Skill Classification and Information Processing

Task 1

(http://media.g-
win.com/betweekly/images/game16/STEPHEN%20HENDRY%20MBE.jpg)

Skill: Snooker shot.

(http://www.tennisforall.org/serves/chela_serve%201.htm)

Skill: Tennis serve.

(http://www.cnnsi.com/rugby/news/2001/02/03/wales_england_ap/t1_wilkinson_all-
01.jpg)

Skill: Conversion kick.

(http://www.deccanherald.com/deccanherald/oct01/img/cricket.jpg)

Skill: Cricket shot (sweep).

(http://www.theposh.premiumtv.co.uk/content/pete/media/db/S25/156621.JPEG)

Skill: Football pass (side footed ground pass).

(http://www.boxingpress.de/fotos/lewis-botha-ko-punch-01.jpg)

Skill: Boxing punch (Hook).

1. The tennis serve is the most skilful out of all the 6 skills I have chosen because it matches these 7 points that recognise a skilled performance:

Learned
Goal Orientated
Aesthetic
Successful
Consistent
Economic (in terms of time/energy)
Cognitively Processed

The tennis serve requires a lot of practice to groove the skill into the long-term memory, to be able to produce a powerful, accurate and effective service it requires a

huge amount of learning. The serve is so vital for that the game that professional players will dedicate a large amount of their practise to learning how to serve accurately with power.

The serve is definitely goal orientated because the service can easily win you the point/game and if your serve is strong enough it can dominate and control the whole match. The service can ace the opponent or it can be good enough that the opponent has to return with a poor shot giving you a chance to take the point.

When a tennis service is carried out with skill an finesse it can be very aesthetically pleasing, if the technique is perfect and the serve has a lot of power it looks smooth and well learned.

It is very difficult to make a service successful, it either needs to be out swinging toward the inner side of the service box or hit with a lot of power to the far corner of the service box. Although it's very hard to hit these spots with the right power when the server does achieve in reaching these points it often results in a successful serve.

Possibly most difficult part of carrying out a skilful tennis serve is being able to do it consistently, the server has to follow the perceptual traces they have in there long-term memory perfectly. Any small error in technique can cause a foul service or a service, which is easily returned.

The service must be economic especially in terms of energy as tennis matches can last for very long periods of time. The server must use his or her momentum as much as possible instead of using their muscles extensively. If a tennis player uses as much as energy as they can muster from their shoulder muscles for each serve and not using much of a swinging motion to create momentum, then their serving shoulder will begin to ache quite rapidly and reduce the efficiency of their service.

The tennis serve has to be cognitively processed because there is so little margin for error, if the server does not cognitively process what they are doing and don't concentrate on where they're trying to serve the ball then it's very likely they won't succeed in carrying out a successful serve.

2.
Skill is "the learned ability to bring about predetermined results, with maximum certainty, with the minimum outlay of time energy or both" (Class notes, original source - Knapp, 1963).
This means to be able to carry out a skill knowing exactly how it is going to work with the least use of energy and time.

Technique is "the building blocks which allow athletes to achieve skilled performance" (Douthwaite, 2000). Techniques are "building blocks" because they need to be practised and mixed with abilities in order to make a skill happen. Techniques are specific to the activity but some people have different techniques within the same skill (i.e. different people sometimes use different stances to do the same skill)
Motor abilities are "relatively enduring traits which are generally stable qualities or factors that help a person carry out a particular act" (Class notes, original source - Fleishman). Meaning that abilities are usually traits you are born with but can be trained to become improved.
The types of abilities are: **Speed, power, balance, co-ordination, agility, reaction time, flexibility and timing.**

Skill, technique and abilities are all linked together in the equation:
Skill = Ability + Technique + Practice

Different skills require varying abilities and techniques; but they all necessitate training/practice in order to become perfected and 'skilful'. All skills need some of the abilities in order to perform the skill; skills also need a technique but techniques in some sports vary from person to person, each different style can be just as effective as each other.

A skill is combining technique and ability and turning into a skilful movement. Without technique you would struggle to carry out the skill successfully and without any of the abilities essential for the in particular skill it would be difficult to physically carry out the skill correctly. Yet these two combined are not usually very valid if you do not practice combining the technique and abilities needed to perform the skill.

Snooker shot: The snooker shot requires very fine and perfected abilities, because it is a fine motor skill. Yet the technique is the most important part of the snooker shot. The abilities that the snooker shot requires are:

Balance
Power
Timing
Co-ordination

Balance is needed in order to position your self in an adequate position in front of the ball you desire to pot; and then hold this situation until you've taken the shot and followed through.

Power isn't needed in all snooker shots; yet it you'll need explosive power in order to pot the ball you want to pot next for example bring the white ball back up to the other end of the table to be in a effective position to pot the next ball and so on. This power must be very well controlled otherwise you can leave yourself in an awkward position; i.e. you might want to use power but aim to get backspin but end up hitting it not hard enough and not getting the appropriate spin.

Timing is needed in order to know when you're in the right state of mind and position to pot the ball you're aiming for. For example have must have thought about the shot before you attempt to pot it, as a very slight mistake can be the difference between missing and potting.

Co-ordination is vital in the snooker shot, as you must be thinking about the position of your hands in proportion to the position of the white ball and the ball you're aiming to pot. You must also be thinking about where you want to strike the white ball (i.e. at the bottom for backspin or on the top for top spin or on the sides for side spin). So you have to use your hands an eyes to be able to pot the ball and hit the white ball in the correct position.

Techniques vary through different shots and players; most players have a unique style to their play. For example some players prefer to hold the cue with their backhand very loosely yet others like to grip it tightly. This is the main variable within the snooker shot technique. The position in which the snooker cue lies in the

hands can also vary; most players like the slide the cue between thumb and forefinger (as when the thumb and finger cross it leaves a groove for the cue to lye and slide smoothly), but even this technique can vary.

The technique can also vary depending on where the ball is and how close it is too the cushion and also the power they wish to exert. If the white ball was quite close to the cushion and the player wants to hit the ball quite powerfully they might slide the cue along the cushion with their hand lying over the top with the cue coming through the fingers. This gives the player a longer level to strike the white ball with maximum power.

