C^4-A-R-B

TRAINING

Training Principles, Methods, and Drills for:

C^4 – Coordination-Cognitive Function-Core-Cardio

A – Agility

R – Reaction Time

B – Balance

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C^4-A-R-B
INSTRUCTOR TRAINING CORRESPONDENCE COURSE

COURSE COMPLETION INSTRUCTIONS FOR CONTINUING EDUCATION CREDITS

Prior to reading the Manuals and reviewing the PowerPoint videos:
Complete __all__ information on the **FINAL EXAM cover sheet**. Exams **will not** be processed unless all information is **complete** and **must be legible**!

Suggested Course Completion Sequence:
Step 1. Read the Training Manual.

Step 2. Review the PowerPoints (view videos in PowerPoint slides).

Step 3. Practice the movement patterns and drills.

Step 4. Complete the **FINAL EXAM ANSWER FORM**.

Step 5. Complete the provided **Course Evaluation** form.

Return the ***Course Evaluation, Final Exam Cover Sheet and the Final Exam Answer Form*** to the email or address listed on the Exam Cover Sheet.

All 3 documents (Final Exam Answer Form, Final Exam Cover Sheet with Control Number, Course Evaluation) **must be returned for the exam to be processed! All information must be legible!**

To pass the course you must complete the exam with a score of 80% or better. Notification of course results and Certificate of Completion is **emailed** to the email address you provide.

There is a $10 charge to replace certificates.

EmpowerUSA's C^4-A-R-B program course objectives are to:
- Identify who can benefit from training
- Explain why the methods and principles behind the program are safe and effective
- Provide the rationale for training routines that include the following components:
  - Coordination
  - Core
  - Cognitive function
  - Cardio
  - Agility
  - Reaction time
  - Balance
- Instruct how to perform various body movement patterns safely and effectively, including:
  - Single Step Patterns, with and without Arm Movements
  - Combination Step Patterns, with and without Arm Movements
- Teach how to apply the concept of 'Simple to Complex' when designing and leading workout routines.
- Identify and explain the numerous possible movement pattern variables that can be modified to properly challenge an individual.
- Provide information about and instruction for various types of drills that could be used in a workout.
- Teach the 5 basic single stepping patterns, along with various ways that these patterns can be combined into 2-Step and 3-Step patterns, with and without arm movements. These include:
  - V-Step
  - Lateral Step
  - Reverse V-Step
  - Anterior Cross-Over Step
  - Posterior Cross-Over Step
- Provide teaching methods and drills that challenge and improve reaction time.
- Explain methods that can be used to increase cognitive function during movement performance, thus improving brain health.
- Teach the 63 potential foot positions that, if integrated into workouts, can enhance hip mobility, coordination, and agility.
- Overall, provide trainers with new and unique training drills and methods that will keep participants positively motivated and challenged enough to continue to enhance the quality of life though improved function and performance of activities of daily living.

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INTRODUCTION

WHAT IS C^4-A-R-B TRAINING?
C^4-A-R-B is an acronym. I used this term because I believed that when people first saw the term, they would think it is related to nutrition! Lol, I tricked you! The term has nothing to do with nutrition and everything to do with some very important components of an overall wellness and fitness program.

C^4 – there are 4 sub-components for this:
- Coordination - improved by learning and practicing various upper and/or lower body movement patterns and combinations of movement patterns.
- Cognitive function - every drill can be used to challenge brain function by forcing the mind to stay engaged through cueing, mental tasks, etc. Impacts coordination, agility, reaction, and balance, too.
- Core - improved through the unique footwork patterns and adding various types of loads, position changes and movement patterns to the upper body.
- Cardio - perform the patterns continuously to elevate the heart rate and enhance aerobic endurance once the movements are "mastered".

A – Agility - improve the ability to change direction quickly.
R – Reaction Time - decrease the time between a stimulus (various cues) and the desired movement.
B – Balance - improved by manipulating variables that influence both static and dynamic balance.

WHO CAN BENEFIT FROM C^4-A-R-B TRAINING?
These components are often considered for athletic training – how each one can impact improved athletic performance. What population is normally concerned about improving athletic performance? Teens, young adults and, maybe, middle-aged to older adults who continue to actively compete in athletic events.

How often do non-athletes think about improving any of these components in a fitness/wellness program? How often do trainers consider these components when designing workout routines for non-athletic youth, teens, and adults?

I have typically observed that coordination, cognitive function, agility, reaction time and balance become an important consideration when "working with older adults!" I agree – it should be an important part of a program for an older adult…., but why do we wait until a certain age before we make those types of training a priority? Think about these questions/statements:
- Aging, beginning in our late twenties, involves some level of decline in our physiological function – unless we do the 'things' necessary to stop it or slow it down.
- It is never too late to improve the condition and function of the body through exercise, which is why older adults are encouraged to participate in safe and effective fitness programming.

- **Is it possible to achieve the same level of physical improvement that could be achieved at a younger age, if we begin exercising at an older age?**
- Who would achieve the highest level of potential function and benefit the most?
  - A 25-year-old, non-athlete who begins working on coordination, cognitive function, agility, reaction time and balance and continues to include it in the fitness regimen throughout life, versus
  - A 65+ year-old, non-athlete, who just starts to include coordination, cognitive function, agility, reaction time and balance training into a workout program?

The C^4-A-R-B Program can be integrated into any exercise routine, including kickboxing or boxing fitness, and may especially be beneficial for persons with Parkinson's Disease (EmpowerUSA's TKO-PD program). So, C^4-A-R-B training should be included in EVERYONE's workout routines!

WHY C^4-A-R-B TRAINING?
Let's identify "why", by discussing each component of C^4-A-R-B training, people should include these components into a lifelong, regular fitness routine.

Why Coordination Training?
Coordination exercises can:
- Help to build more muscle.
- Increase daily energy levels.
- Improve agility and flexibility.
- Enhance concentration and memory.
- Stimulate the release of endorphins (called happy hormones).
- Enhance self-esteem and self-confidence.
  - Check out the expression on people's faces when they finally "master" (or at least improve performance of) a movement pattern that was once a difficult challenge for them!

Why Cognitive Function Training?
Exercise prevents mild cognitive impairment by improving blood flow. To start with, exercise sends your heart racing, which pumps blood around your body, increasing the oxygen to your brain. Exercise can also help to stimulate the production of growth hormones that help to create new brain cells.

Exercise can also boost memory and thinking indirectly by improving mood and sleep, and by reducing stress and anxiety. Problems in these areas frequently cause or contribute to cognitive impairment.

Research suggests that engaging in mentally stimulating activities helps build your cognitive reserve, your ability to withstand adverse brain changes before you exhibit symptoms. Experts believe that people who have been exposed to more brain-stimulating activities may be more resilient to these negative effects. It is believed that new skills and habits create more connections between brain cells and brain areas. The

more new things a person learns, the more connections there are, so even if some of them die as a result of brain disease, there are still some connections that remain, which allows a person to remain more functional."

Why Core Training?
The core is where all body movements originate – that is why it is important to train (muscular endurance, strength, power, and flexibility) the core in all possible movement patterns from a variety of positions while manipulating a variety of variables (load, direction of force, cadence of movement, etc.). The physical condition of the core will impact its abilities and capabilities to influence coordination of movement, agility in movement, reaction time for movement and balance while moving.

Why Cardio Training?
Improvement of cardiovascular (or cardio-respiratory) function is not a primary objective of C^4-A-R-B training. When a person starts learning a new movement pattern, it should be performed slowly while fully engaging the brain to learn the movement pattern. This will not elevate the heart rate enough to experience significant aerobic endurance benefits. However, as a person practices a movement pattern, coordination, agility, reaction time and balance are improved enough to be able to increase the cadence (speed) of movement, which will require a more elevated heart rate to continue moving for a longer period.

Training is specific. Aerobic endurance is improved for this specific movement pattern, as well as general aerobic conditioning, by practicing the movement pattern at a speed that increases heart rate for an extended period. Keep in mind that coordination, agility, reaction time and balance are negatively impacted by muscle fatigue. So, once a person becomes familiar with a movement pattern and can perform it proficiently for a longer period before fatigue begins to influence the movement, a person's ability to maintain high levels of coordination, cognitive function, agility, reaction time and balance.

Why Agility Training?
Agility is our ability to change directions quickly. While it is useful in many sports, it is also useful in **everyday life for avoiding obstacles** and preventing injuries.

When you think of agility training you immediately imagine some of the top athletes aiming to gain performance benefits for their given sport, but recent research suggests that this style of training can also benefit older individuals. Simply being active isn't enough to gain long lasting health benefits for aging individuals especially as it relates to preventing injuries related to falls. Research points out that 33% of folks 65 years of age and older fall and adding in decision-making skills combined with change of direction, sudden stops and starts as well as acceleration and deceleration can be crucial for preventing injuries.

Agility training can improve dynamic balance, which is the ability to maintain control of a moving center of mass over a changing base of support. Reactivity and quickness drills can enhance natural reflexes, helping you to move faster in almost everything you do.

Agility training may improve reflexes and ability to execute rapid body movements enabling effective balance control. Visual training may improve visual processing, attention and cognition of visual information pertaining to obstacle avoidance.

Why Reaction Time Training?
Reaction time is very important for everyday life. It enhances safety and ensures that a person's body is primed to move whenever necessary. Think about all the activities people do every day that rely on quick reaction times to perform successfully.

Reflexes slow with age. Physical changes in nerve fibers slow the speed of conduction. And the parts of the brain involved in motor control lose cells over time. This decline in function can be slowed by including training activities that requires the brain to observe and interpret certain stimuli and then quickly respond.

Why Balance Training?
Many things change because of aging. Muscle tone, eyesight, and basic limb strength are just a few things that can lead to falls. According to recent studies, one in five hip fractures in older adults leads to death within one year of the incident. Secondary infection after surgery, pneumonia, and exacerbation of underlying disorders (the issue that caused the fall in the first place) are all reasons individuals have a higher mortality rate after a hip fracture. Of course, there are many reasons seniors should add balance training to their routine. Here are a few.

- Mobility - A good balance routine added to a regular exercise regimen will help people stay mobile longer. Feeling unstable on your feet can be a vicious cycle. First you feel a little unsteady when performing certain activities, next thing you know, you are avoiding that activity and reducing your overall mobility. Since you are not moving as much as you used to, your strength and balance are reduced, leading to more instability on your feet.
- Muscle tone - exercise and balance routines help improve muscle tone, which means better balance and more cushion for the bones in case of a fall.
- Better Reaction - exercise and balance routines improve reaction time (catch yourself before you fall).
- Bone Strength - exercise, particularly resistance training, builds stronger bones.
- Cognitive Ability- regular exercise keeps the mind sharp as well, which means better processing of the environment and the ability to avoid risky situations.
- Overall Health - even if falling is not a big concern, it is important to remember that exercise and balance routines can help improve overall health. The results include stronger muscles and bones, better cardiovascular function, and improved self-confidence, all of which are great for health and well-being.

