d o n ‘ t | f r e e z e

2018 Group 11-03

Tan Jiong Rui (3A127)
Xu Duan Yang (3A231)
Yang Zhenzhao (3P230)
Or Yong Hur (3P315)

Hwa Chong Institution (High School)

Abstract

Reaction time is the amount of time it takes an organism to respond to a stimulus. This trait is especially crucial in a game of basketball as it has been observed during competition. A mere difference of 0.02 seconds could very much determine the team that is in possession of the ball. If players are slow to react in a game, the ball is often given away to the opponent. Hence, the aim of this project was to improve the reaction time of players. These solutions aimed to improve the overall reaction time of players, before branching out to target the execution of their improved reaction time in different specific areas like rebounding. The results highlighted that there was indeed improvement in players' performance resulting from their decreased reaction time.

Introduction

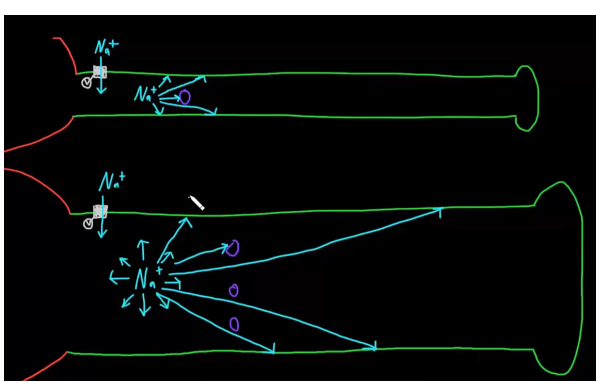
Slow reaction time for HCI basketball during their games in the B-division basketball competition was observed. It was found that many games' outcome did not lie in the difference in skills but was due to the players not reacting for the ball immediately in trivial situations. This caused the basketball team to lose vital scoring opportunities and instead give the ball away to opponents, leading to undesirable performance by the team such as losing the game. Analysing these games, we have concluded that our problem is something that even basketballers in the professional level have a difficulty of overcoming -- reaction time.

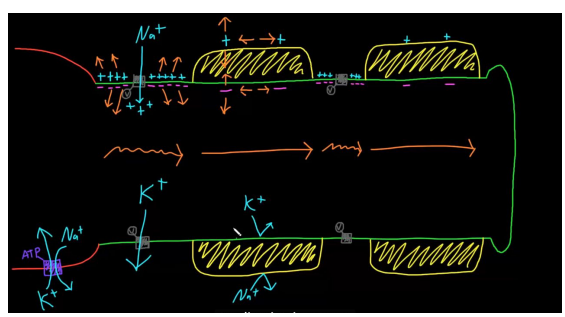
Here are a few factors affecting human reaction time.

Factors affecting reaction time:

1. Diameter of the axon. When the axon's diameter is larger, the positive ion (Sodium) will be able to move through the obstacles within the axon such as vesicles, large proteins or filaments at a faster rate. Hence allowing the action potential to be passed down the axon at a faster speed. Therefore, increasing one's reaction time.

However, this method is not practical for the project as there is no feasible ways to increase axon diameter





2. Myelination. Myelination is the process where the myelins (fatty tissues) which wraps around the axons increases in size. This weakens the attraction between the anions on the inner membrane the axon and the Sodium cation on the outer membrane of the

axon. Thus, the anions will be able to come off the inner membrane and mix with the Sodium ions that enters the axon during a nerve impulse within a shorter time span. Hence, the axon will be depolarised within a shorter time and thus, the action potential will travel across the myelinated part of the axon at a faster speed. Accordingly, the nerve impulse will be transmitted at a faster speed and one's reaction time will be reduced.

Myelination usually occurs naturally and increased neural activity can also trigger the growth of myelin. Another way to increase neural activity is for the brain to undergo repeated action

How repeated action increase myelination:

There are two non-neuron (or "glial" cells that exist in the brain, play a role in creating new myelin. The first is a glial cell called an astrocyte. Astrocytes monitor neuron axons for activity, and lots of repeat signals from a particular axon triggers the astrocyte to release chemicals that stimulate the second cell, known as oligodendrocytes, to produce myelin, which wraps around the axon.

