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Training Agility in Team Sports

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"To me agility is all about the movement patterns deployed in sport and optimizing their application to ensure that ultimate sports performance is maximized."

-Ian Jeffreys From:
http://complementarytraining.net/interview-with-ian-jeffreys

To quote my colleague and friend James Smith "getting strong is like falling out of a boat and hitting water". Whilst I would not go so far, it is true that certain physical qualities are extremely easy to develop; they are easy to define and measure, they don't have too many "moving parts", and they are highly trainable. Agility is not one of those qualities. I have had the good fortune to work with rugby athletes from all over the world. Two of my most recent appointments have involved working with athletes from Argentina and Japan (with Los Pumas Argentina and Toshiba Brave Lupus respectively). Neither nation is traditionally blessed with huge size- whereas some teams at the Rugby World Cup had only one backline player weighing less than 100kg, Argentina had only one back weighing *more* than 100kg. Out of necessity we were forced to develop a high tempo, agile style of play, "if you can't run through them, run around them." This bore some success, with Los Pumas finishing top at the World Cup for defenders beaten as a percentage of total carries. Toshiba Brave Lupus also made a significant year-to-year improvement in defenders beaten after adopting the same approach. Of course, many factors including quality of opposition, weather, and team tactics will influence these statistics, but the trend is a promising one.

In this chapter I will attempt to share the science, rationale, and practical considerations that underpin the system of agility development that I utilize in the training of my professional rugby athletes. Though some elements are undoubtedly specific to rugby, I believe the principles are universal to running based team sports, which all demand agility in some form. With knowledge of the game and some imagination, the model can quickly be adapted to another sport. Remember that I work with adult, professional players who have a reasonable base of physical preparation. If you work with younger athletes, it may be necessary to omit the later phases of this model from their training. With college age athletes, my preference is to start with just the first couple of phases of training, then add a phase each year as a more specific stimulus becomes necessary to enhance performance. Furthermore, in Japanese rugby we have a very long pre-season period of around 20 weeks. Each phase of training will be performed for an average of 4 weeks (slightly longer for phase 1, slightly shorter for phase 5). This is far longer than the typical European pre-season of 8-10 weeks. If you do not have the luxury of time, it may be necessary to either shorten each phase to 2-3 weeks each, use the later phases to transition into the in-season period, or combine phases together into a hybrid block of training. This is a judgement call that has to be made by you the coach.

Though steps have been taken to explain drills as clearly as possible, sometimes the easiest way to understand an exercise is to watch it performed. Readers will be able to find many of the drills detailed in this chapter on the Instagram account @rugbystrengthcoach. Similarly, I can be contacted via email at keir@rugbystrengthcoach.com, where I welcome any questions, comments and feedback. Lastly, I would like to extend my sincere gratitude to Jay DeMayo for inviting me to contribute to The Manual Vol. II. I am certain I would not be where I am today without the knowledge, friendships, and guidance I have experienced in visiting the CVASP seminar and consuming Jay's materials online. To be able to pay him back a little in the form of this chapter is both an honour and a pleasure.

Phase 1- Hard Skill

"When you only have a hammer, everything looks like a nail", the greater the number of tools at the disposal of the craftsperson, the more likely he or she will be able to meet the demands of the task in front of them. The same is true of agility: the broader the base of movement literacy that has been developed in the earliest stages of athletic development, the better equipped the athlete is to effectively meet the demands of agility tasks with which he or she is presented. Thus, the first step of agility development is to ensure the athlete develops a broad base of general motors patterns to prepare for any likely eventuality in his or her sport. Though no two motor patterns are alike, agility movements can be broken down into broad categories, each with a fairly unique set of movement characteristics. I would argue for field based sports like rugby, the list is as follows:

Cutting or shuffling- pushing through the inside edge of the foot to create lateral displacement of the center of mass

Crossover- pushing through the outside edge of the foot to create lateral displacement of the center of mass. This may be abrupt to transition from lateral movement to linear acceleration, or gradual whereby the athlete combines a linear running and turning task at the same time

Drop step- pushing through the inside edge of the foot to turn the body and initiate linear acceleration with the other leg

Turning- simply rotating the body to face in a different direction from a standing base with zero velocity (turning in motion would come under cutting, shuffling or crossover movements)

Linear deceleration- pushing primarily through the balls of the feet with negative shin angles to decrease linear velocity

Back pedaling- mechanically similar to linear deceleration, but initiated from zero velocity and performed to achieve horizontal displacement of the center of mass in a backward motion.

