learning & Skill Acquisition

Module Outcomes

- Knowledge of the classification of Motor Skills and the Motor Skills Continuum.
- Understanding of an Ecological Dynamics approach to Skill Acquisition:
 - Nonlinear Pedagogy (NLP)
 - Degrees of Freedom (DoF)
 - Constraints-Led Approach (CLA)
 - Representative Learning Design (RLD)

[UK Coaching: Understanding Skill Acquisition](#)

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Classification of Motor Skills

- A motor or movement skill:
 - An activity that involves voluntary muscular movement with the correct degree of muscular control.
 - Skill can be defined as “a learned, coordinated activity which achieves a goal”.

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Gross & Fine Motor Skills – Muscular Involvement Continuum

- Fine or gross skills are classified based on the amount of movement required to complete the skill:
 - Fine motor skills require greater precision in the control of the small muscles.
 - Gross motor skills involve movements of large parts of the body or the whole body, they also require less precision.

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Open & Closed Motor Skills – Environmental Influences Continuum

- A open motor skill is performed in an unpredictable environment:
 - Object or context is changing.
 - Performer must respond, movements must be adapted.
- A closed motor skill is performed in a highly predictable environment:
 - Environmental changes do not need to be considered.
 - The performer has full control of the timing of the movements and can initiate the action when they are ready.

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Discrete, Continuous & Serial Skills – Continuity Continuum

- Discrete skill:
 - Distinct start and end.
 - Skill can be repeated but performer starts again.
- Continuous skill:
 - Brings together discrete motor skills in a repetitive movement.
 - No obvious beginning or end.
- Serial skill:
 - Links together discrete motor skills in a movement sequence or pattern.
 - The order of these elements is important.

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Self (Internally) & Externally Paced Skills – Paced Continuum

- Self (Internally) Paced Skill:
 - The performer controls the speed the skill is performed at.
 - The performer controls timing and the rate.
- Externally Paced Skill:
 - The performer does not control the rate/speed.
 - Often involves the reactions of the performer.

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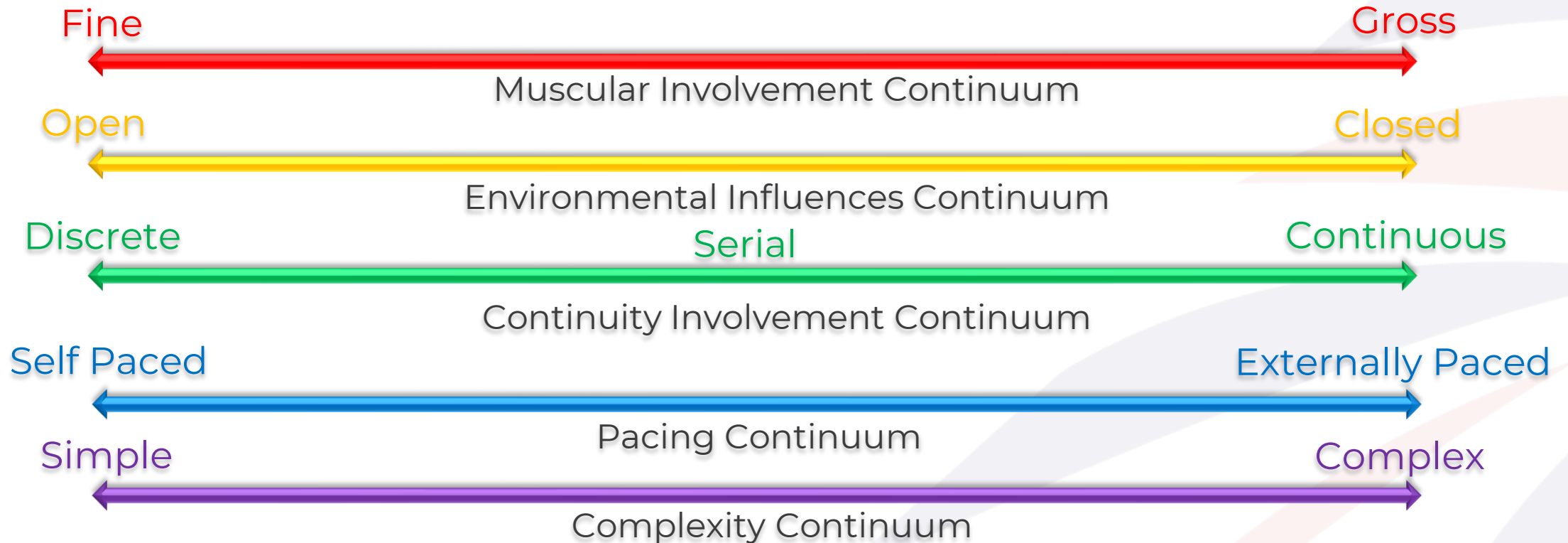
Simple & Highly Complex Skills – Complexity Continuum

- Simple Skill:
 - Small amount of information to be processed.
 - Few decisions to be made.
- Complex Skill:
 - Large amounts of information to be processed.
 - A number of decisions to be made quickly.
 - High number of sub-routines that are coordinated quickly and accurately.