LOWER BODY MOVEMENT PATTERN OPTIONS & PROGRESSIONS

Single Step Patterns

Single Step Patterns include:
- V-Step – starting stance positions both feet aligned (side by side) and close together, then step forward, at a 45° angle, with one foot. Return that foot to the starting position and then step forward at a 45° angle with the other foot. This is one complete V-Step.
- Lateral Step – starting stance positions both feet aligned (side by side) close together, then step laterally (straight to the side) with one foot. Return that foot to the starting position and then step laterally with the other foot. This is one complete Lateral Step.
- Reverse V-Step – starting stance positions both feet aligned (side by side) close together, then step backward, at a 45° angle, with one foot. Return that foot to the starting position and then step backward at a 45° angle with the other foot. This is one complete Reverse V-Step.
- Anterior Cross-Over Step – starting stance positions the feet wider apart than the V-Step, Lateral Step and Reverse V-Step to perform this step. It is recommended to have the feet positioned as if standing and talking to someone (normal side-to-side spacing). One foot steps across the front of the other foot, to a position that the person can easily remain balanced. The base leg should flex while stepping, to help maintain balance. Keep the shoulders square to the front – minimize shoulder rotation with the step to get maximum effect from this step. Return the foot back to the starting position. Repeat with the other foot and return to the start position.
- Posterior Cross-Over Step– starting stance positions the feet wider apart than the V-Step, Lateral Step and Reverse V-Step to perform this step. It is recommended to have the feet positioned as if standing and talking to someone (normal side-to-side spacing). One foot steps across the back of the other foot, to a position that the person can easily remain balanced. The base leg should flex while stepping, to help maintain balance. Keep the shoulders square to the front – minimize shoulder rotation with the step to get maximum effect from this step. Return the foot back to the starting position. Repeat the step with the other foot and then return it to the start position.

Note: The starting position for the feet is one of the variables that can be manipulated to change the level of challenge for stepping pattern. This is covered in more detail later. The important thing to do is start simple and gradually increase complexity. Observe people move to learn where they are successful and then build on that. The normal or regular stance that is described above has proven to be the best starting point whenever I have taught these exercises, but you need to determine what will work best for you.

Instruction – Simple to Complex

Define 'Simple' – in this situation, 'simple' would be the result of breaking down a movement or movement pattern into the smallest component possible.
- For example, a V-Step involves stepping with both feet – one foot steps forward at a 45° angle, then steps back to the start position. Then, the other foot steps forward at a 45° angle, then steps back to the start position.
  - The V-Step could be broken down into two components:
    - Initially learn to step with one leg, then learn to step with the other leg.

Define 'Complex' – in this situation, 'complex' would be the result of performing the full V-Step pattern by alternating single repetitions from one leg to the other.

Eventually, the full V-Step pattern becomes 'simple' for an individual to perform. More movements would need to be added to the V-Step to increase complexity and challenge.
- For example, add a Jab to each V-Step foot movement – punch forward with the right arm when you step forward with the right leg and punch forward with the left hand when you step forward with the left leg.

Eventually, after several practice repetitions, this movement combination will become 'simple' for an individual. One way (there are numerous options) to increase complexity to this combination is to change the punching arm.
- For example, change the Jab to a Cross punch for each V-Step foot movement – punch forward with the **right** arm when you step forward with the **left** leg and punch forward with the **left** hand when you step forward with the **right** leg.

There are many possible variables that can be manipulated to make a movement pattern move from 'simple' to 'complex'. Hopefully, the examples provide that understanding. What may be 'simple' for someone who is experienced in your program, may be 'complex' for a brand-new participant.

The first time you lead a workout with an individual client or a group of participants you will not know the current capabilities or abilities of each person. For this reason, be a trainer who is cautious, conservative, and observant – start simple! Here are some reasons to start simple:
- Gives you a chance to observe and learn where each person is "at", as far as performing basic movements.
- Enhances the level of safety of each person.
- Ensures that each person will experience success at the beginning, which is important for remaining positive and motivated. Imagine what would happen if you asked people to do something that was so difficult that they became very frustrated and possibly embarrassed. Would they continue in your program? Probably not, which means they would miss out on all the positive they could experience by exercising in your program!

How do I take a 'Single Step' movement pattern from simple to complex? Here is an example using a V-Step movement pattern:
- Teach people how to do half of the V-Step – step with one leg only.
    - Make sure they are stepping at the correct angle (45°) with the foot pointing in the direction you assign – typically toes pointed straight forward.
        - If people have difficulty with the angle of the step, position an object on the floor in such a way that their step will be guided:
            - Directly in front of them so they must step to the side of the object to avoid it, or
            - Position it so the object is the target for the step - they step towards it.
    - Perform repetitions on the same leg to build coordination and balance.
- Repeat the process with the other leg.
- Perform practice repetitions – simple to complex (example – I use a "descending reps" model that works well):
    - Perform 16 steps on one leg, then switch to the other leg and do 16 reps.
    - Decrease to 8 repetitions on each leg – do each leg twice.
    - Decrease to 4 repetitions on each leg – do each leg 4 times.
    - Decrease to 2 repetitions on each leg – do each leg 8 times
    - Decrease to 1 repetition on each leg (alternating legs – this is the V-Step!) – do 16 repetitions

This "simple to complex" system should be applied to any Single Step Pattern and to any movement combination, as well. The main objective is to give people enough practice to become proficient in performing the movement pattern and then gradually decrease the number of reps performed before the movement pattern is changed in some way (different side, different movement pattern, etc.).

Recognize each person's success – when something that was once 'complex' for a person, becomes 'simple', that is success. Reward the sense of accomplishment for that person. Encourage him or her to seek more challenges that they can overcome and continue to grow and improve!

Movement Pattern Modification Options
There are several possible options for modifying (decrease or increase) the level of activity intensity and/or movement pattern complexity. Following is a list of variables that can be manipulated, along with descriptions/instructions for how to use each one to regress or progress your clients and/or participants.

Remember, safety is the highest priority. Manipulation of any variable must be done in the safest possible way. You want to challenge people to improve, but not overwhelm them by changing too many things, too much or too quickly. People need to feel successful, not frustrated. Your encouragement is important. And your ability to determine what the proper level of modification is, for each individual, is vital.

Step Distance/Stride Length

How far a person naturally steps will depend on his or her current level of physical capability and ability, related to flexibility, muscle conditioning, sense of balance, coordination, agility, etc. The goal of this program is to increase or improve each person's capability and ability.

- People who do not trust their ability to stay balanced may shorten their stride length and typically assume a head forward and looking down position in attempt to use their vision to help maintain balance. Posture is negatively impacted. The net result is that balance becomes more difficult to maintain.
- A trainer must observe and discover, for each individual, what maximum stride length is within that person's comfort zone – for each type of movement pattern (V-Step, Lateral Step, Reverse V-Step, Anterior Cross-Over, Posterior Cross-Over, etc.).
- Challenge people by:
    - Instructing them to take short steps (shorter stride length than normal), and keep the body centered. This may be difficult for some people who tend to lean the upper body into the direction they step. This will train them to keep the upper body mass centered, which should enhance balance.
        - Dynamic balance is sometimes compromised when the base-of-support (foot position) is too narrow, especially if the upper body mass moves outside of the base-of-support (like when the upper body leans outside of the foot position).
    - Instructing them to take a longer stride length than normal. Maintaining balance is more challenging because the stepping foot will be off the ground, or it will be non-weight-bearing (if you slide your foot instead of stepping), for a longer time.
        - Practicing longer stride lengths also improves mobility and flexibility of the involved joints. When a joint is only utilized in a small portion of its functional range of motion, the muscles and connective tissue around that joint adapt to the limited movement, which would further compromise the ability to maintain balance.
    - Mixing Stride Length instructions within a single step pattern or step pattern combination.
        - Examples: V-Step & Lateral Step combination - instruct participants to:
            - Take long stride lengths on the V-Step and short stride lengths on the Lateral Step, or
            - Take long stride lengths when stepping with the right leg and short stride lengths when stepping with the left leg, or
            - Alternate long stride lengths and short stride lengths for each combination repetition (1st time – long stride lengths, 2nd time – short stride lengths, etc.)
            - Another option for these would be to include the normal stride length in the mix!
        - There are many more possible options for mixing stride lengths. The important things to remember are that:
            - Safety for each individual is the highest priority,

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- Each person will have different levels of potential ability and capability, and
- Effectiveness is important and based on the individual – make sure each person is experiencing the expected results.

Body Height

Body height is related to the degree of hip, knee, and ankle flexion a person is positioned in, while moving. As soon as the knees flex, the hip and ankle joints will also flex, causing numerous muscle groups that directly or indirectly act on those three joints and other joints within the kinetic chain, to increase in activation level.

- Move from a neutral, anatomic position to hips and knees flexed, and ankle joint increases in dorsi-flexion – feel what that does to the quadriceps, glutes, and calf muscles (there are many more muscles involved – these are just the easy ones to palpate). They contract harder to hold whatever position you want to remain in.
    - The more you flex the joints, the higher the activation levels of the involved muscles.
    - Then, when you add movement, the activation levels are constantly changing, as the roles for the muscles are changing (agonist, antagonist, synergist, stabilizer, neutralizer, etc.).
    - Here are ways to add challenge by adjusting the body height while moving:
        - Lowering the body by increasing hip/knee/ankle flexion increases intensity
            - Static (maintain the same height through the movement),
            - Dynamic (change height through one repetition – move up and down)

Step Height Range

This is how high off the ground surface a person lifts the stepping foot. Lifting the foot off the ground does two things:

- Forces the person to balance on one foot for the time duration of the step.
    - The higher the step, the more balance time required.
- Increases the amount of work performed by the involved muscle groups.
    - The higher the step, the higher the intensity of the step.

The step height ranges from:

- Slide step (no lift) – for safety:
    - The ground surface should be friction-free or very low friction
    - Be aware of the ground surface and the type of shoe each person wears.
        - Example – carpet may appear to low friction, but that can be impacted by the type of shoe a person is wearing (mainly the level of possible friction created by the material of the shoe sole).
- Step-over (amount of lift based on instruction or object height) – for safety:
    - Use proper form – the upper body should remain centered and upright, with only a slight lean forward when stepping-over.
    - Observe an individual's ability to maintain balance while stepping, and adjust accordingly, if necessary.

Load

This is where the principle of Progressive Overload can be applied to provide new challenges as a person adapts to the current physical stresses experienced. Changing the vertical load will impact muscle function, which could potentially influence coordination, agility, and balance.

- Coordination – if the body is required to move a higher-than-normal load, new or additional muscle tissue may need to be recruited. The coordination of the new muscle tissue activation sequence must be learned and practiced to improve in movement efficiency.
- Agility – moving an increased load will challenge agility; the movement patterns need to be practiced, to maintain or improve agility.
- Balance – the muscles need to learn to handle and react to movement of a new and higher load.

Start with body weight, then gradually increase the vertical load.
- When vertical load is increased, you may need to simplify the movement patterns. As a person gains proficiency at performing the simplified, loaded movement pattern, the complexity of the movement pattern can be gradually increased.

Load Force Direction

Load can be applied to and/or against movement in and from various directions – not just vertical.

- Gravity-dependent (vertical/downward) force application. This load force direction:
  - Assists or causes downward movement (descending into a squat or lunge) and forces eccentric contraction of specific muscle groups.
    - Higher loads increase the level of eccentric contraction force.
- Horizontal/Oblique (all directions except vertical) force application – may be applied directly or obliquely with (assists) or against (opposes) movement.
  - This type of force application impacts the level of activation required by agonist, antagonist, synergist, stabilizer, and neutralizer muscle groups – all of which will require the brain to learn how to efficiently perform the new movement patterns.

Horizontal/Oblique load force can be applied using anchored elastic resistance or a cable/pulley machine.
- Simple to complex application could include:
  - Single to multi-planar application,
  - Single to multi-angle application, or
  - A combination of both multi-planar and multi-angle force applications.