Linear acceleration- pushing primarily through the balls of the feet with positive shin angles to horizontally displace the center of mass and increase linear velocity

Getting up from the floor- raising the center of mass to regain a particular position e.g. athletic stance or linear acceleration

Though all of the above patterns are featured in field-based sports, my opinion is that not all patterns are created equal. Some patterns inherently pose more injury risk to the athlete, barring disaster, an athlete is extremely unlikely to suffer a non-contact injury getting up from the floor, linear acceleration, and backpedaling. However non-contact ACL tears, muscle strains and rolled ankles are all too frequent in cutting and crossover movements. Logic dictates that riskier patterns should be prioritized in agility training. Similarly, some patterns are easier to learn and perform proficiently than others. To witness expert linear deceleration simply observe a toddler who is being taken somewhere he or she does not want to go. Much to the frustration of the parents, with no coaching whatsoever the toddler will instinctively adopt highly efficient deceleration mechanics: dropping the centre of mass, producing sharp negative shin angles and pushing primarily through the balls of the feet (temper tantrum optional). Lastly it may be argued that some agility movements are simply composites of the other agility patterns. For example, the drop step features aspects of linear deceleration and cutting/shuffling on the front foot, turning through the torso, and linear acceleration on the back foot. Thus, it may be argued that a more efficient approach to agility training is to train the constituent's parts and let the rest take care of itself. For these reasons my personal preference with rugby athletes is to concentrate my efforts on teaching and refining two broad categories of agility movement, namely cutting/shuffling and the crossover. As with any motor skill teaching these patterns requires an understanding and application of the science of motor learning. Of all the models I have encountered, I have found dynamical systems learning theory to be the most encompassing and effective for coaching. Dynamical systems learning theory states that all motor behavior is a product of the environment, the nature of the task presented to the athlete, and the individual characteristics of the athlete. Manipulation of these variables will have profound effects on the subsequent motor behavior for example: Whether a ball carrier elects to attempt to evade the defender with a cutting/shuffling pattern, by running around them, or simply carrying the ball into contact will undoubtedly be influenced by the amount of free space available, location on the pitch, remaining time on the clock, weather conditions, the nature of the opposition etc. The rules of the game will create limits on the number of potential actions an athlete may take in response to a relevant environmental stimulus (more on this later). Lastly the individual strengths, weaknesses, anthropometry, preferences and playing style of the athlete will all influence the likelihood of a particular course of action being taken. For example, larger, stronger, slower players will more frequently

seek contact situations whereas smaller, faster players will firstly seek to evade opposition players.

Just as a sleigh being pulled in the snow forms tracks that heighten the likelihood of a particular path being taken with each subsequent journey, performing a motor skill in particular fashion increases the likelihood of similar execution in subsequent repetitions (thank you to Jeff Moyer for this analogy). Thus, in the initial stages of agility development, the role of the coach to manipulate environmental and task constraints to cement the fundamental components of the desired motor skills, to make the right "tracks", to make them early, and to make them as deep as possible. These are the so-called "attractors" or hard skill components which feature when performing a skill regardless of the context. With reference to the cut/shuffle and crossover, attractors may be considered as follows:

Cut/shuffle: pushing through the inside edge at the foot to create lateral displacement of the centre of mass, with the centre of mass remaining inside the base of support (this generally means that the opposite leg is available to produce force in opposition if required)

Crossover: pushing through the outside of the foot to create lateral displacement of the centre of mass, with the centre of mass being projected outside the base of support (a key difference- the ability to quickly decelerate and change direction following a crossover is greatly diminished in comparison to the cut/shuffle

The primary objective of phase 1 is to progress athletes from a stage of unconscious incompetence (low level of mastery with zero awareness of technical flaws) to unconscious competence (high level of mastery requiring zero conscious thought- essentially autonomous movement). This is first achieved in a closed environment, simply because if the fundamental components cannot first be performed with a high level of mastery in a closed environment, technique will only worsen when the athlete is required to attend to numerous environmental stimuli, to make decisions and to modify the timing and execution of the selected motor skill. The athlete must *earn the right* to train in more complex and challenging environments. Logic dictates that exercises must first be mastered at slow speeds before they can be mastered at maximum speed. Thus phase 1 should commence with exercises being performed at speeds slow enough to ensure perfect technique to engrain good movement habits and cement skill

attractors. As proficiency improves, the movement speed can be progressively increased until exercises are eventually performed at 100%.

My personal preference is to perform agility patterns in a rhythmic, continuous fashion with a mix of variations of each pattern being performed in a circuit with short rest periods between each variation. This permits for a large number of repetitions to be performed in a relatively short space of time (more perfect repetitions = faster, "stickier" learning), with a fringe benefits to be derived in the form of work capacity. Effort should be taken to maintain an aerobic work environment, as the detrimental effects of glycolytic work on mechanical efficiency are well known. The list of exercises selected for each circuit are those which we have judged as a team to contain all of the broad varieties of each movement which a player is likely to exhibit during a game of rugby. These are as follows:

Shuffles- primarily lateral movement fed from a static or low speed running base e.g. to optimise defensive positioning or make a tackle.