Tennis Serve: The tennis serve is very gross motor skill and as with snooker it is self paced to a certain extent but can be effected by other factors, i.e. the player moving more to the centre of the court so you would aim to hit it to the far side of the court to try an make it as difficult as possible for him. The technique is also very important and it necessitates *a lot* of practice to perfect. The abilities required to carry out a tennis serve are:

<div align="center">

Power
Balance
Co-ordination
Flexibility
Timing

</div>

Power is needed to hit the ball with the correct speed and direction (velocity); the higher the speed at which the ball is travelling, the less time the other player has to react to the direction of the ball, thus making it much more difficult to return when it's travelling at very high speeds. The fastest serve ever recorded in competition is 149mph, which was set by Greg Rusedski.

Balance is vital in order to be able to control your racket and the ball. For example you might be able to hit the ball at very high speeds but if you keep loosing your footing as you swing the racket then it's likely you will never get the ball into the designated service area. You body position must maintain the practised balanced position to replicate effective services every time; i.e. it must follow a practiced perceptual trace. Concurrent feedback is useful to perfect your balance because your body position will either feel right or not and during the service your muscles will tell you if it feels correct or not.

Co-ordination is necessary so that you can throw the ball up and see where it is going and then be able to bring your racket up while keeping your eyes on the ball and strike it at the correct position to produce a skilful serve. To do this you must use your proprioceptual senses; in particular your kinaesthetic sense which will tell your brain where your arm and hand holding the racket are in proportion to rest of your body and thus allowing you to watch the ball while you strike it with the racket.

Flexibility is needed to a certain extent so that you can fulfil the maximum power. I.e. to transfer the maximum power from racket to ball you must flex your knees, elbows and spine this flex can then be turned into extension working like a spring (the more you bend a spring back the harder it will spring forward when you let go).

Timing is critical for hitting the ball at the right height in the air, the player must time the start of his technique very well in order to strike the ball when it has reached it's maximum height, when it's not moving upwards and not moving downwards, this means that the player can control the ball completely without it being effected by it's own upward or downwards motion.

Technique is greatly required in order to carry out the tennis serve successfully and consistently. The body position is vital and the way you flex and spring up to hit the ball is also very important. The position you hit the ball in the air is also important. The standard tennis serve technique is usually very similar, yet some vary slightly. The body must move from a low position with the racket behind your head, with the face of the racket facing the direction in which you wish to hit the ball and also you might hit the ball at an angle to curl it through the air and make it spin when it bounces in the service area. This all must be done while throwing the ball up in front of with the correct height and direction so that you can hit it accurately and with the correct grip on the racket to hit it effectively (*Reference: http://www.tennisforall.org)*:

Conversion kick: The rugby conversion kick is a gross motor skill, which is also self-paced but can occasionally be externally paced depending on the conditions. For example the kicker would be still under the control of the shot but if there was a strong wind he would have to counter for that and change the direction of his kick, thus making it slightly externally paced as the kicker will have to change their normal approach to counter for external environmental conditions. The abilities needed to carry out the conversion kick are:

<div align="center">

Power

Balance

Co-ordination

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Power is necessary to basically kick the ball with enough height and direction to get it through and over the posts. The kicker has to judge how much power they'll need to reach the posts because if they use too much power when it is not required they may lose accuracy.

Balance is vital for kicking the ball in the correct place, because you must lean back in order to lift the ball into the air but at the same time be in a controlled balanced stance to hit the ball with height and direction.

Co-ordination has to be used in order to be able to look at where you're trying to kick the ball and at the same time kick it with your foot. Rugby players concentrate a lot before taking a kick; they look from ball too posts and back to ball in order to try and see the route that they want to ball to go through. Again they have to use their kinaesthetic senses in order to be able to look toward the posts and hit the ball with their foot.

Technique is very important in a rugby conversion, you can see that it requires a lot of practice as they concentrate on the kick for a long period of time before actually kicking the ball. Some players prefer too come at the ball quite straight where others stand horizontal to the ball and hit it with their foot around the ball. Either way they have to get a large amount of force behind the ball in order to reach the posts; this is why they must be very self-paced in their time taking, so they are confident the ball will pass through the posts. Their technique must be very well practised and used as a perceptual trace for all their kicks so that they can duplicate the conversion again and again.

Cricket shot: A cricket shot is a gross motor skill and as with the other skills is part self paced and part externally paced because the bowler chooses where to bowl the ball and at what speed and the batter chooses what shot too play. Yet the ball is travelling either with so much speed or so much spin that it's very hard to back out of a shot if you've already begun the footwork and bat movement. The abilities needed for cricket shots are:

Reaction time
Power
Balance
Agility
Timing

Reaction time is probably the most important ability to have when facing heavy spin or a fast bowler, as the ball is either coming too fast for you to have any time to really think about the shot you wish to take or it spins so much in front of you, that you have to react almost immediately if you wish to play an effective shot. Batters will often try and guess at what length and speed the bowler will bowl at so they can play a more effective shot.

Power is needed to strike the ball; although you can use the force of the ball and send it back off your bat, although the most effective way to get the ball through the field for four runs or over the field for six runs is too put a lot of power into your shot so that the fielders cannot catch it before it reaches the boundary.

Agility is important for batsmen as they must be moving their whole body position to get in the right position to hit the ball, but they must do this very quickly and accurately because they have very little time to react; so they need to be agile in order to move their bodies so quickly.

Timing is also incredibly important to play a good cricket shot, as it's no good playing your shot after the ball has gone past your or hasn't yet reached you. To hit the ball in the "sweet spot" the batter has to time when the ball is going to be in the optimum position to hit.

Technique comes into play in all cricket shots, because they must use their feet, torso (vertebrae) and arms to be in the correct place to hit the ball, for example if a batter wanted to play a sweep shot they would have to bend down onto one knee and flick the bat with their wrists across the front of their body with the bat being horizontal to the ground so the ball doesn't go in the air for a catch but also doesn't hit the ground and lose it's speed. Each batter has his favourite technique/type of shot but the techniques are usually quite similar throughout all batters. The elite of the batting world are usually the ones with the best reaction times, body positioning and timing.