Step Rate/Cadence

Step rate, also known as step cadence, is how many steps can be or are performed within a specific time frame. For this variable, the concept of "simple to complex" would translate into "slow to fast" or "few to many".

This variable includes two considerations:

- The speed at which each step is performed.
  - People can adjust the speed of their normal gait (or walking/step pattern) to be slower or faster than normal.
- The transition time between the first half of a single step pattern or in between each step pattern of a combination step pattern.

How often do we think about challenging people by asking them to vary their step rate/ cadence while performing a movement pattern? It is not a requirement that every step is performed at the exact same speed or cadence as the previous step or the next step in a movement pattern.
- How much do you think the mind will be engaged if we ask people to change the step rate/cadence at various points in a single step pattern or a combination step patter? Would this be a way to add some cognitive challenge into the exercise?!

Should include rate or speed changes during all phases of movement, which includes:
- Execution phase
- Transition phase
- Retraction phase

Slower step speeds, rates or cadences will increase the time-under-tension of the muscle groups involved, which will also improve muscular endurance and the ability to stabilize static and moving joints.

Level of Stability
The 'simple to complex' concept applied to this would translate into 'maximally stable to maximally unstable' – the term 'maximally' is relative to the individual, especially for an unstable environment. What is slightly unstable for one person may be maximally unstable for someone else.

Stability should not be challenged until a person is 100% confident in the ability to move with balance and coordination. Safety is the number 1 priority! There are some situations where, even though a client feels 100% confident in performing a movement pattern, I have a safety measure in place when I begin to adjust the level of stability in which the person is performing the movement patterns.
- For certain clients, when I change the level of stability of a movement pattern, I have them perform the movements next to a ballet bar, or some other very stable item that could be used to grab or lean against for a balance point. Having this "safety tool" nearby relieves the fear the person may have for performing a movement pattern in a less stable environment.

Stability modifications for each possible starting position:
- Standing
  - Foot position and spacing (Base of Support vs. Center of Gravity)
  - One foot unstable or both feet unstable,
  - Base leg on an unstable surface, or
  - The stepping leg moving onto an unstable surface.

- Seated
    - Modify the amount of your body that is in contact with the seat, or
    - Modify the stability (hardness or softness) of the sitting surface. Examples:
        - Hard chair, balance pad on the seat, BOSU, Stability Ball, etc.

Foot Position
The feet can be placed into 63 different positions (reference the Foot Position Diagram), both at the start position and the landing position after a step is performed, if three options are considered:
- Lateral Spacing - distance between the feet – regular, wide, and narrow
- Anterior/Posterior Alignment – staggered feet (one foot more forward than the other)
- Foot Direction – the direction that the feet are pointing, relative to each other
Important Note: The number of '63' possible foot positions is based on **one (1)** single position being considered for each - 'Regular', 'Wide' and 'Narrow'.

Lateral Spacing
'Regular' distance would be considered the spacing between the feet when standing normal, having a conversation with someone.
- There would be only one position for this spacing.

'Wide' distance would be any position that has more distance between the feet than the normal stance.
- A 'Wide' stance has higher lateral stability but may have lower anterior/ posterior stability.
- A 'Wide' stance could have several different distances that would only be limited by:
    - Hip joint flexibility in the lateral movement pattern (abduction – frontal plane).
    - Core stability - ability to hold the upper body in a safe position.
    - The ability to remain balanced while stepping and landing

'Narrow' distance would be any position that has less distance between the feet than the Regular distance.
- A 'Narrow' stance has lower lateral stability and may have less anterior/posterior stability.
- A 'Narrow' stance could have multiple distances, but the number is limited because of skeletal structure.
    - Most might think that having the feet aligned, one foot in front of the other, is the least stable position, but for some people and some step patterns, i.e., the two 'Cross-Over Steps), a cross over position may be less stable.

Anterior/Posterior Alignment
There are several possible front-to-back spacings between the front foot and the rear foot. The spacing range would be limited by three main factors:
- Flexibility in the hip joints sagittal plane movement pattern (flexion and extension)
- Core stability – ability to hold the upper body in a safe position
- The ability to remain balanced while stepping and landing

For safety, observe and assess participants to determine a safe distance between front foot and rear foot, in all 3 Lateral Position spacings (Regular, Wide & Narrow).

- A possible start position for this "staggered foot position" assessment is heel-to-toe – the front foot heel is aligned laterally with the rear foot toe.

Foot Direction

Foot direction positions can be manipulated on one or both feet. The 3 options include:

- Foot Forward – toes pointing straight forward
- Foot Outward – toes pointing away from the body's midline
- Foot Inward – toes pointing in toward the body's midline (known as "pigeon-toed")

Flexibility of the hip joint muscle groups can impact a person's ability to position the feet in each of these directions. When observing and assessing people for the ability to use Foot Direction as a variable for movement, consider the following:

- If Hip External Rotators are tight and Internal Rotators are weak, the Foot Forward and Foot Inward positions may be difficult to move into or maintain.
- If Hip Internal Rotators are tight and External Rotators are weak, the Foot Forward and the Foot Outward positions may be difficult to move into or maintain.

Find where a person is successful in performing a movement pattern with specific foot positions but try to supplement their training with safe and proper corrective flexibility and strengthening exercises to improve range of motion and movement capabilities.

Foot Directions can be combined. Some examples include:

- Step pattern can start with a Foot Forward position, step into a Foot Outward position and then return to the start position in a Foot Forward position.
- Step pattern could start with a Foot Forward position, step into a Foot Outward position and then return the start position in a Foot Inward position.

Upper Body Position

Highest priority - changing the upper body position during lower body movement must be done safely! To train movement functionally the various combinations of upper and lower body movements should be performed. Learning and practicing the many movement patterns required to safely perform activities of daily living (ADLs) is vital.

Upper body movement, with or without lower body movement, impacts center-of-gravity and base-of-support, and the ability to maintain balance. Involved joints include:

- Neck/Cervical Spine – flexion, extension, lateral bending, and rotation
- Shoulder (Gleno-Humeral) – abduction, adduction, flexion, extension, horizontal adduction, and horizontal abduction
- Thoracic Spine – flexion, extension, lateral flexion, and rotation
- Lumbar Spine – flexion, extension, lateral flexion, and rotation
- Hip Joint:
    - Standing – flexion, extension, abduction, adduction (closed chain – standing with feet anchored)
    - Seated – flexion, extension (closed chain – seated)
- Elbow – flexion, extension (minimal impact unless movement is loaded)

When the upper body changes position, with or without lower body movement, the body's center of gravity changes and the base-of-support is challenged. For this reason, the muscles that stabilize the base-of-support when the upper body is moving must be trained. There are numerous potential bases-of-support, including:

- Feet – standing
    - One or both feet
    - On heels
    - On ball-of-the-foot
    - On outside edge of feet
    - On inside edge of feet
    - All the different potential foot positions for:
        - Side-to-side spacing
        - Front-to-back spacing
- Knees – kneeling
    - Changing hip positions – changes the direction of the lower leg, relative to the upper body (internal or external rotation, anatomical/neutral)
- Gluteus Maximus (Butt!) – seated
    - Both glutes
        - Fully in contact with seat
        - Sitting on front half of both glutes (on the edge of the seat)
    - One glute – requires a bit of a side lean, with a slight lateral spinal curve into the lean, by the upper body; always work both sides!
        - Fully in contact with seat
        - Sitting on front half of one glute (on the edge of the seat)
    - Foot contact
        - Both feet on the floor – see the foot position options under 'Standing'
        - One foot on the floor - see the foot position options under 'Standing'
        - No feet on the floor
    - Leg position (will impact foot position)
        - Knees bent
        - Spacing between knees
        - Knees straight (feet will be on heels)
        - One leg with foot in contact with the floor
        - Two legs with feet in contact with the floor
        - Change height of knees relative to hip joint, while seated
            - Both feet higher than the hip joints
            - One foot higher than the hip joints

Important Safety Note: Do not use a body position that requires the hip to move into 90° or less (knee above hip) joint position if a participant has had a hip replacement.

- Any combination of the options above!
- Gluteus Maximus (Butt!) & Back of legs – seated on the floor, legs outstretched.
    - Spacing between the legs/feet
    - One leg touching the ground
    - Both legs touching the ground

The stability of each of the listed bases-of-support can be incrementally adjusted from 'maximally stable' to 'maximally unstable'. Examples include:

- Standing on a solid, hard surface (hardwood floor) to standing on a .5" flat mat to standing on a 3" balance pad to standing on a BOSU
- Kneeling on a 1" flat mat to kneeling on a 3" balance pad to kneeling on a BOSU
- Seated on a hard surface chair to sitting on a padded chair to sitting on a balance pad (on a chair) to sitting on a capsule-shaped stability ball to sitting on a round stability ball.
- Seated on a hard surface floor to sitting on a 1" soft mat to sitting on a balance pad.

The muscles of the involved/activated kinetic chains will react to any upper body position change, to maintain balance (cause, control, or prevent movement) and successfully complete the desired movement pattern(s).

Sensory Environment Progressions

Vision is the main sensory environment that is manipulated in this program. Vision is extremely important to the ability to maintain balance – for this reason, vision should only be manipulated when it is safe to do so.

When beginning to consider using this variable, it would be wise to do four things:

- Make sure all possible unsafe situations are addressed. The space should be clear of objects that could be dangerous if a person was to lose his or her balance.
- Make sure each person is comfortable with manipulating the ability to see during an exercise activity! Some people may have challenges (i.e., the ability to focus vision quickly) with vision that could possibly cause fear or intimidation.
- Position people close to a stable item that they could easily and quickly grab to regain balance, if necessary. That will enhance safety and possibly remove some of the fear that could some people my have about closing their eyes.
- Utilize a means by which vision can be quickly restored. Don't use blindfolds. The time and physical movement required to remove a blindfold would further challenge the ability to regain balance. The best option is to ask people to use their own eyelids to control their level of vision.

Safety could also be enhanced if you have people work as partners – one person doing the exercise and the other person is the "spotter". Make sure that people are paired up according to functional capacity:

- Spotters need to be able to assist, as needed.
- Balance-challenged people need stronger spotters.

Vision can be manipulated through various levels:

- Full vision - both eyes open
    - Head looks forward and to both right and left sides
        - Hold in each position
    - Rotate head side-to-side
- Partial Vision – one eye open (do both eyes)
    - Head looks forward and to both right and left sides

- Hold in each position
  - Rotate head side-to-side
- Switch from eye-to-eye, blinking each eye in a specific cadence (slow to rapid)
- Low or No vision – eyes partially closed to closed
  - Hold in each position
  - Rotate head side-to-side

The level of lighting can also be manipulated to impact vision (with full consideration for safety being the highest priority).
- Potentially combine the above listed changes in head position and eye status (open or closed) with a change in lighting levels.