Shuttles- utilisation of a cutting motion to decelerate then subsequently accelerate in a new direction e.g. to gather a loose ball, to retreat following a kick by the attacking team

Cutting- primarily lateral movement fed from a high speed running base e.g. to evade a defensive player when carrying the ball, what to optimise offensive positioning in support of a ball carrier

Base to crossover to linear acceleration- the initiation of linear acceleration from a static place e.g. to cover large differences in defence following a wide pass from the base of a ruck or scrum

Shuffle to crossover to linear acceleration- as above but fed from a base of lateral movement e.g. the decision to move from a potential tackle situation to cover large distances in defence following an attacking pass or kick

Curve running- a combination pattern of turning and running fed from a very high speed running base (speed at which a cut/shuffle pattern is not possible) e.g. high-speed evasion of a defender when carrying the ball, or when an immediate change of direction is not required e.g. to optimise field position when retreating to gather the ball.

Tracking defence- to cover large distances when use of linear running is not appropriate e.g. when it is necessary to maintain a body position square to attackers.

Readers are welcome to select different exercises to suit the demands of their sport or athletes. The possibilities are endless and there are no right answers. What is more important is that the principles of motor learning are respected, that the athlete is progressed in a logical manner and good movement habits are formed, because it is far easier to create good habits than correct bad ones.

Phase 2- General Reactive Drills

Once the attractors of the cut/shuffle and crossover have been mastered, it is time to introduce the fluctuators or "soft skill" elements to the learning process. These are the elements of a motor skill which are context dependent and will vary from repetition to repetition according to the environmental and task constraints. These are a vital feature of human movement as they allow the athlete to alter and shape the skill to better meet the demands of the environment. For example, the angle of a cut when evading a defender may vary according to the running velocity or the position of the defender relative to the ball carrier. The lateral displacement of the center of mass when running a curve will vary according to how sharp a turn is required. All fluctuators that may be sensibly conceived should be explored during this phase, because an athlete cannot exhibit in competition (with any degree of proficiency) that which they have not prepared for in training.

Personally, I think it is a big jump to progress directly from closed environment general motor patterns into sport specific drills where multiple stimuli must be attended to, decisions made, and motor skills quickly modified and adapted to task demands. As such, Phase 2 features what I have termed as "general reactive drills." These are drills in which the athlete is now forced to exhibit the same motor patterns as Phase 1, but in reaction to a non-specific stimulus e.g. whistle, visual stimuli, or mirroring of a partner.

The reasons for implementing these drills are several-fold:

The difficulty of the drill is higher: the athlete must now devote his or her attentional focus to both the execution of the movement and responding to the stimulus.

We know that the forces exposed to the joints during reactive tasks are significantly higher than those exhibited during pre-planned movements. This builds upon the neuromuscular qualities developed in the previous phase.

Due to the unpredictable nature of the stimulus we can be sure that no two repetitions of the same motor pattern will be alike. Each will be slightly different in its speed, joint positioning, starting and finishing position, timing etc., thus the drills ensure that the athlete is forced to begin to explore the fluctuators of each pattern.

Reactive drills typically entail a degree of competition (directly or indirectly) which is useful for generating enthusiasm amongst the athletes and ensuring each drill is performed at full intensity when necessary. Likewise, success and failure are powerful teachers. In the event of losing, athletes will often gradually self-organize to more optimal mechanics to boost their future chances of success and avoid more failure.

Again, readers are welcome to select or design different drills as necessary for their sport. My preferred method in Phase 2 is to create natural extensions of the drills used in Phase 1, whereby elements of reactivity and competition are built into the exercise. For example:

Continuous shuffle may progress to:

Reactive partner mirror- the athlete faces their partner, one is designated the leader, the other is the follower. On the whistle, using the shuffle pattern the leader must try to "throw off" the follower. The follower must try to mirror the movements of the leader as quickly as possible.

Grab the band- the athlete faces their partner, who has a theraband (or similar object) tucked into their waistband or pocket. The objective of the drill is to grab the band from the partner, who must utilize the shuffle pattern to successfully defend the band. The partners then swap on the subsequent rep.

Defend the circle. A larger group of athletes (around 4-6 works best) form a circle in an athletic stance and join hands. One athlete in the group is designated as the

"target" player. Another athlete, the "chaser" is banished to the outside of the circle on the opposite side to the "target" player. On the whistle, the "chaser" must run around the outside of the circle and attempt to tag the "target". The goal of the players in the circle is to rotate the circle in any direction necessary to keep the "target" away from the "chaser" utilizing the shuffle pattern.