Football pass: This is a gross motor skill and is definitely externally paced because a footballer wants to pass to his team but not get tackled by the opponent, so they must be looking for players to give them options, but they are limited in what they can do as the opponent closes them down. So they can't just take their time and pass it to who ever they want, they must pass it to someone who isn't being marked or is making a run and the pass must put in a direction that won't be easily intercepted by the opponent. The abilities needed to carry out an accurate football pass are:

Power (variable)
Balance
Co-ordination
Agility
Timing (variable)

Power is a variable agility as they might only be passing the ball to a player 5 yards away form them which wouldn't require very much effort or power at all whereas a 50 yard lobbed pass would require a lot of power and accuracy to reach the designated person.

Balance is used when passing the ball in football as you're often passing under pressure or while moving so you must keep your body position and footing balanced in order to pass the ball efficiently.

Co-ordination is required so that the player can pass the ball while looking around him at various people including his teammates and opponent who are trying to tackle him or intercept the pass.

Agility is only really used in football passing while on the move, as the player will need to run with the ball and then turn his running stride into a position where he can pass the ball all while he is moving and possibly being closed down by an opponent.

Timing is a variable agility as again when making a straightforward pass to a player only a short distance away under little pressure little timing required. But if you're trying to pass to someone who is making a run across the other side of the pitch it must be timed effectively so that the player making the run isn't caught off side and so the ball can be taken into his stride without to much difficulty.

Technique varies throughout players depending on the type of pass they are trying to achieve. A model pass would involve bringing the foot back by flexing the knee and having the ball level with the grounded foot so to know where it is, so that you can be looking at where you're passing rather than the ball. Then the player has to judge the direction of the ball by changing the angle of his foot and which part of foot hits the ball, for example if he wants to curl it he would hit it slightly on the front but also on the instep or vice versa to curl it in the other direction.

Boxing punch: The boxing punch is certainly a gross motor skill as it requires movement of the vertebrae and footwork as well as requiring the obvious movement of the shoulder and elbow joints. The boxing punch as with many skills is partly externally paced and partly self paced as the boxer himself chooses when to punch but he's only likely to punch when he sees that his opponent has left part of his body exposed for a clean hit.

The abilities needed to carry out a well executed punch are:
Speed
Power
Balance

Co-ordination
Reaction Time
Timing
Agility

Speed is required for the boxer to throw his punch quick enough so that the opponent has the smallest amount of time possible in order to react to the punch so that he can't block the punch or throw a counter punch.

Power is necessary to simply make the punch do as much damage to the opposition as possible, although some punches don't have to be very powerful, jabs for instance, however they still require some power to wear the other boxer down. Jabs often are a set up punch for a hook or uppercut that requires much more power and when they land accurately often can cause a knock out.

Balance is used by boxers quite simply to stay on their feet while throwing and receiving punches, for example great boxers such as Cassius Clay (Mohamed Ali) used their remarkable balance to be very effective at "dodging" punches, as their balance helped them have very quick footwork which enabled them move forward and away from their opponent very quickly.

Co-ordination is vital for boxers to be able to be able to watch their opponent and pick up on mistakes to then take advantage of. To do this they cannot afford to take their eyes off the opponent; so they must be watching them closely while being able to land their punches accurately and meaningfully. This needs good hand eye co-ordination and also good hand to foot to eye co-ordination because they must be watching their opponent ready to move with their feet and torso (i.e. they must flex their vertebrae to bend back out of an oncoming punch) to avoid being punched but also using their hands and arms to be either punching or blocking.

Good reaction times are vital for boxers as they must recognise their opponent's fast incoming punch and almost immediately have to move themselves to avoid being hit. Good reaction times help players to quickly take advantage of a let down of guard by their opponent.

Timing is vital for boxers to know when they should be on the offensive and when they should be on the defensive, as they have bide their time waiting for the opportunity to throw an effective punch as if they time it badly they could quite easily leave themselves open for a counter punch.

Agility is used by boxers to move quickly in an out of situations where they can either throw a punch or be punched themselves. A player with great reaction times but poor agility would still find themselves being hit because they cannot move quickly enough even if they knew the punch was coming.

Technique varies greatly for each punch, as there are so many different types of punch that can be thrown, for example: Hook, body hook, jab, body jab, uppercut, body uppercut, cross and body cross. Each of these to be throw with either left or right hand all in different situations. For example with a jab the boxer will probably have a very closed stance which allows them to work away at their opponent without risking

too much damage to themselves, whereas with a hook or uppercut they would have to open them selves quite a lot in order to get maximum power. Most boxers try and incorporate all types of shots into a combination, for example a boxer might throw a body jab with their left hand to try and bring their opponents hands down to then come in with a hook with the right hand.

3. (Reference: http://www.educ.uvic.ca/Faculty/thopper/Cupr/Archived%5Cassesstgfu.htm)
Learning is based around developing knowledge and/or skills inside particular subjects or sports (for example a certain sport or part of that certain sport). Learning is acquiring the skills, techniques (usually by using simplifications of the technique/s) and knowledge needed to carry out a particular performance and is carried out under instructions at different levels depending on the person's prior knowledge of the skill or task.

For example an unskilled footballer would practise short passes along the floor with a lot or feedback to guide them; whereas a more skilled footballer might want to practise long lofted passes without as much feedback due to their prior knowledge on body position and football as a whole which is the most essential part.

Performance is the ability to acquire a skill through the process of learning and then apply the skill to a real or test situation; where students can show their comprehension of the learning process into actually carrying out the task or skill without any external feedback. A performance is judged whereas practise is advised usually by an instructor/teacher who can structure a practise or give a model showing of how a skill should be carried out which the students can then base as their goal or motivation during practise.

The main difference between learning and performance is the fact that during learning the trainees are given essential feedback from someone who is already adept at carrying out a certain task or skill whereas a performance is in a situation where you have no feedback to guide you, as are they are designed to assess your understanding of the learning in a real or mock situation.

4.

A skill classification file for the tennis serve.

Open ——————————|———— Closed

Ex P ——————————|— Self P

Cont —————————————|— Disc

Gross ——|———————————— Fine

Perc ——|———————————— Hab

5.
Each section of the skill classification file can be useful in terms of designing a practise session.

To make the skill classification file as useful as possible I must first clarify my decisions on the scales:

Open-Closed: I chose a point closer to closed rather than open because essentially when you take a tennis serve the environment is changing very little (in terms of the player/s involved in your game) but I didn't chose to make it fully closed because if the player was skilful enough the placement of the serve may be effected by the movement of the opponent. As the player may like to shuffle across the line whilst anticipating your service (thus changing the environment) so you might decide to try and curl the serve rather than hit it flat and straight.