Surface Height Variations (standing only)
The purpose for this option is to provide other potential body positions/joint angles from which stabilization (balance) must be maintained or movement may be initiated or terminated – new challenges to muscle actions. Options include:
- One foot elevated higher than the other foot (option - use a Step platform and risers to modify the elevation height)
  - Perform upper body movements while lower body is stationery
  - Perform foot movement pattern drills, stepping onto elevated surface
  - Perform foot movement pattern drills, stepping off of the elevated surface

Combination Stepping
Combine all stepping patterns:
- All steps from one side at a time (all right, then all left). Example:
  - Right side
    - ½ V-Step,
    - ½ Lateral Step,
    - ½ Reverse V-Step, then
  - Left side
    - ½ V-Step,
    - ½ Lateral Step,
    - ½ Reverse V-Step and repeat sequence.
- Alternate sides (right, left, right, etc.). Example:
  - Right – ½ V-Step,
  - Left - ½ Lateral Step,
  - Right - ½ Reverse V-Step, then
  - Left - ½ V-Step,
  - Right - ½ Lateral Step,
  - Left - ½ Reverse V-Step and repeat sequence.
- Mix – a few sample options:
  - Sample 1 – first 2 steps on same side, 3rd step on opposite side
    - Right – ½ V-Step,
    - Right - ½ Lateral Step,
    - Left - ½ Reverse V-Step, then

- Left - ½ V-Step,
- Left - ½ Lateral Step,
- Right - ½ Reverse V-Step and repeat sequence.
- Sample 2 – step sequence changed from previous samples, 2nd, and 3rd steps same side, but opposite from first step
  - Right – ½ V-Step
  - Left – ½ Reverse V-Step
  - Left – ½ Lateral Step, then
  - Left – ½ V-Step
  - Right – ½ Reverse V-Step
  - Right – ½ Lateral Step and repeat sequence
- Sample 3 – step sequence same as Sample 2, but now first two steps are same side, and 3rd step is opposite side
  - Right – ½ V-Step
  - Right – ½ Reverse V-Step
  - Left – ½ Lateral Step, then
  - Left – ½ V-Step
  - Left – ½ Reverse V-Step
  - Right – ½ Lateral Step and repeat sequence

The possible step sequences that could be used are numerous – these are only a few of the possibilities. The important concepts behind changing step pattern, step sequence and step side (right or left) are that learning and practicing new movement patterns forces the brain to work - cognitive function that results in improved coordination, agility, reaction time and balance!

Simultaneous Manipulation of Multiple Variables
Safety first! But imagine the possibilities! Take any combination of the previous listed variables and manipulate them at the same time. This is how (and why) a C^4-A-R-B program could (and should) be offered - including classes that are appropriate for different **skill** and conditioning levels. Multiple skill and conditioning level classes provide two main benefits:
- Minimize the intimidation a person might feel, not knowing what the other participants might be capable of doing – no one wants to be embarrassed by not being able to do something or to be able to "keep up".
- Provide a "Path for Progression" that motivates participants – they can see and feel their improvements in class, as well as in the performance of ADL's! Is that enough incentive to continue with this type of training – the benefits are lifelong! Guess who will become your best marketing vehicle!!

Up to this point the main discussion has been about lower body stepping patterns, with some coverage of upper body movements (simple changes of upper body position to manipulate a person's center-of-gravity, impacting how the body's musculature must react. Now it is time to add complexity to the lower body movement patterns – let's get the arms involved!

Arm Movements

The type of arm movements used in a C^4-A-R-B class/workout are limitless. I have used a variety of movement patterns. Following are a few – not a complete list:

- Boxing, Kickboxing or Martial Arts-based workouts – strikes and blocks, such as:
    - Jab, Cross, Hook, or Uppercut
    - Back Fist, Reverse Punch, Hammer Fist, Palm Heel, or Eagle Beak
    - Outward Elbow, Inward Elbow, Upward Elbow and Downward Elbow
    - Blocking Techniques – Knife-Hand, High Rising, Middle Inward, Double-Arm Inward, 2 Arm-X, 2 Arm Push, and Circle
- General Fitness Class – arm movements performed while holding a very light object (my favorite is a slightly deflated air-filled ball that can be easily gripped and moved around).
    - Move the shoulder joints in all possible movement patterns
        - One arm (simple) or both arms (complex) with each step movement
        - One arm - Move the arm in the same direction as the step (simple)
            - Example - Right ½ V-Step with Right Arm pushing a ball forward
        - One arm - Move the arm in the opposite direction or an oblique angle from the step (complex)
        - Two arms – both arms move in the same direction as the step
        - Two arms – one arm does the same direction as the step and the other arm goes in the opposite or an oblique direction from the step (complex)
    - Move the elbow joint in flexion and extension during step movements
    - Combine various shoulder movements with elbow movements
        - One arm or two arms
        - Both arms do the same movement pattern(s)
        - Each arm does different movement patterns – simultaneously. Example:
            - One arm does elbow flexion and extension
            - One arm does shoulder flexion and extension

Important: The intensity (required muscular effort) can be increased by adding a load to the arm movements (externally anchored light elastic resistance, low resistance free weights, medicine balls, etc.). Remember the purpose of this class is NOT to increase muscle endurance, strength, or power – so there is no need to greatly increase the intensity/load. However, adding low resistance levels can safely increase the challenge placed on the muscle groups involved in the movement patterns (agonists, antagonists, synergists, neutralizers, and stabilizers). Any increase in the load or resistance being moved is also an increase in the movement inertia. For example, consider the difference between using, with arm movements, while performing various step patterns:

- An air-filled ball – basically zero resistance in gravity and in motion energy
- A 3 lb. medicine ball – 3 lbs. of mass being pulled by gravity and in motion energy
- An 8 lb. medicine ball - 8 lbs. of mass being pulled by gravity and in motion energy

The muscular system needs to learn to activate effectively while attempting to move the body efficiently (coordination, agility, reaction time, balance) with each different load.

Single Step Patterns with Arm Movements
Following are some possible step and arm movement combinations.

Same Side Arm & Leg – Moving in Same Direction
Examples listed show only right side but can also be performed on the left side.
- Right side ½ V-Step with Right shoulder flexion (Front Raise exercise)
- Right side ½ V-Step with Right Jab (forward punch)
- Right side ½ V-Step with Right elbow flexion (Arm Curl exercise)
- Right side ½ Lateral Step with Right shoulder abduction (Lateral Raise exercise)
- Right side ½ Lateral Step with Right Hammer Fist
- Right side ½ Lateral Step with Right Outward Elbow Strike
- Right side ½ Reverse V-Step with Right shoulder hyper-extension
- Right side ½ Reverse V-Step with Right arm downward Hammer Fist
- Right side ½ Anterior Cross-Over Step (moves left) with Right arm cross body reach (hand moves to the left)

Same Side Arm & Leg – Moving in Opposite Direction
Examples listed show only right side but can also be performed on the left side.
- Right side ½ V-Step with Right shoulder hyper-extension (swings back)
- Right side ½ V-Step with Right arm downward Elbow strike (to rear)
- Right side ½ V-Step with Right elbow extension (flex elbow as you step back)
- Right side ½ Lateral Step with Right shoulder adduction (abduct as step back)
- Right side ½ Lateral Step with Right Punch across the body, to the left
- Right side ½ Lateral Step with Right Inward Elbow Strike
- Right side ½ Reverse V-Step with Right shoulder flexion
- Right side ½ Reverse V-Step with Right Cross punch (forward)
- Right side ½ Anterior Cross-Over Step (moves left) with Right Hammer Fist (to the right)

Same Side Arm & Leg – Moving in Oblique Direction
Examples listed show only right side but can also be performed on the left side.
- Right side ½ V-Step with Right Hammer Fist to the right side
- Right side ½ V-Step with Right arm push to the right side
- Right side ½ V-Step with Right shoulder horizontal abduction
- Right side ½ Lateral Step with Right shoulder flexion
- Right side ½ Lateral Step with Right Punch forward
- Right side ½ Lateral Step with Right Palm Heel Strike forward
- Right side ½ Reverse V-Step with Right shoulder abduction
- Right side ½ Reverse V-Step with Right Hammer Fist to the right side
- Right side ½ Anterior Cross-Over Step (moves left) with Right shoulder flexion

Opposite Side Arm & Leg – Moving in Same Direction
Examples listed start right side but can also be started on the left side.
- Right side ½ V-Step with Left shoulder flexion
- Right side ½ V-Step with Left arm Jab (forward punch)
- Right side ½ V-Step with Left elbow flexion
- Right side ½ Lateral Step with Left shoulder abduction
- Right side ½ Lateral Step with Left Hammer Fist
- Right side ½ Lateral Step with Left Outward Elbow Strike
- Right side ½ Reverse V-Step with Left shoulder hyper-extension
- Right side ½ Reverse V-Step with Left arm downward Hammer Fist
- Right side ½ Anterior Cross-Over Step (to left) with Left arm reach to right

Opposite Side Arm & Leg - Moving in Opposite Directions
Examples listed start right side but can also be started on the left side.
- Right side ½ V-Step with Left shoulder hyper-extension (swings back)
- Right side ½ V-Step with Left arm downward Elbow strike (to rear)
- Right side ½ V-Step with Left elbow extension (flex elbow as you step back)
- Right side ½ Lateral Step with Left shoulder adduction (abduct as step back)
- Right side ½ Lateral Step with Left Punch across the body, to the left
- Right side ½ Lateral Step with Left Inward Elbow Strike
- Right side ½ Reverse V-Step with Left shoulder flexion
- Right side ½ Reverse V-Step with Left Cross punch (forward)
- Right side ½ Anterior Cross-Over Step (to left) with Left Hammer Fist (to right)

Opposite Side Arm & Leg – Moving in Oblique Direction
- Right side ½ V-Step with Left Hammer Fist to the right side
- Right side ½ V-Step with Left arm push to the right side
- Right side ½ V-Step with Left shoulder horizontal abduction
- Right side ½ Lateral Step with Left shoulder flexion
- Right side ½ Lateral Step with Left Punch forward
- Right side ½ Lateral Step with Left Palm Heel Strike forward
- Right side ½ Reverse V-Step with Left shoulder abduction
- Right side ½ Reverse V-Step with Left Hammer Fist to the right side
- Right side ½ Anterior Cross-Over Step (moves left) with Left shoulder flexion

These are just a few of many possible movement combinations.

Begin with single arm movements or techniques (simple). Gradually increase the number of arm movements (complexity) for each ½ step:
- Simultaneously move both arms in the same direction (same movement pattern)
- Simultaneously move both arms in the same direction (different movement patterns)
- Simultaneously move both arms in opposite directions (same movement pattern)
- Simultaneously move both arms in opposite directions (different movement patterns)
- Alternate arm movements after each ½ Step.

All the variable modifications listed for "Single Step Patterns" can also be applied.

Combination of Two or More (Multiple) Step Patterns
This variation provides a unique challenge by having participants perform one movement combination on one side of the body, then moving right into a completely different movement combination on the other side of the body. A 2-Step (each side) example could be:
- Perform a right side ½ V-Step followed by a right side ½ Lateral Step, then change sides and perform a left side ½ Reverse V-Step followed by a left ½ Lateral Step

To make this more complex, you could:
- Increase the number of step patterns on each side
- Increase the number of combinations used – here is a 3 Combination example:
  - Perform Combination #1 on right side, then
  - Perform Combination #2 on left side, then
  - Perform Combination #3 on right side, then
  - Re-start the same Combination sequence, except on opposite sides
    - Perform Combination #1 on left side, then
    - Perform Combination #2 on right side, then
    - Perform Combination #3 on left side.
- Add in arm movements - start with a single arm movement, then progress to more.

Utilize all the possible progression steps listed for Single Step Patterns.