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Motor Skills Continuum

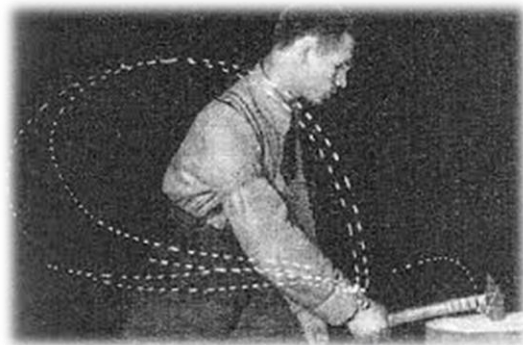
- Motor skills can not always be classified neatly and frequently fall into the continuum between the two.



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Degrees of Freedom (DoF) Problem – Freezing

- The degrees of freedom problem in motor control states that there are multiple ways for to perform a movement in order to achieve the same goal.
- The central nervous system solution to the human body's enormous variation in movement choice and control when directing is to freeze the number of possibilities at the beginning of motor learning.
- Eventually, with practice, we begin to unfreeze the degrees of freedom and the movement starts to look more coordinated.



Degrees of Freedom, Bernstein 1967

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Nonlinear Phases of Learning Movement Skills

- The stages of learning movement skills recognises that humans are complex adaptive systems.
- Phases of skill development do not just follow a linear pathway.
 - Athletes may regress, spiral, or may be in all three stages in various parts or aspects of their performance.



Stages of Learning, Newell 1985

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Skill Development – Phase 1 Assembling Coordination

- Searching for and discovering movement solutions.
 - Harnessing various parts of our bodies to work together to acquire and stabilise movement patterns.
 - Either to solve a new movement problem or difficulty has increased.
- All athletes will go through this stage developing a skill.
 - Adults also need to assemble new coordination patterns they may have lost (injury, pregnancy etc.) or never developed as children.
- Set problems, don't just give solutions.
 - Everyone is different, Let go of an ideal 'technical template'.
 - Embrace bandwidths of functional movement solutions.
 - *It is important to recognise when a movement pattern or technique is likely to cause injury or be ineffective in other situations.*

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Skill Development – Phase 2 Adaptability

- Aiming to develop both coordination stability and then as much adaptability as possible.
 - Stability of coordination is the ability to retain and transfer movement solutions to the match environment.
- Once a coordination pattern becomes stable, change elements of the practice to encourage stabilisation and flexibility of movement solutions.
 - Avoid just reducing errors and trying to repeat exact movement patterns.
 - Allow athletes to solve movement problems rather than rehearsing possible answers.
- Even in sports that require repetition and precision, athletes still need to navigate lots of adaptations (growing, recovering from injury etc.)
 - Variability is vital to avoid physical imbalances, strains, and stress injuries.

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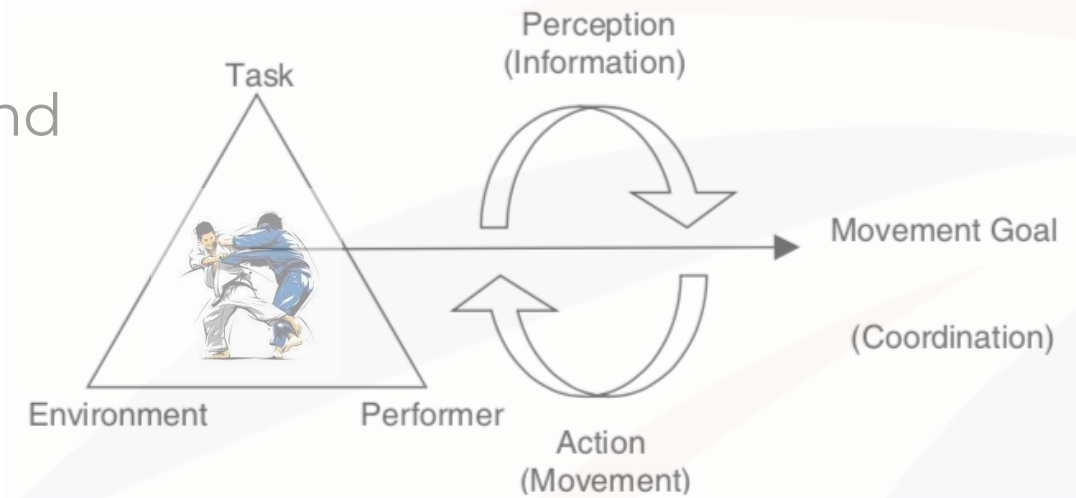
Skill Development – Phase 3 Performance

- Exploiting effectiveness and stabilising performance.
 - Athletes will move between phase develop, grow, learn, or encounter changes in the performance task and environment.
 - More independent and leading development, not everyone will get to this phase in all aspects.
- The athlete now has an increased sensitivity to the performance environment information and the ability to utilise the movement solution opportunities that are available to them.
 - Skilled athletes can pick up information that other people simply cannot access as it does not exist to them.
- Skilled athletes will hone their attunement to the perceptual information available.
 - Attuned to other player's intentions and the influence of the environment.
- The balance between stability and adaptability is being honed too.
 - Stabilising coordination patterns as close as possible to the point of instability to be fluently agile.