Externally Paced-Self Paced: I chose to put this between the centre and Self Paced, as the tennis serve is mainly self-paced as you take your time and can stop and restart at any point during the process if you feel the need to. Yet the position of your opponent will effect your placement of the service as if the player is nearer the centre of the court you will try to serve it flat and straight to the far side of the service area whereas if your opponent is stood nearer the far side of the court you will try and hit the ball down the centre whilst making the ball curl away from the opponent.

Continuous-Discreet: I chose a point full at the discreet end because there is a clear beginning to your body movement and then a clear ending to the service when you bring your racket back from the follow through into a position ready to receive the possible return.

Gross-Fine: I chose to make this gross because the tennis serve requires the use of all parts of the body, not only the obvious use of your arms. As at the beginning of a serve you must bend your legs and arch your back slightly too then spring back with as much force as possible; as the more you bend back the more elastic potential energy you create to then "spring" back according to *Hook's Law.*
 (Reference: http://www.physicsofbungeejumping.homestead.com/forces.html).

Perceptual-Habitual: I put this down as a perceptual skill because it's not like a sudden reaction which causes the skill; it is a well timed skill which requires perceptual thought and perceptual processes/traces in order to be carried out effectively.

By knowing the skill can, under some circumstances, be slightly open and externally paced the trainer can make the skill completely closed and completely self paced by eliminating the opponent meaning that the trainee can focus on getting the ball over the net and into the service area rather than actually trying to make it difficult to return in the early stages of training. By knowing this you can also make the training progressive by slowly adding an opponent into in the practise where by the trainee can gage how effective different styles of serve are in comparison to the position of the opponent.

The fact that the tennis serve has a discreet start and end can help the trainer break down the skill into, for example, a beginning, middle and end to be practised individually and then brought together.

Skills are usually either very fine or very gross skills and finding the middle point usually simplifies a skill (making it less effective in real situations but simplifying the learning process greatly). In terms of the tennis serve you can let your trainee at first practising repeating a service by simply using the arms without footwork and without using a spring like technique to gain power, thus making the skill much finer and easier to carry out. Then as the trainee becomes more skilful the trainer can progress him/her onto using footwork and arching the back for extra power and therefore a grosser and more effective service.
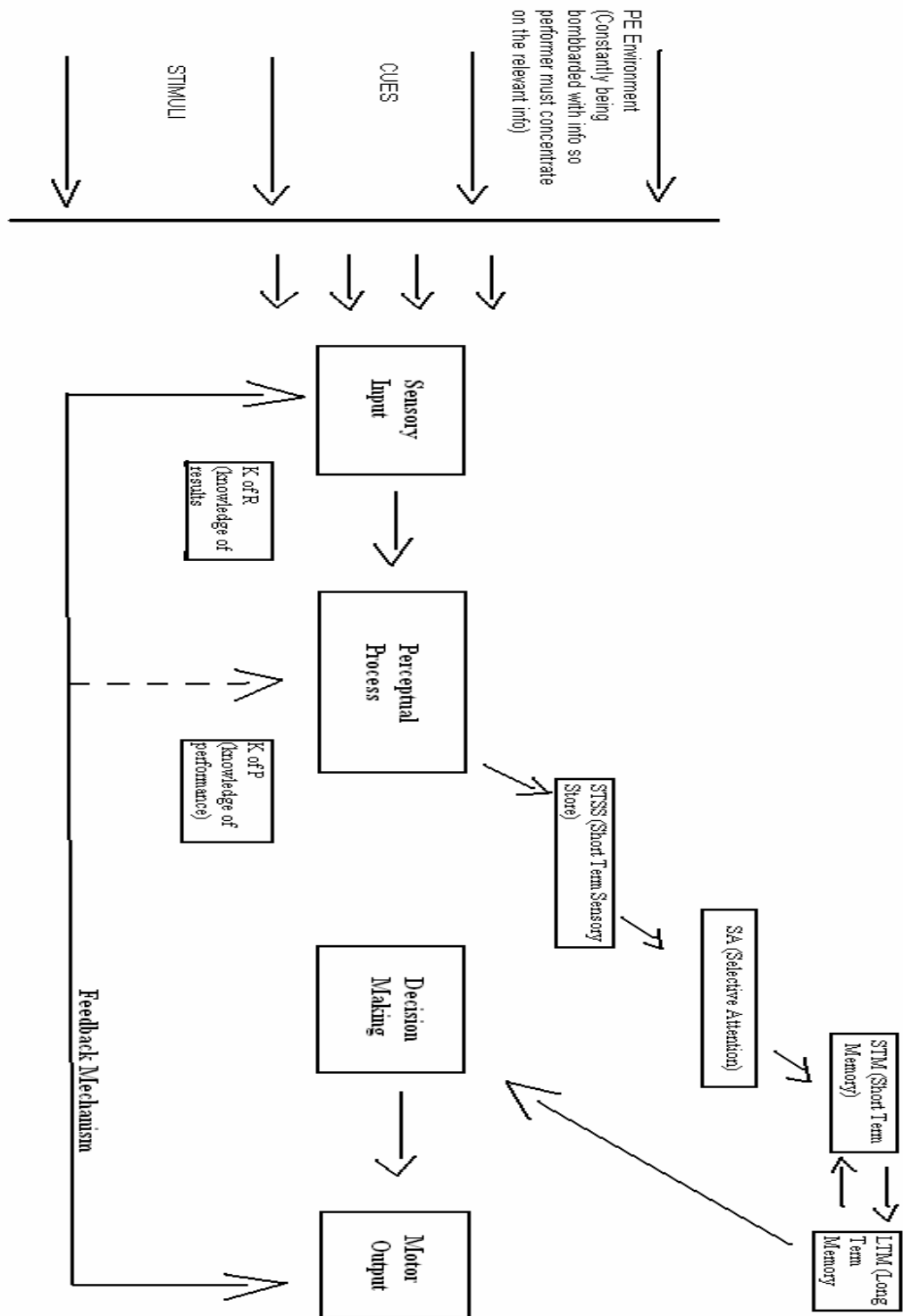
Just by knowing that the tennis serve is a very perceptual skill, which requires cognitive processing the trainer can base a whole training session around it. If the trainer understands that a model tennis serve requires a lot of different processes they can then break the training down into these sections to practice them individually to then hopefully bring together in a final performance. For example the trainer might want to practice each section of the service which requires a perceptual trace to follow so they can then easily be put together by the trainee (i.e. racket grip, body position/stance, throwing the ball up, exchanging weight from back to front foot, going from low to high body position, keeping a straight arm to create a bigger "lever" to increase power, timing this movement correctly to hit the ball at it's highest point, hitting the ball with power *and* accuracy and follow through). All of these parts of a simplified tennis serve require some trace of thought to carry out and without practising them individually it can be very difficult to get any of them right when put together.