Hence, as neural activity is increased, there is an increased growth of myelin, and one's reaction time can then be reduced.

Link to our solution

The neural network that is involved for a basketball player in a game of basketball is very complexed. This is because they are required to react to many different situations to carry out different plays, such as rebounding, shooting, making plays for teammates or simply keeping the ball under one's procession. To make sure that myelination occurs in all the neural pathways that is involved in a game of basketball, different drills targeted at specific plays in a game of basketball were proposed by the group as a solution to the problem. This therefore ensured that the reaction time of a basketball player would be increased under all situations of a basketball game.

Solution Design

6 participants were invited to experiment the solutions. Before subjecting them to the drills, the participants' general reaction time was recorded through the use of the F1. During the first 2 weeks of the implementation of the drills, there was no improvement. Hence, the drills' intensity was increased, and the frequency of our drills increased from 2 times per week to 4 times per week. Adjusting the participants' workout such that the different drills targeted their weak areas.

The focus of our drills was on improving players' reaction in specific situations on court.

Breakdown of each solution:

First, the rebound solution. The key to getting rebounds is proper timing and positions,which are also the areas the solution plans aim to impact. The

quickest way to get a rebound is to explode up to get the ball right as it drops down from the rim. This requires the players to react quickly and jump when the ball is at its highest point. A 170cm player will easily be able to out rebound a 190cm player if he jumps for the ball a split second before the taller player does.For these solutions, the best way for them react faster is to grant them experience of catching the rebounds in situations that forces them to react faster. When they have seen balls drop from the rim countless times, The brain automatically traces the pattern and gives them a general idea on how the ball will drop at different angles and they will also be jump a lot faster, almost like a subconscious action.

Secondly, there is the solution for defence. “ Offence wins games, defence wins championship” This quote by Kobe bryant clearly shows the importance of defence in basketball games. Some people misunderstood defence is based on footwork. It is true but reaction time is also a key to allow defenders stick to the offence. To tackle defence, the team focused on the ability to have quick leg movements when defending and also quick hand movements (reaction to the movement of the ball) to steal the ball.

Thirdly, the solutions for court vision. Participants were forced to look and pass to the open men when placed under difficult, tiring and overbearing situations. This aim to let players have a constant look out for empty men on the court so that passes would be of optimal effectiveness.

The subjects actually showed no signs of improvement in their reaction time in the first two weeks. However, after conducting more research and countless experimentation, the drills were tweaked and subjects showed vast improvement .

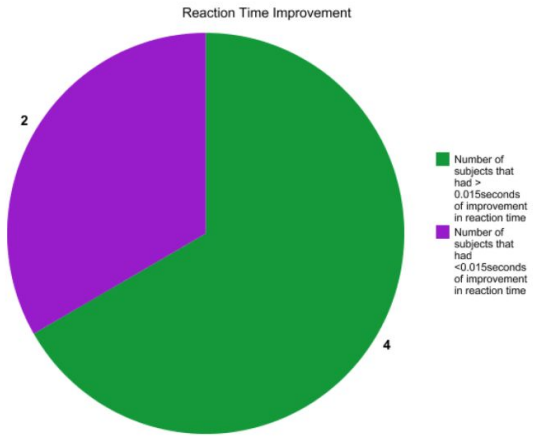
Video recordings of their games were captured obtain information on number of rebounds, steals, assists and turnovers. The success of this project is measured by the difference in reaction time of the test subjects before and after the team’s drills and the subjects’ performance on court in 4 specific areas before and after doing the team’s drills.