The shuttle pattern may progress to:

Shuttle races- line up players in pairs on the middle of a line in an athletic stance (similar to the start of the 5-10-5 drill). On the whistle the athletes must attempt to complete a series of actions which force them to utilize the cut/shuffle pattern. There is plenty of room for variation here: the drill may be a pre-planned pattern reacting only to the whistle at the start, the nature of the stimulus may dictate which direction the athlete runs to first (e.g. whistle = left then right, verbal command = right then left etc.), or one athlete may pick the starting direction based off winning a small competition e.g. rock-paper-scissors. Another tweak that I am a fan of is using cones or other small markers as part of the task. One typically sees that athletes like to maintain too high a center of gravity, adopt poor shin angles, or simply cheat when changing direction during races. But when athletes are forced to place a marker over the line they cannot help but lower their center of gravity and sharpen their angle (or risk falling over). Likewise, evidence of cheating is there for all to see.

Reactive partner mirror- this is exactly the same as the example above as for the continuous shuffle but executed in a shuttle pattern. One athlete leads, the other must follow. Occasionally I will implement short sprints of 5-10m in this drill to finish each rep; i.e. the first whistle starts the drill, the athletes mirror one another for a given duration, and on the second whistle both athletes must sprint through the line. This allows for a little more competition in a drill in which normally there is no clear "winner". Note that if athlete numbers do not permit for partner based work, the athlete can simply react to a whistle or other stimulus for each change of direction.

Cutting may progress to:

General reactive cut- athletes line up approximately 5-10m apart facing one another. One is designated the attacker and the other the defender, who remains stationary. On the whistle the attacker runs to the defender, who at the last moment indicates a side (e.g. by pointing a hand, using a particular color of cone, a verbal command). The attacker must perform a cut to this side and evade the defender. This drill can be made more challenging by increasing running speed, decreasing the distance between attacker and defender when the command is given, or by introducing conflicting stimuli which the athlete must take additional time to process (e.g. a verbal command to cut left is given but the hand, the real stimulus, may point right).

Pole weave- a number of poles are arranged in a random "obstacle course" fashion in a roughly 5x5m area. Athletes are organized into pairs: one leader, one follower. The drill starts with a small run in of around 5m. As the leader enters the grid, he or she must negotiate their way through the poles utilizing the cutting pattern. The follower must trace an identical path through the poles utilizing the same pattern. The athletes then swap and repeat the drill. In truth this exercise is somewhere between general and applied in its classification: yes, the athlete must attend to specific environmental stimuli (the body position of the leader) and that the execution of the pattern must be slightly modified to achieve a successful outcome, but the drill is general enough that little decision making is required, the athlete knows what pattern must be used, and the number and nature of stimuli that must be attended to are far simpler than game situations (e.g. available space or position of secondary attacking and defensive players).

Base to crossover to linear acceleration may progress to:

Reactive base to crossover- the set up for the drill is identical as pre-planned but the direction in which the athlete initiates the crossover is in response to a stimulus. Again, my preference is that this is turned into some small race or competition to encourage intensity and fun. However, I prefer to tightly limit the space to reduce the accumulation of any unnecessary structural or neuromuscular fatigue, 5-10m at most is sufficient.

Shuffle to crossover to linear acceleration may progress to:

Reactive shuffle to crossover- exactly as above example, but the drill begins with a shuffle pattern. The coach has a few options here: perform the shuffle in one direction only and simply perform the crossover at the next stimulus, perform the shuffle in a reactive fashion and then complete the crossover in pre-determined direction (e.g. single whistle = change direction of shuffle, double whistle = crossover), or perform the shuffle and the crossover in an entirely reactive fashion (chaos!). The only real limitation here is imagination and scientific rationale.

Curve running may progress to:

Reactive post weave- as a rugby coach I like to use the equipment I have available to me and I find rugby posts are extremely useful for training curve running reactively. With cones, it is easy to cheat and run extremely tight to the marker. This does not happen with the posts. If an athlete cheats, they get a face full of pad and ruin their modelling career. Two primary options here: first, line up on the try line facing the posts and accelerate. Just as the player arrives to the first post, they receive a stimulus indicating to which side they must run a curve around the post; e.g. verbal command "left!." They finish the rep by running a curve in the opposite direction around the next post. The second option is to run this as a race with two similarly abled players in pursuit of one another, separated by 5-10m at the start. The leading player selects the direction in which they wish to weave through the posts, and the following player must follow. As with other drills, the reactive post weave may be progressed by increasing running speed or giving the signal later in the approach to the post.

Tracking defense may progress to:

Reactive tracking defense- In the context of rugby defense, when the shoulders turn, a player becomes incredibly easy to beat. So we use tracking defense to cover a lot of distance whilst staying square to the attacker. In the event that the attacker cuts inside, the defender is well placed to react and make a tackle. This is the exact situation we try to simulate with reactive tracking defense- start the drill by tracking across using the crossover. On the whistle the athlete must decelerate in the cut position and perform a short burst (1-2 steps) in the opposite direction. This

is an incredible rugby specific situation so I will not spend much more time explaining this.