Task 2 (References: Davies et al, & Fleishmen,)
Analysis of the tennis serve (During a singles match – <u>during competition</u>).
(Reference: http://www.geocities.com/sjb_physed/AlevelPE_SkillAcq_Memory.html)

To analyse the tennis serve and see how the performer carries out the skill bit by bit I'm going to use an information processing model which looks like this

PE Environment
(Constantly being bombarded with info so performer must concentrate on the relevant info)

CUES

STIMULI

Sensory Input

K of R (knowledge of results)

Perceptual Process

K of P (knowledge of performance)

STSS (Short Term Sensory Store)

SA (Selective Attention)

Decision Making

STM (Short Term Memory)

LTM (Long Term Memory)

Feedback Mechanism

Motor Output

This is an example of an information processing model and I will use it to analyse the skill of tennis serving. (Reference: Class notes).

The **Physical Education Environment** for tennis player can vary depending on where the court is and the type of game. Assuming it's a singles competition the server will be being bombarded with varies pieces information, obviously the court and the opponent but also, the various umpires, ball boy/girls, the crowd, anything going on above and also any noises which the player can hear, all of this inside a confined arena. Before the player serves they must be singling out the essential information which will benefit their serve, mainly the movements and position of the opponent and also the position of the service box (although it does not move, if the player doesn't know where the service box is he will not b+e able to serve accurately). By knowing this valid information they can adapt their service to make it as difficult as possible for the opponent to return.

In terms of **cues and stimulus** there are not really any specific cue or stimuli as the serve is self paced yet server usually serves when the crowd is silent and his/her opponent is ready and waiting and the server is prepared to serve.

In the PE Environment, cue and stimulus are collectively called **Sensory Inputs** simply because they cause anything that is interpreted by your sensory system and dealt with accordingly; the sensory and nervous systems deal with these inputs in a certain way. The 3 main sensory inputs are:
- **Visual** which come first as light travels faster than sound
- **Audial** which comes second
- **Proprioception** (which is always present) can be broken down into 3 subdivisions, touch (pressure, temperature, pain etc), kinaesthetic (which tells your brain via neural pathways when your body has made a movement thus allowing you to know where your limbs are in comparison to your centre of mass, so you can know where your arms are without actually looking at them) and equilibrium (which tells you whether or not you're balanced).

All of these pieces of information must enter the body via the sensory system and therefore must be stimulus. The sensory inputs the tennis server will receive will be in the form of the environment around him (visual and audial) and also input from the body in terms of equilibrium (the tennis player getting balanced in the correct position before serving) and also kinaesthetic senses which tell the tennis player whether or not his body is the right position to hit the ball in a certain direction with power and the option of spin.

The information taken in is then passed through the sensory system into the **Short Term Sensory Store (STSS)** with each store having a large capacity for information, the information can be kept here for as little as a quarter of a second before it is selectively attended too. The STSS's main function is to store each piece of information individually so they can then be easily filtered in the process of **Selective Attention (SA).** A vast amount of information is flooded into the STSS by the sensory system, but most of it is useless in terms of a tennis player wanting to serve, so selective attention is vital to filter away unwanted information so that necessary information can be used to improve the efficiency of the service.

Selective attention helps to ensure that the information processing system isn't overloaded with so much information that it is unable to interpret any of it usefully. For example if a tennis player tried to process all the useless audial information as well as the useless visual information (such as crowd and umpires) on top of the useful information (seeing the other opponent and seeing the court) the player would be so bombarded with information that he would not be able to concentrate on serving

properly. A more everyday example would be trying to work in a very noisy environment or while watching the television; it is very hard to interpret your work while also trying to interpret what is happening on the television. Hence why you won't see tennis couches shouting orders to their player while he is trying to play as the game requires full concentration.

After the useful information has been selected it will be passed into the **Short Term Memory (STM)** where all the work happens for the performance but no information is stored. Yet only 7 +/- 2 pieces of information can be stored inside the short term memory so without selective attention to the stimulus the STM were be overflowed with too many pieces of information that it could not interpret them all.

The STM memory works first by cross referencing the information with the **Long Term Memory (LTM)** to try and find any similar information which may be in the LTM; if similar coded information is stored in the LTM then this will be sent back to the STM so it can deal with it in the same effective way (follow a *perceptual trace* (generalized motor program)). A tennis player would find this perceptual trace in their LTM because they will have practised serving many times before coming into the match at hand. This all has to happen very quickly inside the STM as there is no storage inside the STM over 3 seconds.

During a tennis serve this is the process which will happen in the STM but during practise it will work in a different way; this is the process of encoding these perceptual traces into the LTM so they can then be referred too, this works by rehearsal. This works by important information going into the STM and not being found coded into the LTM and if it is considered important enough by the tennis player he can then store it into the LTM for future reference.

For example a tennis player will train his/her serve regularly in order to keep "engraving" the code into the LTM so it becomes more and more natural and the skill becomes easier to produce, this is known as 'grooving'. Any information which is stored in the STM but not considered vital enough for long term memory storage is usually lost.

The **Long Term Memory** can store information permanently and it has limitless capacity which can be retrieved by the STM at any time for decision making. The LTM holds information which has been trained/rehearsed and also information which has be learnt during previous experiences (i.e. a tennis player will be to recall information about a player which they have played before from their LTM so that they can then exploit his/her weaknesses which they have remembered about from previous experiences. For example they may know that their backhand is weaker then their forehand so will try to serve into an area which will force the opponent to play a backhand which will either give the server the point make it easier to return.