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Constraints-Led Approach (CLA)

- CLA is a coaching methodology which takes a context specific approach to facilitate motor learning and skill acquisition.
- Manipulation of the individual, task, and environment in practice to induce variability needed for motor learning.
 - Encourage the athlete to find their own movement solutions based on constraints and the goal to be achieved.
- Allow movement self-organisation by developing tightly connected perception and action capabilities.
 - Keep movements whole (simplify instead of deconstructing).
- Move away from the idea of predictable technical movement rehearsal.
 - Embrace the messiness of performance.



Model of Constraints, Newell 1986

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Constraints-Led Approach (CLA) – Examples of Controlling Factors

Performer	Task	Environment
Cognitive skill, emotional capabilities, mental attributes, goals, motivations, intentions	Specific rules, markings, boundaries, surfaces	Family support and networks
Physical constraints including strength, speed flexibility, height, weight and acoustic and visual function	Instructional constraints including coaching methods, types of feedback provided, exposure to discovery learning	Cultural expectations and attitudes. Social construction of age, gender, race etc.
Genes	Use of video, images, situations and models for practice	Peer group pressure, media images, commercialisation, of sport and physical activity
Specific activities undertaken during practice time	Design and scaling of practice and equipment	Access to high quality facilities for training
Amount of learning and previous experience	Design of practice tasks: Task simplification vs Task decomposition	Access to high quality learning opportunities and teaching
Develop status of various subsystems including those for locomotion, postural control etc.	Artificial aids and devices	Physical constraints such as gravity, altitude, ambient light, temperature.

Examples of controlling factors that interact in emerging sports behaviour, Renshaw et al 2019

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Representative Learning Design (RLD)

- Representative Learning Design (RLD) is the name given to designing practice where the tasks and activities reflect the performance or competition environment.
 - When athletes learn a sport in the context of the performance environment, there is a higher chance that the gains made in practice will be retained and transferred to the game.
- RLD allows for ‘perception-action coupling’.
 - This occurs when athletes learn to coordinate a skill with the information they perceive within the environment.
 - Skills athletes learn in environment that is representative have a higher rate of transfer than those learnt in a isolation.
- RLD helps athletes to recognise opportunities for action (affordances), where the skill emerges in relation to the environmental fit.

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Representative Learning Design (RLD) – Your Role as Coach

- It's natural to think, when it comes to RLD, that the sport teaches itself, this isn't the case!
 - You're in the perfect position to employ RLD in your sessions to maximise the potential of your participants.
- For instance, taking 'slices' of a contest and designing tasks that give athletes more opportunities to practise and experience that element than would happen in a tournament.
 - You could also make a task easier without taking away the information needed to build that skill.

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Representative Learning Design (RLD) – A Judo Example

- A novice player may not currently have the skillset to time an ashi-waza in randori, so regressing the practice task might be more appropriate.
- A first step of "Tug of war sweeps" would make a solid foundation.
 - By gripping each other in the middle of the mat and scoring a point if they can pull their opponent to their side of the mat or sweep them, the players will be practicing sweeps against players who have severely compromised their own balance by pulling maximally.
- A progression could then be placing targets on the floor (rubber spots, bean bags or belts) and scoring a point if you can make your opponent step on the target.
 - This will compromise their opponents weight for a shorter period of time, as it is multi-directional and allows haptic feedback and contextual skill development.
- Once a player is successful in these regressed tasks (which crucially retain the Uke not being compliant) progressing the task to a randori where they can score 5pt for a sweep, 1pt for any other throw would let them explore the throws more in context.

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Representative Learning Design (RLD) – Is My Practice Representative?

- Use the following tips as a rule of thumb for quickly judging if a practice task is representative or not:
 - Does the task let the players make decisions? Or is the player just rehearsing a pre-set movement?
 - Does the task let the players use the same skill in several different ways?
 - Does the task let the players use several different skills, i.e., tai-otoshi, uchi-mata, seoi-nage (spotlight the skill that you want to emerge, rather than prohibit everything else).
 - Is the player performing an action against a resisting opponent, moving how they would in a contest?



RPAT (Representative Practice Assessment Tool) Krause et al., 2017