My athletes training tends to operate in the broader context of an aerobic-alactic model. We focus as much as possible on the development of aerobic and alactic qualities (which offer more return on investment (ROI) per unit of training time and effort in my humble opinion) and let overzealous rugby coaches train glycolytic qualities (which have a shorter window of adaptation and less ROI) for us in sport practice and matches. For this reason, higher intensity agility movements (essentially anything from Phase 2 onwards) should be performed for limited durations with moderate to long rest periods so as to stress the alactic pathway and not become predominantly reliant on the glycolytic pathway.

Phase 3- Soft Skill Drills

Whilst general reactive exercises are a good progression on pre-planned movements, they are still a long way from reflecting the true demands of sporting agility. The number and type of stimuli that the athlete must attend to are too few and general. The athlete is not forced to evaluate the situation, draw on their knowledge of the game, to anticipate and to recognize patterns to select the most appropriate movement from their "tool box". Likewise, in Phase 2, once a decision has been made the athlete just executes the movement. There is no modification to execution or timing of the movement as the information being perceived or processed updates and changes. Thus, the objectives of Phase 3 are to progress athletes closer towards that reality, and continue to build on the foundation of Phases 1 & 2.

For an in-depth understanding of the science underpinning agility consult the extensive reviews conducted by Dr. Jeremy Shepperd, Dr. Warren Young, Dr. Ian Jeffreys and Dr. Patrick Holmberg. However, to summarize the work of these excellent researchers, agility is primarily constrained by 4 primary areas:

1. **Perceptual Constraints**

   This is the ability of the athlete to perceive his or her environment through the senses; e.g. auditory, haptic and proprioceptive, though primarily visual. A number of factors will affect visual perception including visual acuity, the breadth of the visual field, ability to distinguish colors, to fix a moving image on the retina, to distinguish

detail in moving objects, eye dominance, and the physical ability of the eyes to quickly scan in a particular direction.

Obviously, a coach can quickly get washed up in the detail of visual perception if they are not vigilant. Thankfully the science suggests that actually a very small percentage of the variance between elite and sub-elite performers can be explained by the information gathered by the senses. The real difference appears to lie in how this information is processed, more on this later. My hunch is that without the investment of time and resources that most clubs do not have, the best way for a coach to cover their bases here is to make sure their athletes are getting regular eye tests, that if they need contacts they are training and competing with them in, and that they have the correct prescription at all times.

2. **Physical Constraints**

Interestingly, much like perception, physical qualities (the potential to produce force) do not appear to be a great distinguisher of elite from sub-elite athletes in agility movements. In pure pre-planned tasks, there is no significant difference. The ability to distinguish the two groups arises when the athlete is forced to perceive environmental stimuli, make decisions and adapt their movement in response to the environment.

This is not to say that physical ability cannot be disregarded completely, putting an expert driver behind the wheel of a car with a crappy engine and four busted tires and they are not going to win the race! Physical qualities should be maximized, and then expressed to their maximum with elite level information processing, decision making, and motor control. The development of physical qualities is where 99% of strength coaches feel comfortable and have good experience, so I will not dwell on this area. My opinions on developing physical qualities for agility can be summarized as follows:

Train a broad range of movement velocities to reflect the unpredictable demands of the environment.

Learn how to produce, transmit and absorb force in all three planes of movement.

Train unilateral and bilateral patterns with equal emphasis.

Try not to look like "10 pounds of crap in a 5 pound bag." Any excess mass you're carrying must be decelerated and overcome and it takes extra force to do so. In the

short term, movement will be slower and in the long term the energy cost of activity will be significantly higher.

Make sure you are well conditioned to repeat high intensity efforts with the greatest possible frequency and sustainability in the context of your sport.

3. **Cognitive Constraints**

Cognitive factors- the ability to effectively direct one's attention, quickly derive meaningful information from the perception of one's environment, to select appropriate responses, and to creatively solve movement problems. This appears to be one of the main factors that separate great athletes from good athletes. My guess is that cognitive developments are why some athletes may not have the best physical development, yet are without a peer on the field. They seem to have "extra time on the ball" or what people call "game speed". Conversely physical development in the absence of cognitive development gives rise to the "combine warrior", an athlete who runs a blazing 40 or jumps out of the gym, but often looks like a fish out of water once they get put in a real game situation.

Cognitive processes influencing agility may include:

Attention- which aspects of the visual field are attended to, and which are deemed irrelevant. For example, a rugby player may pay more attention to the spin or bounce of a ball to better anticipate its flight path, or in the foot position or torso angle of an attacker to infer the likely direction of a side step.