Partner Drills (2 to 4 people working together in a group)
Perform any of the Step Patterns (single or multiple step patterns), with or without upper body and/or arm movements:
- All partners facing the same direction
- Partners facing the opposite or oblique directions – option examples:
  - Two people - they face each other
  - Three people – two people facing one person
  - Three people – form a triangle, all 3 facing to the center of the triangle
  - Four people – form a square: each person on a "corner" of the square facing the center of the square (two people facing each other, from opposite corners
  - Four people – two people facing the other two people

Balance Drill challenges using elastic tubing – the person trying to statically maintain balance (holding a stable position) is the anchor for elastic tubing while the other partner performs tubing exercises.
- The pull of the elastic resistance tubing, due to the exercise being performed, will challenge the ability of the person to remain stable and balanced.

Elastic is held stable by a partner - the person performing the stepping pattern is holding the other end(s) of the elastic resistance.
- The movement pattern should be directed away from the anchor person so that resistance increases as the movement pattern is performed and decreases as the step pattern returns to the start position.

- This set-up challenges dynamic balance (maintaining balance while moving) due to the increase in the resistance level and pull of the elastic tubing against the movement.

Note: Drills using elastic resistance can be used without a partner. The elastic resistance should be anchored on a stable and static point that is positioned in such a way that the elastic resistance force directly or obliquely opposes the movement pattern

Kicking Drills
If participants can perform kicking motions, these can be:
- Added into step patterns (integrated with 'Step Height') as a higher-level challenge to coordination, agility, and balance, or
- Used as balance drill activities by manipulating the cadence of the movement execution.

Be considerate of the following:
- Kicking height is not important – safety IS!
- To utilize the hip joint in all possible movement patterns, learn how to perform the following kicks, from a fitness perspective (not a competitive fighting perspective):
  - Front Kick
  - Side Kick
  - Straight Back Kick (also known as 'Donkey Kick)
  - Outside Crescent Kick
  - Inside Crescent Kick
- When integrating kicking motions, remember that the retraction phase of the kicking motion is as important as the execution phase – pull it back with good form.
- The cadence of each segment of a kicking technique can be manipulated to be easier (simple) or more difficult (complex).
  - Slow kicking requires require more muscular effort and mindful focus.
  - Each kick has 3 phases – execution, stop, retract.
    - The cadence of or time duration of each phase can be manipulated
- Surface stability for the base leg will impact the ability to balance during a kick.

Walking Drills
- Movement/stepping patterns various walking pattern shapes
- Use different hold/balance times during each state of the gait cycle
- Change variables that impact balance
Add various upper body (trunk & arm) movements/exercises during gait – loaded and unloaded

REACTION TIME
Reaction time is defined as the length of time taken for a person to respond to a specific stimulus. Reaction time is very important for our everyday lives and needs intact sensory system, cognitive processing, and motor performance. Reaction time is a good indicator of sensorimotor coordination and performance of an individual.
- Improves the ability to react to an external stimulus.
- Shortens the time between stimulus and muscle power production.
- Improves balance in sudden situations.
- Faster thought process during everyday life situations.
- Needed to perform activities of daily living more safely and effectively.

Research has shown that part of the aging process includes a physiological breakdown of the brain – connections are lost. This process can be slowed by exercising the brain – making it work in specific ways, especially during exercise. New connections can be formed. And **we should not wait** until we are "older" to exercise the brain! Get ahead of the game – start early, when we are younger, before the physiological decline begins! **Improving reaction time should be a program goal once a movement pattern/drill becomes familiar enough, through practice, to be easily performed.**

Cueing
Cueing can be done by using a variety of different cues (stimuli), such as:
- Assigning specific verbal cues or commands to a specific movement, movement pattern or drill to be performed. Some possible verbal cues could be
  - Numbers
  - Colors
  - Names/Words - people, places, directions (right, left, north, south, east, west, etc.), step patterns, days of the week, months, etc.
- Assigning specific visual cues to a specific movement, movement pattern or drill to be performed in a specific way. A visual cue is something that the participant must see and react to – no verbal component. Some examples are:
  - Body movements – assign a cue to a desired reaction
    - Hand – right or left hand, number of fingers, finger pointing
    - Arm – direction of movement, right or left arm
    - Head – direction of movement (look up/down, turn right/left, lateral movement right/left
    - Leg – movement direction, right/left leg

Cueing – Simple to Complex
Cueing is no different than any of the other teaching/learning methods. To keep participants motivated by, and positive about their training, they need to be and feel successful. If someone is overwhelmed by a task and feels like a failure, there is little incentive to continue – and the benefits of this kind of training will never be realized! Participants must be adequately challenged – not too much and not too little! Therefore, the trainer MUST constantly observe and assess everyone as tasks are performed. Progress people when they are mentally and physically ready!

Simple cues would be one single verbal or visual cue assigned to one specific action. Complexity can be increased after this initial cue is "mastered." Here is an example:

- Simple – either right or left hand can be used
    - 1 finger – V-Step, 2 fingers – Lateral Step, 3 fingers – Reverse V-Step
- More complex – move only when the left-hand fingers are used
- More complex – face the same direction as the participants and assign a specific hand to a specific leg that should lead the movement pattern; For example, if you raise the Right hand 1 finger – the initial step of the V-Step must be with the right leg
    - Because you are facing the same direction as the participants, this progression is 'simple' compared to the next progression because the participants will be able to easily decide which leg should initiate the step pattern.
- More complex – **face the participants** (mirror image) and assign a specific hand to a specific leg that should lead the movement pattern; For example, if you raise the Right hand 1 finger – the initial step of the V-Step must be with the right leg, but this time the participants will be moving that initial step to the opposite side of the arm/hand you use to give the cue.

There are numerous ways to progress cueing for reaction. Use your imagination and be creative! This will bring a lot of fun into the workouts!

Considerations
- **Learning Stage** – any movement pattern that is new to an individual needs to be learned and practiced. This is what improves coordination, agility, reaction time, balance, and cognitive function (the brain physiologically responds to new stimuli and repetitive practice).
- **Performance Perfection Stage** - Once a movement pattern is learned and performance is improved, it can evolve into a cardio training exercise because the brain is now familiar with the movement pattern, which means the body can perform the movement pattern in such a way that the heart rate is elevated.
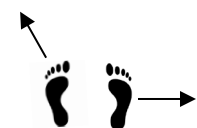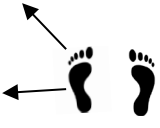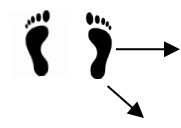
If you observe any level of frustration in your participants, remind them of these points:
- Cardio training - heavy breathing, heart beats fast, muscles get tired, and sweat!
- Resistance training - muscles fatigue, heart beats faster, and sweat!
- These are all external signs that we exercised our bodies.
- How do we know when we exercise the brain? When we must think about and focus on what we are doing! It should be difficult, at first! That is exactly what we want! Brain function improves by practicing those difficult tasks! THAT is how you know your brain is being exercised – a difficult movement becomes easier to perform!

IMPORTANT: Following are some various footwork drill options. The arrows depict the first half of a step – the foot will return to the starting position before the next step is taken. **ALSO IMPORTANT:** The following Step Charts depict only the "Feet Aligned & Parallel" position. Included are charts that show 63 different possible foot positions. This variety of foot positions combined with all the possible Step Pattern Combinations suggests that the possible challenges to coordination, cognitive function, agility, reaction, and balance are seemingly endless!

C⁴-A-R-B - Skills & Drills
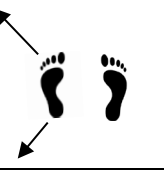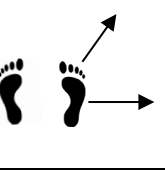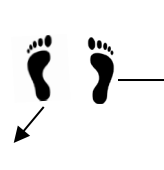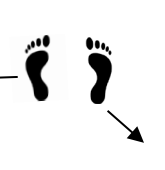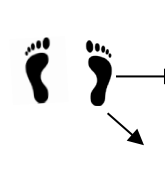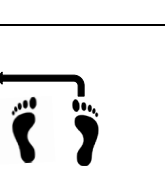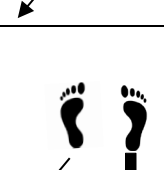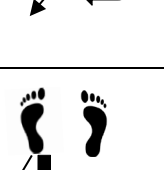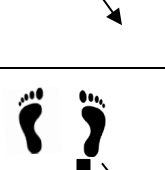
SINGLE STEP PATTERNS – practice leading with the right and the left foot				
V-Step	**Lateral Step**	**Reverse V-Step**	**Anterior Cross-Over**	**Posterior Cross-Over**
			Step with both feet (shows only left step)	Step with both feet (shows only left step)

V-STEP – 2 STEP COMBINATIONS		
½ V-Step & ½ Lateral Step (Opposite Legs) **Option – Reverse the order (start with Lateral Step)**		
½ V-Step & ½ Lateral Step (Same Leg) **Option – Reverse the order (start with Lateral Step)**		
½ V-Step & ½ Reverse V-Step (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ V-Step & ½ Reverse V-Step (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ V-Step & ½ Anterior Cross-Over (Opposite Leg) **Option – Reverse the order (start with Anterior Cross-Over)**		
½ V-Step & ½ Anterior Cross-Over (Same Leg) **Option – Reverse the order (start with Anterior Cross-Over)**		
½ V-Step & ½ Posterior Cross-Over (Opposite Leg) **Option – Reverse the order (start with Posterior Cross-Over)**		
½ V-Step & ½ Posterior Cross-Over (Same Leg) **Option – Reverse the order (start with Posterior Cross-Over)**		

C⁴-A-R-B - Skills & Drills
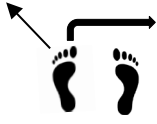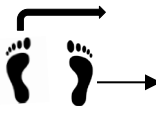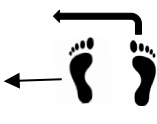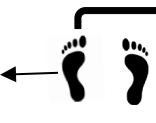
Lateral Step - 2 Step Combinations		
½ Lateral Step & ½ V-Step (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ V-Step (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ Reverse V-Step (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ Reverse V-Step (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ Anterior Cross-Over (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ Anterior Cross-Over (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ Posterior Cross-Over (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Lateral Step & ½ Posterior Cross-Over (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		

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Reverse V Step - 2 Step Combinations		
½ Reverse V Step & ½ V-Step (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V Step & ½ V-Step (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V & ½ Lateral Step (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V Step & ½ Lateral (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V Step & ½ Anterior Cross-Over (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V Step & ½ Anterior Cross-Over (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V Step & ½ Posterior Cross-Over (Opposite Legs) **Option – Reverse the order (start with Reverse V-Step)**		
½ Reverse V Step & ½ Posterior Cross-Over (Same Leg) **Option – Reverse the order (start with Reverse V-Step)**		

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Anterior Cross-Over Step - 2 Step Combinations		
½ Anterior Cross-Over Step & ½ V-Step (Opposite Legs) **Option – Reverse the order (start with 1/2 V-Step)**		
½ Anterior Cross-Over Step & ½ V-Step **(Same Leg)** **Option – Reverse the order (start with 1/2 V-Step)**		
½ Anterior Cross-Over Step & ½ Lateral Step **(Opposite Legs)** **Option – Reverse the order (start with 1/2 Lateral Step)**		
½ Anterior Cross-Over Step & ½ Lateral Step **(Same Leg)** **Option – Reverse the order (start with 1/2 Lateral Step)**		
½ Anterior Cross-Over Step & ½ Reverse V-Step **(Opposite Legs)** **Option – Reverse the order (start with Reverse V-Step)**		
½ Anterior Cross-Over Step & ½ Reverse V-Step **(Same Leg)** **Option – Reverse the order (start with Reverse V-Step)**		
½ Anterior Cross-Over Step & ½ Posterior Cross-Over **(Opposite Legs)** **Option – Reverse the order (start with 1/2 Posterior Cross-Over)**		
½ Anterior Cross-Over Step & ½ Posterior Cross-Over **(Same Leg)** **Option – Reverse the order (start with 1/2 Posterior Cross-Over)**		