Simple skills such as riding a bike might be rehearsed so much that they become almost habitual skills as the coded information has been recalled so many times that it becomes second nature. Also information can be easier to recall if when you learnt it, it was very meaningful or novel too you, i.e. if you learnt about a subject you found very amusing or enjoyable it will much more effectively coded into the LTM for recalling, the opposite happens when you learn something which you find very tedious or boring. For example during a test on algebra which you found very boring when you were learning it, the information you have stored in your LTM memory will be much harder to recall as it will not "stick out" in your mind.

Once all this information ha been processed by LTM and STM the person can then **make a decision**; for example and tennis player about to serve is seeing his PE

Environment and has selectively attended to the stimuli he needs to concentrate on, so now he's is fully concentrated on the important stimulus (i.e. equilibrium (is s/he balanced), kinaesthetic senses telling him/her if their body position is correct and visual input from the other player and the playing court). So he can know make a decision on whether or not to serve and if so where to serve, if his kinaesthetic senses are telling him his body position is incorrect (by cross-referencing with rehearsed stances from LTM) then he can start over. S/he can then use the visual input to decide on where he wishes to place the serve and whether it requires any spin. When the server has decided that s/he is ready they can then turn all of the information they have processed into a **motor output** using his perceptual trace and past experiences to make the serve as effective as possible.

Feedback can also play a big part in helping a tennis player perfect his serve depending on the opponent they're facing. There are 8 types of feedback which a tennis player may receive about their service, they are:
(Reference: http://www.teachpe.com/A_level_skill_acq_files/feedback_assignment_example_1.htm)

Concurrent – which you receive as you are performing, this maybe extrinsic or intrinsic.

Terminal – This is feedback which is given to a player before/after a performance, eg, a coach analysing a players game and then giving relevant feed back on it.

External/Extrinsic – Feedback from another person.

Internal/Intrinsic – Feedback that comes back from the performer (i.e. while they're playing)

Immediate – feedback you receive during your performance.

Delayed – feedback you get after the match, eg, in your next training session from your coach.

Knowledge of Performance - knowledge gained through feedback, eg, self analysis or a coach video analysing your performance/technique.

Knowledge of Results – results given to the performer which can then be analysed to help future matches.

The main types of feedback which a professional tennis player will use to aid their service will be concurrent (intrinsic – immediate), knowledge of performance and knowledge of results.

Concurrent feedback will be used by the tennis player in order to try and get into a good rhythm of serving. For example when they throw the ball up they will get immediate concurrent feedback from their body telling them if it is at the right height and travelling in the correct direction.

They will use knowledge of performance in order to analyse their opponent, they can go over previous times they have met to try and specialise on beating that particular person or alternatively they can analyse videos of opponents who have beat the particular player they are going to face to see how that person served in order to win and subsequently try and replicate the same style of service.

Tennis players will use knowledge of performance feedback concurrently in order to see which kind of service their opponent is worst at returning. For example they might realise during the game that their opponent has a particularly weak return of service on their backhand so will continue to serve to their weak point to try and get the upper hand. This knowledge of performance will help the player use feedback as a means of error detection and then ultimately error correction. The server will be

able to see which services are successful and which ones are flawed against each individual opponent; so that this information can then be used for error correction to then produce consistently effective services.

2. The effect of the information processing theory on coaching and performance.
(References: Class notes).

Most aspects of the information processing model can help adapt a training program, obviously some sections more than others; also there are other important aspects of sport which can be broken down into models which can benefit sports players, such as **reaction time** which plays a big part in the **decision making** process.

In terms of stimuli if the trainer knows that visual stimuli travels faster than audial stimuli he can use this to his advantage, also if the trainer knows that the larger the stimuli is, the easier it is to recognise and act upon. For example a football team might want to play the offside trap and know that visual input travels faster than audial, the dominant defender might use a hand signal to indicate when his backline should be moving up to try and leave the opposition offside. Also by understanding that the louder a visual input is, the more likely it is too create an action from the players around him/her. So basically this would mean the main defender having shouting louder when he wants them to do something, the same example can be used, if he wanted to play the offside trap he can tell them much louder to push up so that the audial input is much larger and therefore making any action happen much faster.

The perceptual processes (STSS, SA, STM and LTM) can also play a big part in training if they're understood fully by the trainer; in particular STSS and STM. This is mainly because the STSS has to gather all the incoming information from the sensory system and take it through the process of selective attention to gather all the valid information to then be passed onto the STM. This can be used to enhance counter-attacks in any sport as during a counter attack the attacking team are trying to take advantage of the opposition having fewer players in defence as they have been caught trying to attack. Thus meaning the attacking team will have more players going forward than the opposition will defending. This means for example the defenders in a football match will have many more visual stimuli coming at them and making it much harder to process any of them effectively; instead of just the stimuli coming from the one player they're attempting to man mark.

If a defender can only store 5 pieces of information in his STM (7-2) and s/he has 6 attackers coming towards them then it is going to be harder for him to pick up on the one player who is making the defence splitting run and the other players who are making the dummy runs. So if a team practise trying to counter-attack very quickly they can put the defence under a lot of pressure as they cannot process effectively all of the valid information coming visually in front of them. This is on top of his fellow defenders making audial stimuli to try and organise them selves; so a very quick counter-attack can be used to over whelm defenders with stimuli making them much less effective defensively.

Another way players can use the theory of perceptual processes is by working on the oppositions perceptual traces; for example a defender has a certain way of defending and has perceptual traces that s/he will follow to deal with certain situations. In a football match an attacker can take advantage of this by playing in an odd style or employing tactics which the defence has not encountered before and so do not know how to deal with. A great example of this in motion is used by Ruud Van Nistelrooy, who confuses defenders at set pieces by standing in an offside position

and then coming back onside at the last moment as the kick is taken; no defence had ever encountered this tactic before and didn't know how to counter it, the first time he used this tactic in a real game situation it resulted in a goal.

So training can be based around taking advantage of the perceptual processes; but another part of the information processing model which can be used to enhance training and performance is the decision making segment. Decision making is based around reaction time, the factors affecting reaction time and anticipation; trainers must also know how reaction times can be improved. Reaction time is so very important because your reaction time affects your performance dramatically in almost all sports.