Anticipation- the ability of the athlete to "predict" future movement of the ball or players based on their current position, direction, velocity, behaviour, where their visual field is fixed etc., so that movement can be planned "one step ahead."

Pattern recognition and knowledge of game situations - essentially a mental database that the athlete builds up in their head of "if X, then Y" situations. The sooner the athlete can detect patterns of offensive or defensive behaviour in opposition players or tactical schemes, the sooner an appropriate response can be selected, reducing response time (the interval between perception and the initiation of movement). Developing experience and knowledge of game

situations also allows the athlete to make judgement calls about the most appropriate motor response to an agility program, what action is most likely to succeed?

Problem solving- a mixture of intellect, creativity and confidence that allows players to attempt different strategies in solving motor problems. Whilst certain elite athletes do not fit the typical academic mold of "intelligent", there can be no question that the best players in the world possess sporting intelligence in abundance. They are smart, they think outside the box and they have the balls to give it a try.

4. **Motor Control Constraints**

Motor control is simply the ability to select, execute and modify a motor pattern to successfully achieve a task. The pattern selected is a function of motor literacy (what tools do you have in the "tool box"? This has hopefully been addressed in Phase 1) and processing (making a decision about the optimal course of action based on perception of information and cognitive factors previously discussed).

As outlined earlier the execution of a motor pattern, or "spontaneous motor behaviour" in the context of dynamical systems learning theory arises as a result of the interaction between athlete, environment and task. The athlete must quickly recall a general motor pattern comprised of attractors- those elements that never change from rep to rep, and then adjust the fluctuators- those elements that always vary from rep to rep- in response to the environment. Cementing the attractors has been achieved in Phase 1. Exploration of the fluctuators has begun in Phase 2 and continues in earnest in Phase 3.

The modification of motor patterns is the ongoing adjustment of skills based on constantly updating of the environmental information being perceived and processed by the brain. Understanding the cyclical relationship between perception and action is fundamental to understanding modification of movement. Athletes cannot simply pick a movement and pull the trigger. They must stay present and always be ready to change the plan as the situation changes.

Phase 3 in a Nutshell

To state the obvious: the above are all highly task specific. The cues that an athlete must attend to or ignore vary from skill to skill. Being able to anticipate the movement of a sporting implement or player will differ from sport to sport. A database of knowledge about what works and what doesn't work will only work in the sport in which it was developed. Problem solving will be extremely context dependent because as the problem changes, so too does the optimal solution. This is why a good athlete in one sport cannot simply switch sports and excel at the same level. Everything they have learned is now general, not specific. Thus, the goal of Phase 3 is to shape the learning environment and task constraints to help athletes develop this sport and task specific knowledge. I believe that learning should be implicit wherever possible, and I subscribe to the idea that the athlete really doesn't care what comes out of the coach's mouth. Learning is most vivid when the athlete discovers the solution for themselves, "they have to get burned to know it's hot." My role as coach in Phase 3 is to create drills that force the athlete to use the patterns that we have previously taught and practiced in Phases 1 & 2, but now in situations that are highly relevant to the game. Athletes are encouraged to experiment and vary what they do throughout the process, to remember what worked well and what didn't work so well, what might have been useful pieces of information to attend to and what was a waste of time. In doing so the cognitive and motor processes that lead to effective agility are gradually developed and strengthened.

Drills are performed one on one in competition fashion at full speed. This is a natural progression of the exercises performed in Phase 2, as now the athlete must process specific visual information, utilize this information to select a pattern (that the coach secretly knows he/she must use to be effective), and modify the timing and execution of that pattern so to achieve a successful outcome. In doing so the athlete is able to develop the type of cognitive and motor development that exemplifies elite level agility. Careful attention must be paid to the design of drills, with sport coach and strength coach working together to create the right kind of learning environment. Too much freedom and the athlete may never utilize and refine the desired movement pattern. Not enough freedom and the drill becomes so contrived that no specific knowledge of situation, anticipation or pattern recognition can be developed. It should be noted that the goal of this phase is not a successful outcome but rather learning and discovery. Learning from failure can be just as productive as experiencing success. As these

drills are highly specific to one's sport, I will not dwell too much on the drills I use with rugby athletes. However, my goal is to create exercises in which athletes are forced to use all the typical variations of both the cut/shuffle and the crossover including:

Cut/shuffle	**Crossover**
Corner 1v1 (defender chasing across)	1v1 Kick chase back (stop, crossover, run back)
Head on 1v1	2v2 Wide channel ruck defence
2v2 Narrow channel ruck defence	Tracking defence 1v1
Gathering the ball close to the touchline/tryline	1v1 Chase back defence (defender's back turned)

In the interests of adhering to Bernstein's philosophy of "repetition without repetition", the variables of each drill should be frequently changed to force greater exploration of the fluctuators and develop deeper knowledge of game situations (e.g. modify drill dimensions, change personnel, change start position, alter the speed of the run in etc.). This lays the foundation for Phase 4.