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Posterior Cross-Over Step - 2 Step Combinations		
½ Posterior Cross-Over Step & ½ V-Step (Opposite Legs) Option – Reverse the order (start with 1/2 V-Step)		
½ Posterior Cross-Over Step & ½ V-Step (Same Leg) Option – Reverse the order (start with 1/2 V-Step)		
½ Posterior Cross-Over Step & ½ Lateral Step (Opposite Legs) Option – Reverse the order (start with 1/2 Lateral Step)		
½ Posterior Cross-Over Step & ½ Lateral (Same Leg) Option – Reverse the order (start with 1/2 Lateral Step)		
½ Posterior Cross-Over Step & ½ Reverse V-Step (Opposite Legs) Option – Reverse the order (start with 1/2 Reverse V-Step)		
½ Posterior Cross-Over Step & ½ Reverse V-Step (Same Leg) Option – Reverse the order (start with 1/2 Reverse V-Step)		
½ Posterior Cross-Over Step & ½ Anterior Cross-Over (Opposite Legs) Option – Reverse the order (start with 1/2 Anterior Cross-Over)		
½ Posterior Cross-Over Step & ½ Anterior Cross-Over (Same Leg) Option – Reverse the order (start with 1/2 Anterior Cross-Over)		

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3 Step Combinations – starting with full Step Pattern
- Always work both sides
- Third step can be changed from:
    - Same side as #2 step, or
    - Opposite side from #2 step
        - V-Step with
            - ½ Lateral Step
            - ½ Reverse V-Step
            - ½ Anterior Cross-Over Step
            - ½ Posterior Cross-Over Step
        - Reverse V-Step with
            - ½ Lateral Step
            - ½ V-Step
            - ½ Anterior Cross-Over Step
            - ½ Posterior Cross-Over Step
        - Lateral Step with
            - ½ V Step
            - ½ Reverse V-Step
            - ½ Anterior Cross-Over Step
            - ½ Posterior Cross-Over Step
        - Anterior Cross-Over Step with
            - ½ V Step
            - ½ Reverse V-Step
            - ½ Lateral Step
            - ½ Posterior Cross-Over Step
        - Posterior Cross-Over Step with
            - ½ V Step
            - ½ Reverse V-Step
            - ½ Lateral Step
            - ½ Anterior Cross-Over Step

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3 Step Combinations – starting with ½ Step Pattern & finish full step pattern
- Always work both sides
- Second step can be changed from:
  - Same side as #1 step, or
  - Opposite side from #1 step
    - ½ V-Step with
      - Lateral Step
      - Reverse V-Step
      - Anterior Cross-Over Step
      - Posterior Cross-Over Step
    - ½ Reverse V-Step with
      - Lateral Step
      - V-Step
      - Anterior Cross-Over Step
      - Posterior Cross-Over Step
    - ½ Lateral Step with
      - V Step
      - Reverse V-Step
      - Anterior Cross-Over Step
      - Posterior Cross-Over Step
    - ½ Anterior Cross-Over Step with
      - V Step
      - Reverse V-Step
      - Lateral Step
      - Posterior Cross-Over Step
    - ½ Posterior Cross-Over Step with
      - V Step
      - Reverse V-Step
      - Lateral Step
      - Anterior Cross-Over Step

Three (3) ½ Step Combinations – always work both sides
- Create 3 Step combinations by using one half of each of the 5 Step Patterns:
  - Same leg for all 3 steps
  - Alternate sides of each of the 3 steps (first and third steps will be with same side)
  - First 2 steps same side with third step on opposite side
  - First step on one side and last two steps on the opposite side from first step

C⁴-A-R-B - Skills & Drills

Arm Movements
Arm movement patterns can be used, like stepping patterns, to challenge coordination, reaction time and cognitive function.

Potential Arm Movement Manipulations – Joint Motion & Movement Direction
Arm movements can be associated with a specific activity, such as:
- Sport-specific movement patterns – boxing, martial arts, swimming, throwing sports, racquet sports, etc.
- Arm exercise movement patterns using shoulder, elbow, or combination shoulder & elbow movements.

Use of arm movements that a person is unfamiliar with will provide the greatest amount of potential challenge and benefit for the participant because the individual must complete the 3 steps of learn, practice, and master the movement – building new neurological pathways in the brain.

<u>Shoulder Joint</u>
Shoulder joint movement patterns can be performed in:
- Short-lever position – elbow fully-flexed, to
- Mid-range lever position – any position between fully-flexed and fully-extended, to
- Long-lever position – elbow fully-extended

Shoulder joint movement patterns can be performed in various ranges of motion (ROM):
- Small ROM – barely any joint movement, to
- Full Functional ROM (FROM) – this is relative to each individual and is the greatest possible range of motion in which the specific movement can be safely and properly performed. Joint structure, past injury, current joint health status are some of the factors that can impact the FROM of each individual.

Possible shoulder joint (no elbow joint movement) movement patterns include:
- Flexion – sagittal and oblique planes
- Extension (and hyper-extension) - sagittal and oblique planes
- Abduction – frontal and oblique planes
- Adduction (and hyper-adduction) - frontal and oblique planes
- Horizontal Abduction – transverse and oblique planes
- Horizontal Adduction - transverse and oblique planes
- External Rotation – transverse (arms adducted), sagittal (arms abducted) and oblique planes
- Internal Rotation - transverse (arms adducted), sagittal (arms abducted) and oblique planes
- Circumduction – small to large range of motion circular patterns

A good place to start (warm-up) arm movements is with 'short lever' (elbow flexed), 'small ROM' of each of the movement patterns listed above.
- Gradually increase the ROM, then
- After reaching FROM, begin extending from the short lever position, then
- Gradually work to the Long-lever position.

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Elbow Joint
The elbow joint movements include flexion and extension. There is also movement at the elbow joint that causes the forearm to supinate and pronate.

The elbow joint can also move using a small ROM to the FROM for an individual. It is possible that some people's elbow joint cannot move to fully-extended and/or fully-flexed position due to factors that could include joint structure, elbow flexor muscle size, elbow extensor muscle flexibility, previous joint injury, current joint health status, etc.

Wrist Joint
The wrist joint can move into flexion (palm to forearm), extension (palm away from forearm) and lateral flexion (thumb to radius and pinky finger to ulna). The hand can move from supination to pronation, but there is minimal wrist joint movement.

Finger Joints
Finger joints can be moved from full flexion (making a fist) to full extension (wide open). Fingers can also be moved laterally (from fingers together to fingers apart).

Elbow, Shoulder, Wrist and Hand Joint Position Combinations
Utilizing various combinations of the possible shoulder, elbow, wrist, and hand joint combinations should provide numerous ways to challenge coordination, reaction time and cognitive function. The more joints involved in a movement pattern, the harder the brain must work to make the movement happen properly. Reaction time (the time it takes to process what needs to happen for the joint movement desired and making the movement happen) is impacted. Cognitive function is challenged when the desired movement pattern is unfamiliar and must be learned, practiced, and mastered.

Head/Neck Positions & Movements
Head position and neck movement can also impact the level of challenge to coordination, agility, and balance. And if these 3 skills are challenged, it stands to follow that reaction time and cognitive function will also be impacted, until the desired movement patterns are learned, practiced, and mastered.

Put It All Together!
All the previously described movement combinations for stepping, arms, and head/neck can be performed individually or in combination with one or more of the other movement patterns – always using the concept of 'Simple to Complex'.

An example 'Simple to Complex' sequence:
- #1 - Simple – the step pattern and arm movement pattern move the same direction.
  - Perform the V-Step and single arm shoulder flexion when stepping forward and shoulder extension when stepping back to the start position (feet together).
    - Same side arm and leg, with each step (right leg & arm, then left leg & arm).
    - More complex - opposite arm and leg, with each step.
- #2 - More Complex – the step pattern and arm movement direction are different.
  - Perform the V-Step and single arm shoulder abduction when stepping forward and shoulder adduction when stepping back to the start position (feet together)
    - Same side arm and leg, with each step (right leg & arm, then left leg & arm).
    - More complex - opposite arm and leg, with each step.

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- #3 - More Complex – the step pattern stays the same, but the arm movement patterns are different on each step.
  - Perform the V-Step and single arm shoulder flexion when stepping forward with the right leg and shoulder extension when stepping back to the start position (feet together), then single arm abduction when stepping with the left leg forward and shoulder adduction when stepping back to the start position (feet together).
    - Same side arm and leg, with each step (right leg & arm, then left leg & arm).
    - More complex - opposite arm and leg, with each step.
- Reaction Time & Cognitive Function Challenge
  - Once a group of participants become familiar with all 3 sequences, meaning that coordination, agility, and balance are at peak performance levels, you can now focus on challenging reaction time and cognitive function by cueing which combination pattern you want the [participants to perform.
    - Assign a number to each movement combination and have participants perform the movement pattern when you call out (auditory cue) the number.
    - Assign a number to each movement combination and have participants perform the movement pattern when you hold up (visual) that number of fingers.
    - Assign a number and a side (right or left leg) to start the movement pattern. Participants must perform the assigned movement pattern leading with the correct side leg. For example, tell them that if you give the number with the left arm, they must lead with the left leg – or vice versa.
      - Here is where you can challenge them even more by facing them when you give the cue – when you cue with your right arm, their right leg will move to the opposite side of your right arm

There are hundreds of possible movement combinations that could be used. Here are some suggestions:
- Observe participants – learn each person's current level of ability and capability.
- Structure classes according to the various possible levels of skill and fitness – this provides two important situations: 1) Participants are adequately challenged, but not over-challenged, and 2) Participants know that there is a path for progression - participants should experience success.
  - Skill levels - beginner, intermediate, and advanced
  - Fitness levels - beginner, intermediate, and advanced
- Establish a reward system for group and/or individual milestone achievements.
- Create a class plan.
- Maintain a record what is accomplished in each class – for the group and for each person. Journaling what happens in each class – what worked, what didn't work, what should/could be done in following classes – can provide the capability of progressing the group and each person safely and effectively.

Important to Consider – arm movements can be loaded, to add to the challenge on the body. The loading can range from empty hands, to holding air-filled balls, to light weights or medicine balls. Squeezing an object in the hands:
- Will cause the gripping muscles of the forearms/hands to 'work' (a positive thing), and
- May cause an **increase in blood pressure** (not a positive – safety is a priority; assess whether the risk vs. the benefit is high or low for the participants).

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Step Pattern w/Arm Movement Drill Examples
Following are some examples of Step Pattern with Arm Movement Drills that could be used in classes. This is a **"short"** list – the possibilities, when you consider all the potential movement modifications that could be integrated into each drill, are almost limitless. The purpose of this list is to provide ideas that will stimulate your creative genius to develop your own drills within the types of class formats you will be leading.

For the purposes of the following drills, imagine that participants are holding a single air-filled ball, that can be easily gripped with one hand.