Faster Reaction Time = Better Performance

Great examples are all goal keepers in team sports where the goal keeper has to make reaction saves as there is no real time to process the information as, if it takes too long you will already have missed the opportunity to save the goal. A great example is ice hockey where the shots are usually taken very close to the goal and hit with a lot of power and speed; thus meaning the goal keeper has very little time to react to a shot before it goes into the back of net. Yet in individual sports like table tennis you need superb reaction times to be able to continuously react to where your opponent is hitting it with a lot of power.

Reaction time and the time taken to eventually respond can also be broken down into a model, which looks like this:
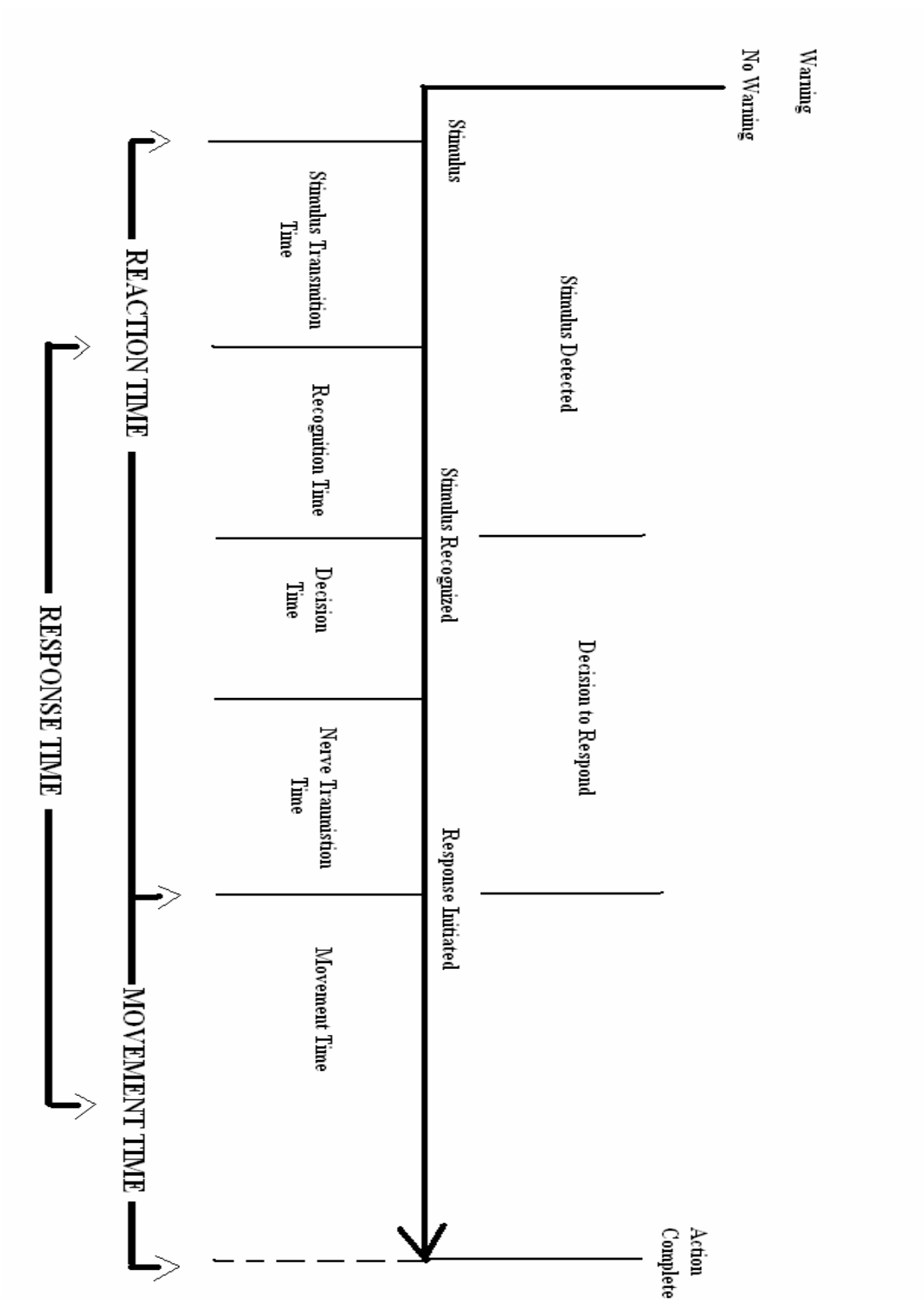
This model shows how a reaction is detected and then acted upon within the brain and sensory system. (Reference: Class notes).

There are two types of reaction, simple reaction time and choice reaction time. Simple reaction time is quite simply reacting to one stimulus with one single response (for example reacting to a whistle in a team sport or gun in a sprint) whereas choice reaction time is where an array of stimulus's are presented but one must be chosen for a certain response (for example in a team sport where two players are trying to take the ball off you; meaning you'll have to process what both of them are doing to evade being tackled). A choice reaction time is much slower because with more stimuli the brain has to process more information to eventually select the appropriate one for the appropriate response. This is stated in Hick's law which says that the more possible alternatives the slower the reaction time, yet because the number of alternatives goes up the reaction time doesn't keep going up in a straight line, it eventually flattens out because the STM can only deal with 7 +/- 2 pieces of information. So for example if my STM could only deal 7 pieces of information, if I had to react to 8 pieces of information and have that timed, and then to 9 pieces of information the reaction time would show little difference because my STM can only deal with 7 pieces of information in the first place.