Phase 4: High Specificity Drills

Just as Phase 3 was a necessary progression of Phase 2 (which does not fully represent the agility demands of sport), so too must Phase 3 be further progressed. In true sporting agility, the athlete has to attend to the position, velocity, direction, behaviours etc.; of not just one defensive player, but multiple players. The athlete must not just concern his or herself with selecting the optimal motor response based on their own position and speed, but also that of his or her teammates. And all of the above must be constantly monitored and considered in the modification of execution and timing of the selected motor response. In short: the psycho-perceptual demands of true sporting agility are exponentially more complex than those found in Phase 3. As such the exercises in Phase 3 are now progressed to include multiple players in both attack and defense, increasing the number of stimuli that must be perceived and processed. Similarly, whereas in Phase 3 exercises are used to force the athlete to select and refine a particular movement pattern, exercises are less tightly controlled in Phase 4. In each exercise

both attackers and defenders may select from a variety of different motor responses to achieve a successful outcome. There are several reasons for this design:

To allow each individual within the team to discover his or her individual movement style. Consider that in dynamical systems learning theory all motor behaviour will be attributable in part to the athlete. Individual differences in intellect, preferences, physical qualities etc., will naturally gravitate athletes to a particular movement style. Lock forwards who approach seven feet in height do not tend to be the most dynamic side steppers in the world, just as small scrum halves typically don't seek to carry to the ball into contact. The role of the coach in Phase 4 is to help each athlete discover their optimal style.

In Phase 4, gone is the guided discovery outcome of Phase 3. Athletes should now concern themselves with only achieving a successful outcome, using whatever pattern, in whatever format of execution or timing they need to do so. Just as there are obvious consequences for success or failure in a real game, drills should be designed with inherent consequences for a successful or unsuccessful outcome. The best challenge I have encountered is that the losing team from a drill were required to hand over their cell phones to the winning team, who were permitted one minute to do whatever they liked on the losers' social media accounts. Understandably the drill took on some real intensity with that kind of forfeit on the line!

To progress psycho-perceptual demands from Phase 3. With larger numbers, athletes are forced to attend to multiple players in attack and defense, process this information and factor it into decision making. For example, the relative position between two players in the defensive line will influence an attacker's decision to either pass the ball into space or carry the ball and evade. In attack the relative position and velocity of one's teammates will have equal influence on the course and nature of action taken.

To better anticipate, detect the patterns of behaviour and complement one's teammates. Whilst a number of constraints will vary from week to week such as the characteristics of the opposition, pitch dimensions, weather conditions, refereeing style etc., one's teammates, and the team's style of play remain fairly consistent throughout the season. The better each team member can seamlessly

work with those around them, the faster environmental stimuli can be processed, that good decisions can be made and the more optimally they can be modified, with obvious performance benefits.

In phase 4 the line between agility training and sport practice becomes even more blurred. For this reason, I prefer to give sport coaches even more input into the design of exercises in this phase. Firstly, they know more than me about game scenarios, and secondly because training should always strive to be a collaborative process combining the expertise of all practitioners involved. The drills my athletes typically tend to perform in Phase 4 are again natural progressions of those utilized in Phase 3. For example:

<table>
<tr><th>Phase 3</th><th>Phase 4</th><th>Rule/decision making progression</th></tr>
<tr><td>Corner 1v1 (defender chasing across)</td><td rowspan="8">As phase 3 but with varied pitch dimensions and increased player numbers. This may be equal e.g. 3v3, offensive advantage e.g. 3v2, or defensive advantage e.g. 3v2.

Variation can also be introduced into the drills by handicapping attack or defence to delay movement response, limiting space that can be operated in, constraining the activity of certain players etc</td><td rowspan="8">Attack may select any attacking strategy or offensive spacing of their choosing e.g. narrow spacing & carry the ball vs wide spacing and pass into space etc.
Defense must respond accordingly and select the optimal strategy to win e.g. rush defense vs zone defense</td></tr>
<tr><td>Head on 1v1</td></tr>
<tr><td>2v2 Narrow channel ruck defence</td></tr>
<tr><td>Gathering the ball close to the touchline/tryline</td></tr>
<tr><td>1v1 Kick chase back (stop, crossover, run back)</td></tr>
<tr><td>2v2 Wide channel ruck defence</td></tr>
<tr><td>Tracking defence 1v1</td></tr>
<tr><td>1v1 Chase back defence (defender's back turned)</td></tr>
</table>

As with any sporting ability or action, the whole must be broken into the constituent parts. Strengths and weaknesses must be identified, appropriate action taken, and with training

activities scaled and progressed as the athlete's mastery. Over time these distinct elements must be gradually re-integrated into the whole and optimally expressed in the context of the game. Readers may have noticed that this is the same process I try to adhere to when developing agility in my athletes:

Phase 1- pre-planned agility movements performed in extreme isolation with no linking of perception, processing and action.