Drills for Single Step Patterns (V-Step, Reverse V-Step, Lateral Step, Anterior Cross-Over, and Posterior Cross-Over Steps) Combined with Arm Movements
Possible Arm Movement Directions include:
- Forward
- Lateral
- Backward
- Across the front of the body
- Across the back of the body

Possible Arm & Leg Combinations include:
- Same Side Arm & Leg – Arm moves in same direction as the step direction
- Same Side Arm & Leg – Arm moves in the opposite direction of the step direction
- Same Side Arm & Leg – Arm moves in an oblique direction from the step direction
- Opposite Side Arm & Leg – Arm moves in same direction as the step direction
- Opposite Side Arm & Leg – Arm moves in the opposite direction of the step direction
- Opposite Side Arm & Leg – Arm moves in an oblique direction from a step direction

Note: "Oblique" direction (for the arm) means any movement direction that is not:
- In the same direction as the leg movement, or
- In the direct opposite direction of the leg movement
Example "oblique" directions would be:
- V-Step (leg moves forward) with a lateral arm movement
- V-Step (leg moves forward) with an arm movement across the front of the body

Modification options could include, but are NOT limited to the following:
- Change the cadence of each step by holding the step position for a specific duration before stepping back to the "feet together" position.
- Change the height of the step – as if stepping over an object. Could work balance by holding the foot off the ground for a specific time.
- Change the height of the body position (amount of hip, knee, and ankle flexion) at the end of the steps or through the full movement pattern.
- Change the position of the feet (direction the feet/toes are pointed).
- Change the spacing of the feet at the start position.

Progressions could be:
- Perform 2 full single step movements (i.e., V-Step followed by Lateral Step) with arm movements, through the same list of modifications as previously listed.

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- Perform ½ of one single step movement and ½ of a different single step movement (i.e., ½ V-Step & ½ Lateral Step) with arm movements, through the same list of modifications as previously listed.
- Perform one single step movement and ½ of a different single step movement (i.e., full V-Step & ½ Lateral Step) with arm movements, through the same list of modifications as previously listed.
- Put ½ of three different single step movements (i.e., ½ V-Step & ½ Lateral Step & ½ Reverse V-Step) with arm movements, through the same list of modifications as previously listed.
- There are many more possible combinations that could be created. Remember:
  - Do not over-challenge participants – avoid frustration!
  - Do not under-challenge participants – avoid boredom and lack of progress!
  - Safety is number one priority!
  - Have FUN!

Head Movement & Head Position

Along with stepping pattern and arm movement combinations, you can add challenge to a drill by progressing to performing the drill:

- With the head in a unique position (looking to one side or the other, looking up or looking down, or
- Having the head move in a specific direction or movement pattern while performing the stepping pattern and arm movement.

Vision

Further challenge can be added by changing the field of vision during the movement patterns. Just make sure that however you alter the level of vision, it is done with safety as the highest priority for each participant!

Cognitive Function

Cognitive function is one of the 4 C's for this program. Cognitive function is directly related to and impacts *Reaction Time* (also part of the C⁴-A-R-B program). Cognitive function is specific to the brain – the mental aspects of function. Reaction Time is the bridge between the brain processing a stimulus and then carrying out the required physical action or response. Cognitive function and Reaction Time may be positively impacted in this program in two main ways:

- Introduction of a new physical activity and/or movement pattern that must be learned and practiced. A person must focus the brain on the proper (defined by safety and effectiveness, based on the goal of the activity or movement pattern) performance of the activity – new neural pathways are formed and reinforced until the movement *coordination* (another one of the 4 C's) is established to the potential level it can be for the specific individual. For this reason, cognitive function and reaction time are naturally challenged and likely improved simply by participating in the program.
- By integrating specifically focused "mind" exercises into the physical activities. Having participants combine "mind" exercises with physical movements increases the cognitive challenge to the brain and the conversion of 'thoughts' into physical action – it must perform two actions simultaneously: 1) Control the physical movement pattern performance, and 2) Correctly perform the "mind" exercise. Here are a few ways to make that happen:

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- Ask participants to make specific verbal statements or responses while executing the assigned physical movements or skills correctly. Nothing can be random – the brain must be challenged to think and move the body in a specific way.
    - Example: For 1 minute, perform the V-Step, executing a Jab-Cross combination on each step, while count by 3's on each step. Make this a bit more difficult by telling participants to complete 10 full V-Steps – now you are asking them to make the brain count by 3's AND keep track of the number of repetitions performed! Remember, start simple and then progress in complexity!
        - The "mind" exercise could something as simple as calling out a color while punching on the V-Step (but they cannot repeat the color). Some additional ideas include:
            - Names – all 'male' or 'female' names or alternate 'male' and 'female' names on specific sides (left step – male, right step- female)
            - Country, State or City names
            - Animals, Flower Names, Healthy foods, etc.
            - Have fun with this – consider the group of people or individual you are working with – what subject area would appeal to that group or person?
- Associate a specific verbal cue to the performance of a specific movement pattern or technique. A verbal cue could be anything (number, name, etc.):
    - A specific command – they must hear the command, process it in the brain, which then "instructs" the body what move to do. Simple to Complex Examples:
        - Inform the participants that they will perform a "Forward Step with a Jab-Cross punch combination to the side you call out." Your command or verbal cues would be "right" or "left" – the mind only needs to process which side to step with and which arm punches first for the Jab-Cross.
            - Progression would be to ask them to perform a Cross-Jab on each step (now it is opposite leg and arm that are moving – more challenging).
            - Next progression could be to ask them to perform a Jab-Cross if the cue is "Right" and a Cross-Jab if the cue is "Left".
            - Additional progressions could be:
                - Add specific participant verbal responses
                - Make stepping pattern more complex
                - Make arm movements more complex
                - Do not tell the participants what the movement patterns (arms and/or legs) are in advance – give them the physical actions required and direction (right, left, forward, lateral, backward, etc.) randomly.
                - Gradually increase in the complexity of the verbal cues or commands.

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- Associate a specific physical gesture or movement cue to the performance of a specific movement pattern or technique execution. Some examples could be asking participants to:
  - Mimic your performance of a movement or technique in the same direction or side.
  - Mimic your performance of a movement or technique, but in the opposite direction or to the opposite side.
  - Perform a movement or technique in a specific direction or manner based on your hand gesture or any other specific body movement (head turn, leg move, etc.).

Make this fun and **social** by having class participants lead the group – play follow-the-leader!

The social aspect of a fitness program should always be considered. If people enjoy the time spent in a fitness program, they will be motivated to be consistent in participation for a longer duration – that is how the potential positive benefits can be experienced and maintained! If people enjoy the environment, they will form a community that will encourage all members – new and current – to make it to every class. Establish an environment of friendly competition where people encourage each other to exceed what they can already do!

Wellness is all about the whole person – physical, mental, emotional, and environmental!

POTENTIAL FOOT POSITIONS – C⁴-A-R-B DRILLS

Feet Parallel	Regular Width	Wide Width	Narrow Width
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			
Right Foot Turnout	**Regular Width**	**Wide Width**	**Narrow Width**
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			

POTENTIAL FOOT POSITIONS – C⁴-A-R-B DRILLS

Left Foot Turnout	Regular Width	Wide Width	Narrow Width
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			

Both Feet Turnout	Regular Width	Wide Width	Narrow Width
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			

POTENTIAL FOOT POSITIONS – C⁴-A-R-B DRILLS

Left Foot Turn-In	Regular Width	Wide Width	Narrow Width
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			

Right Foot Turn-In	Regular Width	Wide Width	Narrow Width
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			

POTENTIAL FOOT POSITIONS – C[4]-A-R-B DRILLS

Both Feet Turn-In	Regular Width	Wide Width	Narrow Width
In-Line			
Staggered – Left Forward			
Staggered – Right Forward			

Agility Ladder Drills

Using an Agility Ladder
An agility ladder, if used properly, enhances coordination, agility, balance, reaction time AND Cognitive Function! Once you try and teach some of the drills and drill progressions included in this course you will understand why I emphasized "AND Cognitive Function"!

Agility Ladder Drill Modification Options
The following list identifies variables that can be manipulated to either change the level of **cognitive and/or physical challenge** of a particular drill or to add a specific training stimulus (example: increasing step height is something that can benefit participants who need functional training for the lower body that decreases the potential for tripping or improves the ability to step up from one surface to a higher surface). When a particular agility ladder stepping pattern is mastered (no longer requires the level of focused attention that was demanded when initially learning the pattern), you have a choice – move on to a new stepping pattern or modify one of these variables to increase the challenge.

- Same lead leg every step
- Alternate lead leg each step
- Change lead step leg – if you normally use right leg as lead, change to left leg lead
- Step direction
  - Straight line – anterior/posterior and/or lateral
  - Angle line (about 45°) – antero-lateral and/or postero-lateral
- Add arm movements to the ladder stepping patterns
  - Arm movements – ipsilateral to leg movements
    - In same direction as leg movements
    - In oblique direction from leg movements
    - In opposite direction from leg movements
  - Arm movements – contralateral to leg movements
    - In same direction as leg movements
    - In oblique direction from leg movements
    - In opposite direction from leg movements
- Add multiple arm movements with each individual step
- Add lower body exercise movement with each step
  - Stationary Lunge
  - Squat
  - Hip Abduction
  - Hip Flexion
  - Hip Extension
  - Calf Raise - Knees extended and/or flexed
  - Toe Raise
- Change step height
- Change body height (flex hips, knees, and ankles)
- Change cadence of step or hold position (for balance work)
- Add unstable surface in ladder squares or under ladder (use balance pads or position ladder over a soft mat)

Agility Ladder Drills

The next segment describes some specific drills, along with potential progressions for each drill. These are NOT the only drills possible – this is a **small sample** of what could be done! Apply these principles to any stepping pattern you come up with! **Safety first!**

OUT/OUT-IN/IN #1 – learn and practice this step pattern moving forward and backward.
Drill #1A – moving **forward**; using the same lead leg (right or left) on every step.
- Start with both feet inside the first section (square) of the agility ladder.
- Step with the lead leg forward, but to the outside of the next ladder section; then step with the other leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the lead leg forward, but to the inside of the next ladder section; then step with the other leg into the same ladder section.
    - Both feet are on the inside of the same ladder section.
- Repeat this stepping pattern through the full length of the ladder.

Drill #1B – moving **forward**; the <u>other</u> leg is the lead on every step.

Drill #1C – moving **forward**; <u>alternate</u> lead legs on each step: Example:
- Start with both feet inside the first section (square) of the agility ladder.
- Step with the right leg forward, but to the outside of the next ladder section; then step with the left leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the right leg forward, but to the inside of the next ladder section; then step with the left leg into the same ladder section.
    - Both feet are on the inside of the same ladder section – **now use the other leg as the new lead leg.**
- Step with the left leg forward, but to the outside of the next ladder section; then step with the right leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the left leg forward, but to the inside of the next ladder section; then step with the right leg into the same ladder section.
- Both feet are on the inside of the same ladder section – **now go back to the original lead leg (right leg in this example).**
- Alternate lead legs through the full length of the ladder.

Drill #1D – moving **backward**; using the same lead leg (right or left) on every step.
- Start with both feet inside the first section (square) of the agility ladder.
- Step with the lead leg backward, but to the outside of the next ladder section; then step with the other leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the lead leg backward, but to the inside of the next ladder section; then step with the other leg into the same ladder section.
    - Both feet are on the inside of the same ladder section.
- Repeat this stepping pattern through the full length of the ladder.
-

Agility Ladder Drills

Drill #1E – moving **backward**; the <u>other leg</u> leads on every step.