By simply identifying that choice reaction times are longer than simple reaction times teams can use that to their advantage. For example in a football match if the team knows that one particular player can be very dangerous to them they can focus on putting him under pressure of two people rather than just one, making it much harder for him to take a shot at goal or play an effective pass. This is because the player will have to be processing the information coming in from two people trying to tackle him/her which will make his/her reaction times slower due it causing a time lag in processing which information is most relevant and which isn't and therefore making it much harder to evade being tackled. This works because there is a PRP period between reacting to one stimulus and processing the next. A model of this would look like this:
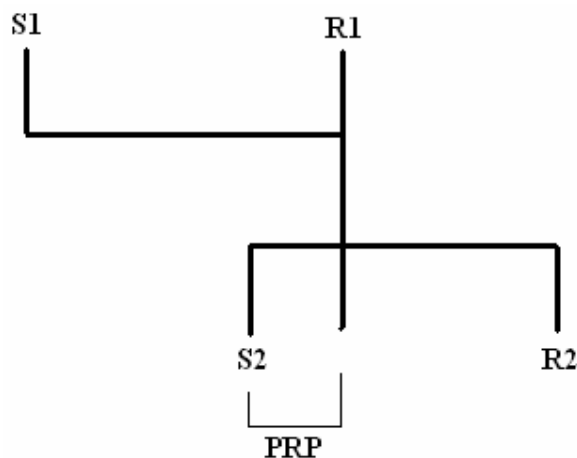
I'll use the same situation where an attacker is being closed down by two defenders.
At **S1** the attacker would be on the ball and would see one defender coming towards him/her.
At **R1** the attacker would be reacting too the defender and moving the ball away from him/her to avoid being tackled. But before this action could finish happening S2 would come in.

At **S2** the second defender would be trying to tackle the attacker as well and thus causing a PRP period of time.

The **PRP (psychological refractory period)** is a period of time in which the attacker knows the second stimulus is there but cannot do anything about it until s/he has finished processing R1 in the brain. This cause's R2 too happen slower than it would if R1 wasn't happening.

R2 is where the reaction finally happens in order to avoid being tackled by the second defender.

In terms of the model itself; it also has vital information that can be used to help a team get the advantage mentally over their opposition. Right at the beginning of the model you can see possible advantages, such as knowing that by giving a warning or not giving a warning can dramatically change the speed of reaction time. For example in a sprint the racers are told; on your marks, get set and then the gun goes, they are given a lot of warning of when the gun is going to come this is why they can react so quickly and almost try and anticipate when the gun is going to go. Whereas in a sport like tennis or table tennis the players can try and disguise their shots so that the opposition thinks they are playing it one way but then they hit it the other, so they have no warning to where the ball is going to go, and thus have less time to react to it.

This can be used in all manner of ways to give a team the advantage, for example in football I outlined earlier how a defensive back line could raise their hand to play the offside trap rather than shouting for them to do it, not only do visual inputs travel faster so the defence can react quicker but it gives the attackers no warning unless they know the particular signal, meaning that when all the defenders push up they will be left stranded in an off side position unless they react very quickly.

If sport players also understand ways in which reaction time are increased and decreased they can also use that to their advantage, particularly in team sports. For example because older people generally have slower reaction times, if a team studies another team for weaknesses they may try and over whelm the elder player of the opposition to take advantage of his slower reaction times. Also in mixed gender sports the men can take advantage of the women on the opposition as men generally have faster reaction times. The same goes for taking advantage of taller players as they ordinarily have slower reaction times due to the nervous impulses having to travel a longer distance through their nervous system before the messages can be fully complete.

Yet the advantage older players have over younger players who have better reaction times and most likely better mobility is that they have being playing the particular game for a longer period of time and therefore have much more experience which can be vital for anticipation. Anticipation works by the player not reacting to a stimulus as such but rather trying to "guess" what the player is going to do to get the advantage rather than reacting simply too his/her body language as the younger player has the advantage of quicker reaction times; anticipation is beginning to carry out a motor process without actually being given a cue form a stimuli. Anticipation can either be very early movements of the opposition which are almost like early stimuli or by past experiences, which older players would have much more of. So it would be a futile effort trying to simply react to their movements because the younger player would be able to counter-act their movements quicker than they could react to the counter-movements. Yet the opposition can still counter this anticipation by using a series of dummies ; this is very frequent in rugby and football where players can either dummy by shifting their body weight from one direction then quickly to the

other or being playing a dummy pass where the exaggerate the movements of a normal pas but then quickly shift the ball in the other direction. In football Brazilian players are often renowned for their skill at dummying and a great rugby player who often shifts his weight from one direction too the other is Jason Robinson who can often run from the very back position of the pitch at fullback up into the oppositions half for a try scoring opportunity by using a very effective dummying technique which is much harder to anticipate and react too.

Great examples of this are players like Alan Shearer who is one of the eldest players in the premiership but still one the most prolific goal scorers. Another great example is Ruud Van Nistelrooy who although isn't particularly old plays in a very effective style, where by he can score a lot of goals without working him self particularly hard. He is renowned for "poaching" goals inside the six yard box, yet it isn't luck that he's is frequently in the right position at the right time, it's to do with anticipation of where the ball is going to be either from a pass or from a ricochet off the goal keeper or defender.

Trainers must also understand how reaction times can be improved as they can be so vital in most sports. The best way is specific practise, for example a sprinter's success is mainly based around one factor which is their start as in the professional sprinting scene the difference in actual max speed is very little, yet some sprints have better acceleration and reaction times to get a superior start. Training must be specific as the sprinter needs to be able to concentrate on the B of BANG from the gun rather than any effecting noises around him/her such as crowd noise, so s/he needs to practise choosing the appropriate audial stimuli from the many possible ones surrounding him/her.

In games like football the players need to frequently practise set pieces like corners so that they can see the flight of the ball and almost automatically know where it is going to be in the air where s/he can head or kick it goal bound. And they must also be able to react to the movement of defenders so they can get to the ball before s/he gets it away from the goal, and from the defenders perspective they must be able to react to movements of the attacker quickly so they can try and get the ball away. By practising this frequently it also reduces pressure and anxiety from the player as s/he knows how to deal with certain deal ball situations whether they be defending or attacking. By reducing pressure from the player s/he can be concentrated fully on the valid information and as a result react more swiftly to get the advantage over the opposition.

Strategies that can be used to practise your choice reaction times can easily be done by making simple 2 v 1 situations where the single player has to react to two stimuli (i.e. two players coming at him/her) and choose whether the player carrying the ball is going to pass or try to carry the ball instead. This will help the player understand what type of body language determine which kind of action; so that in game situations they can anticipate more confidently in 2 v 1 situations.

So the information processing model can be used to great effect in terms of training and game situations to help a team or player have an advantage over the opposition; yet sportsmen and sports trainers must also understand that reaction time is vital for almost all sports (mainly team sports) and also that experience is vital so specific training is very useful.

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