Phase 2- pre-determined agility movements with coupling of perception and action (general stimuli, small variability of movement)

Phase 3- pre-determined agility movements with specific coupling of perception and action (specific stimuli, limited information processing and decision making demands, large variability of movement).

Phase 4- open agility movements with highly specific coupling of perception and action (broad variety of specific stimuli, broad information processing and decision making demands, extremely large variability of movement).

Phase 5 represents the final piece the puzzle: fully realizing adaptation of previous training in a sporting context, and the re-integration of all elements into the whole.

Phase 5- Realization of Adaptation in Sporting Context

All elements previously trained can be considered the separate actions or scenarios that comprise a game of rugby (e.g. attack, defense, ball carrying, supporting play etc.). They are performed in isolation with a high degree of control exerted by the coach. Within a drill, both coach and athlete can broadly predict what will happen with a reasonable degree of accuracy. The obvious value of this development of agility is that weaknesses can be more effectively targeted, with greater potential for overload. The reverse is true when athletes attempt to develop agility simply by practicing or playing their sport. However, the contrived nature of training does not truly reflect sporting reality. Situations arise and unfold spontaneously, no two repetitions are ever alike, and athletes are forced to adapt as their attempts to solve sporting problems succeed or fail (adapt or lose!). Until an athlete can master this environment, performance cannot be fully optimized. Thus, the final piece of the agility training puzzle is to

reintegrate all of the previously trained skills into the whole, and realize this adaptation in the most specific sporting context possible.

Make no mistake that further improvement in the physical, technical or tactical qualities underpinning agility is unlikely to take place in Phase 5. Instead the objective is to learn how to fully express adaptations trained in previous phases in the most efficient manner possible; to develop pacing strategies, refine interaction between team members, make last minute adjustments to team tactics, and to build confidence in both individuals and the team as a whole. This should sound a lot like team practice and friendly matches, because it is. As such sessions should be largely driven by the head sport coach, with guidance given by the strength coach about how the parameters of each aspect of training may be modified to achieve the greatest possible synchronization between the team's tactical, technical, physical and psychological goals (e.g. work duration and intensity, work:rest distribution (which should reflect match demands), total session volume etc.).

Phase 5 is essentially a taper, which typically lasts from one to four weeks in duration depending on a variety of factors including the competition calendar and accumulated fatigue. Given its brevity, I tend to avoid directly programming traditional "agility" work during this phase. It makes no sense, to me, to attempt to develop and express ability at the same time. However, readers are welcome to implement small technical "refreshers" of Phase 1 type work during warm ups to retain development of the hard skill aspects of the cut/shuffle and crossover patterns. Do not worry about investing time and effort into training the soft skill, or psycho-perceptual elements of agility and sport practice and games will more than fulfill these requirements.

A Final Note On In-Season Training

The same principles apply to agility training that govern all physical qualities during the in-season period. Coaches should strive to deliver the minimum effective stimulus that allows athletes to retain development or progress at a sensible rate. Emphasis should always be placed on freshness and maximum readiness over preparation. It doesn't matter how hard you train in the week if the team is tired and underperforming on the weekend. Similarly, coaches should attempt to use the limited time they have with the athlete's in-season to train exactly what the

game doesn't stimulate. Why repeat what they already get in practice or weekly games? In the context of agility, significant emphasis should not be placed on developing highly specific psycho-perceptual qualities that characterize Phases 4 & 5. Instead more time should be dedicated to the more general elements of hard skill development and general reactivity (Phases 1 & 2) which form the foundation of agility expression on the field.

Who is Keir Wenham-Flatt?

Keir Wenham-Flatt MSc CSCS is a certified strength & conditioning specialist and founder of Rugby Strength Coach, the web's #1 resource for rugby strength & conditioning information.

Keir's voyage in the game of rugby has brought him around the globe. Currently he is the Head of Strength & Conditioning for Toshiba Brave Lupus in the Japanese Top League. Prior to his tenure in Japan, Keir worked with the Argentinean National Team in preparation for and while competing in the Rugby World Cup. Los Pumas they finished fourth, their best performance on the world's biggest stage in the sport.

Before heading to South America, Keir was with the 2014 World Club Challenge Champions the Sydney Roosters, and two-time European Cup Champions London Wasps. The sport of ruby has brought Mr. Rugby Strength Coach around the world and to four different contents in his career where he has had the opportunity to connect with and learn from some of the best coaches around the world. For more information and to connect with Keir check out his web site www.rugbystrengthcoach.com.