Drill #1F – moving **backward**; <u>alternate</u> lead legs on each step: Example:
- Start with both feet inside the first section (square) of the agility ladder.
- Step with the right leg backward, but to the outside of the next ladder section; then step with the left leg to the outside of the same ladder section.
  - Both feet are on the outside of the same ladder section.
- Step with the right leg backward, but to the inside of the next ladder section; then step with the left leg into the same ladder section.
  - Both feet are on the inside of the same ladder section – **now use the other leg as the new lead leg.**
- Step with the left leg backward, but to the outside of the next ladder section; then step with the right leg to the outside of the same ladder section.
  - Both feet are on the outside of the same ladder section.
- Step with the left leg backward, but to the inside of the next ladder section; then step with the right leg into the same ladder section.
- Both feet are on the inside of the same ladder section – **now go back to the original lead leg (right leg in this example).**
- Alternate lead legs through the full length of the ladder.

Challenge Options for Steps – increase Step Height. Here are some options:
- Name a specific step that should be higher – examples include:
  - Lead leg only
  - Right leg only
  - Left leg only
  - Steps to the outside only
  - Steps to the inside only
  - Forward steps only
  - Backwards steps only

Arm Movement Challenge Options – add arm movements when participants are ready for an increased challenge. A potential progression sequence could be:
- Arms and legs move ipsilaterally in the same direction (forward or backward)
- Arms and legs move contralaterally in the same direction
- Arms and legs move ipsilaterally in the opposite direction
- Arms and legs move contralaterally in the opposite direction
- Arms and legs move ipsilaterally – legs forward or backward & arms laterally
- Arms and legs move contralaterally - legs forward or backward & arms laterally
Note: These 6 options could be implemented with all 6 of the drills (#1A through #1F)!

OUT/OUT-IN/IN #2 – learn and practice this step pattern moving forward and backward. This pattern is different from Drill #1 – the steps to the outside are done **laterally** (straight sideways from the same ladder section that the feet were inside) instead of forward to the outside of the next ladder section.

Agility Ladder Drills

Drill #2A – moving **forward**; using the same lead leg (right or left) on every step.
- Start with both feet inside the first section (square) of the agility ladder.
- Step laterally with the lead leg, to the outside of the current ladder section; then step with the other leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the lead leg forward, to the inside of the next ladder section; then step with the other leg into the same ladder section.
    - Both feet are on the inside of the same ladder section.
- Repeat this stepping pattern through the full length of the ladder.

Drill #2B – moving **forward**; the <u>other</u> leg is the lead on every step.

Drill #2C – moving **forward**; <u>alternate</u> lead legs on each step: Example:
- Start with both feet inside the first section (square) of the agility ladder.
- Step laterally with the right leg, to the outside of the current ladder section; then step with the left leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the right leg forward, but to the inside of the next ladder section; then step with the left leg into the same ladder section.
    - Both feet are on the inside of the same ladder section – **now use the other leg as the new lead leg.**
- Step laterally with the left leg, to the outside of the next ladder section; then step with the right leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the left leg forward, to the inside of the next ladder section; then step with the right leg into the same ladder section.
- Both feet are on the inside of the same ladder section – **now go back to the original lead leg (right leg in this example).**
- Alternate lead legs through the full length of the ladder.

Drill #2D – moving **backward**; using the same lead leg on every step.
- Start with both feet inside the first section (square) of the agility ladder.
- Step laterally with the lead leg, to the outside of the next ladder section; then step with the other leg to the outside of the same ladder section.
    - Both feet are on the outside of the same ladder section.
- Step with the lead leg backward, to the inside of the next ladder section; then step with the other leg into the same ladder section.
    - Both feet are on the inside of the same ladder section.
- Repeat this stepping pattern through the full length of the ladder.

Drill #2E – moving **backward**; the <u>other leg</u> leads on every step.

Drill #2F – moving **backward**; <u>alternate</u> lead legs on each step: Example:
- Start with both feet inside the first section (square) of the agility ladder.

Agility Ladder Drills

- Step laterally with the right leg, to the outside of the next ladder section; then step with the left leg to the outside of the same ladder section.
  - Both feet are on the outside of the same ladder section.
- Step with the right leg backward, but to the inside of the next ladder section; then step with the left leg into the same ladder section.
  - Both feet are on the inside of the same ladder section – **now use the other leg as the new lead leg.**
- Step laterally with the left leg, to the outside of the next ladder section; then step with the right leg to the outside of the same ladder section.
  - Both feet are on the outside of the same ladder section.
- Step with the left leg backward, but to the inside of the next ladder section; then step with the right leg into the same ladder section.
- Both feet are on the inside of the same ladder section – **now go back to the original lead leg (right leg in this example).**
- Alternate lead legs through the full length of the ladder.

Challenge Options for Steps – increase Step Height. Here are some options:
- Name a specific step that should be higher – examples include:
  - Lead leg only
  - Right leg only
  - Left leg only
  - Steps to the outside only
  - Steps to the inside only
  - Forward steps only
  - Backwards steps only

Arm Movement Challenge Options – when participants are ready for an increased challenge, add some arm movements to each of the previous drills. A potential progression sequence could be:
- Arms and legs move ipsilaterally in the same direction (forward or backward)
- Arms and legs move contralaterally in the same direction
- Arms and legs move ipsilaterally in the opposite direction
- Arms and legs move contralaterally in the opposite direction
- Arms and legs move ipsilaterally – legs forward or backward & arms laterally
- Arms and legs move contralaterally - legs forward or backward & arms laterally
Note: These 6 options could be implemented with all 6 of the drills (#2A through #2F)!

OUT/OUT-IN/IN #3 – learn and practice this step pattern moving laterally.
Drill #3A – moving laterally; using the same lead leg on every step.
- Start with both feet inside the first section (square) of the agility ladder.
- If moving to the right, the lead leg will be the right leg; and vice versa.
- Step laterally with the lead leg, into the next ladder section; then step with the other leg into the same ladder section.
- Repeat this stepping pattern through the full length of the ladder.

Agility Ladder Drills

Drill #3B – Repeat Drill #3A using the other leg as the lead leg.

Drill #3C – moving **laterally & diagonally.** Example:
- Start with both feet inside the first agility ladder section.
- Step right laterally and forward in a diagonal line so that the right foot lands outside the next ladder section – the ladder will be just behind the heel of the right foot; then step with the left foot to be next to the right foot outside of the same ladder section.
- Step right laterally and backward in a diagonal line so that the right foot lands <u>inside</u> the next ladder section; then step with the left foot to be next to the right foot, inside the same ladder section.
- Repeat this stepping sequence for the full length of the ladder.

Drill #3D – moving **laterally & diagonally.** Example:
- Start with both feet inside the first agility ladder section.
- Step right laterally and backward in a diagonal line so that the right foot lands outside the next ladder section – the ladder will be <u>in front of</u> the right foot; then step with the left foot to be next to the right foot outside of the same ladder section.
- Step right laterally and forward in a diagonal line so that the right foot lands <u>inside</u> the next ladder section; then step with the left foot to be next to the right foot, inside the same ladder section.
- Repeat this stepping sequence for the full length of the ladder.

Drill #3E – moving **laterally & diagonally.** This is a combination of Drills 3C & 3D – it is a Ladder Cross-Over Step. Example:
- Start with both feet inside the first agility ladder section.
- Step right laterally and forward in a diagonal line so that the right foot lands outside the next ladder section – the ladder will be just behind the heel of the right foot; then step with the left foot to be next to the right foot outside of the same ladder section.
- Step right laterally and backward in a diagonal line so that the right foot lands <u>inside</u> the next ladder section; then step with the left foot to be next to the right foot, inside the same ladder section.
- Step right laterally and backward in a diagonal line so that the right foot lands outside the next ladder section – the ladder will be <u>in front of</u> the right foot; then step with the left foot to be next to the right foot outside of the same ladder section.
- Step right laterally and forward in a diagonal line so that the right foot lands <u>inside</u> the next ladder section; then step with the left foot to be next to the right foot, inside the same ladder section.
- Repeat this stepping sequence for the full length of the ladder.

Challenge Options for Steps – increase Step Height. Here are some options:
- Name a specific step that should be higher – examples include:
  - Lead leg only
  - Trailing (non-lead) leg only
  - Steps to the outside only
  - Steps to the inside only

Agility Ladder Drills

- Steps only to the front of the ladder
- Steps only to the front of the ladder

Arm Movement Challenge Options – when participants are ready for an increased challenge, add some arm movements to each of the previous drills. A potential progression sequence could be:
- Arms and legs move ipsilaterally in the same direction
- Arms and legs move contralaterally in the same direction
- Arms and legs move ipsilaterally in the opposite direction
- Arms and legs move contralaterally in the opposite direction
- Arms and legs move ipsilaterally – legs laterally & arms forward, backward, upward
- Arms and legs move contralaterally - legs laterally & arms forward, backward, upward

Note: These 6 options could be implemented with all the drills (#3A through #3E)!

OUT/OUT-IN/IN #4 – learn/practice this pattern moving laterally & anteriorly/posteriorly.
Drill #4A – same lead leg on every step. Always practice with other leg leading, too.
- Start with both feet inside the first section (square) of the agility ladder.
- If moving to the right, the lead leg will be the right leg; and vice versa.
- Step back, out of the ladder square, with the lead leg; then step with the other leg so both feet are together
- Step laterally with the lead leg to be outside the next ladder square; follow with the other foot.
- Step forward into the ladder square, followed by the other foot.
- Repeat the step pattern through the full length of the ladder.

Drill #4B – same lead leg on every step. Always practice with other leg leading, too.
- Start with both feet inside the first section (square) of the agility ladder.
- If moving to the right, the lead leg will be the right leg; and vice versa.
- Step forward, out of the ladder square, with the lead leg; then step with the other leg so both feet are together
- Step laterally with the lead leg to be outside the next ladder square; follow with the other foot.
- Step backward into the ladder square, followed by the other foot.
- Repeat the step pattern through the full length of the ladder.

Drill #4C – same lead leg on every step. Always practice with other leg leading, too.
- This a combination of 4A & 4B.
- Start with both feet inside the first section (square) of the agility ladder.
- If moving to the right, the lead leg will be the right leg; and vice versa.
- Step forward, out of the ladder square, with the lead leg; then step with the other leg so both feet are together
- Step laterally with the lead leg to be outside the next ladder square; follow with the other foot.
- Step backward into the ladder square, followed by the other foot.

Agility Ladder Drills

- Step back, out of the ladder square, with the lead leg; then step with the other leg so both feet are together
- Step laterally with the lead leg to be outside the next ladder square; follow with the other foot.
- Step forward into the ladder square, followed by the other foot.
- Repeat the step pattern through the full length of the ladder.

There are numerous options for stepping patterns. These are just a few of the possibilities. I have had the best success when I focus on a single stepping pattern and progress participants through the various modification options (especially the changes in Step Height and adding Arm Movements) noted in this manual section.

Safety is the highest priority!

Make sure participants feel successful – they must experience AND recognize personal improvement in coordination, cognitive function, agility, reaction time and balance!

Reminder!
If you observe any level of frustration in your participants, remind them of these points:
- Cardio training - heavy breathing, heart beats fast, muscles get tired, and sweat!
- Resistance training - muscles fatigue, heart beats faster, and sweat!
- These are all external signs that we exercised our bodies.
- How do we know when we exercise the brain? When we must think about and focus on what we are doing! It should be difficult, at first! That is exactly what we want! Brain function improves by practicing those difficult tasks! THAT is how you know your brain is being exercised – a difficult movement becomes easier to perform!

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