Result Discussion

Participant	Initial reaction time /*s* *	Reaction time after 8 weeks of drills /*s* *
Keagan So	0.232	0.228
Desmond	0.241	0.243
Gao Shan	0.225	0.210
Bryan Wu	0.214	0.197
Yang Zhenzhao	0.213	0.190
Xu Duan Yang	0.194	0.160

*result taken based on the average out of three attempts

From the graph in the above, it could be said that majority of the players had improved in their basic reaction time. Among them, Xu Duan Yang had the most improvement, a high 0.034s while on the other end of the spectrum was Desmond. It could be pointed out that Keagan did not make much of a big improvement because he had previously been doing similar drills on his own and doing such drills has become a habit ingrained in his mind. Therefore when he participated in our solution design, which was also a repetitive activity, it was not as effective because his brain had already been wired to going through these kinds of repetitive exercises. Therefore, it was becoming increasingly hard to further draw out more of his potential in reaction time, considering the fact that he received prior training. Hence, our solution design had no visible impact on his reaction time. The other half of the players made a rather satisfactory improvement in their respective reaction time between 0.010s-0.023s.



*based on first 12 minutes of playing time

In a friendly match before*

Number of	Keagan So	Desmond	Bryan	Zhenzhao	Xu Duan Yang	Gao Shan
Rebounds	2	3	2	3	7	6
Steals	1	1	3	2	0	1

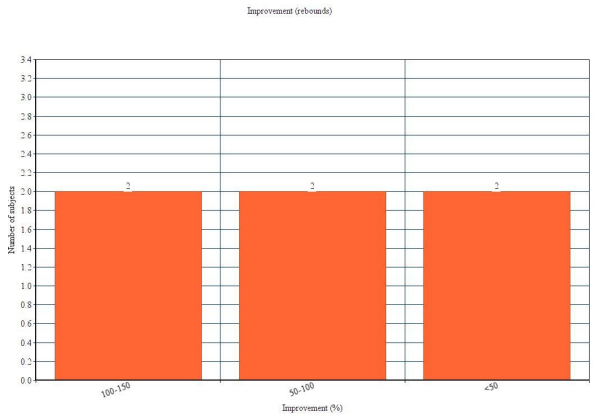
Assists	2	1	2	1	1	2
Turnovers	3	3	2	3	1	2

In a friendly match after 7 weeks of being subjected to our drills*

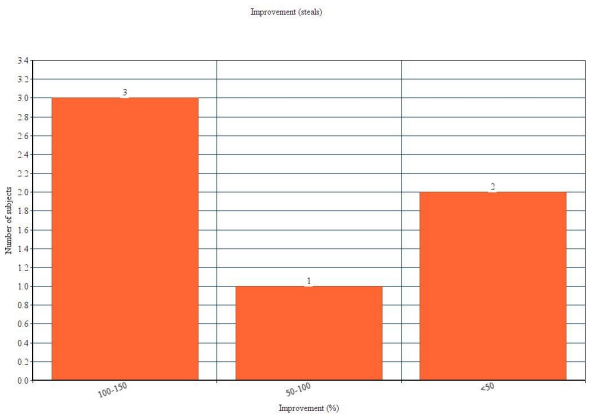
Number of	Keagan So	Desmond	Bryan	Zhenzhao	Xu Duan Yang	Gao Shan
Rebounds	5	4	4	5	11	8
Steals	1	0	6	3	2	2
Assists	3	0	5	1	3	2
Turnovers	1	3	1	1	1	0

*note recorded based on first 12 minutes of playing time

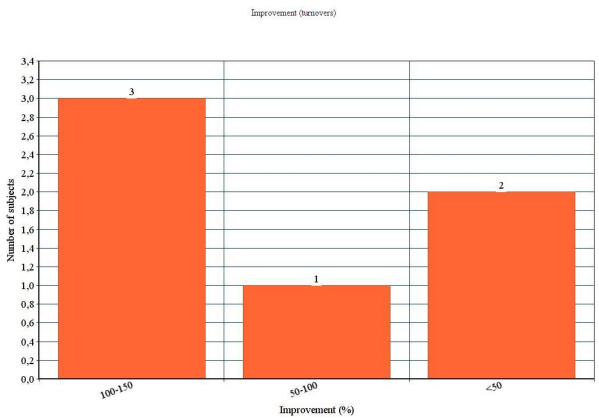
The improvement in the various areas were evaluated by percentage, in the graphs below.

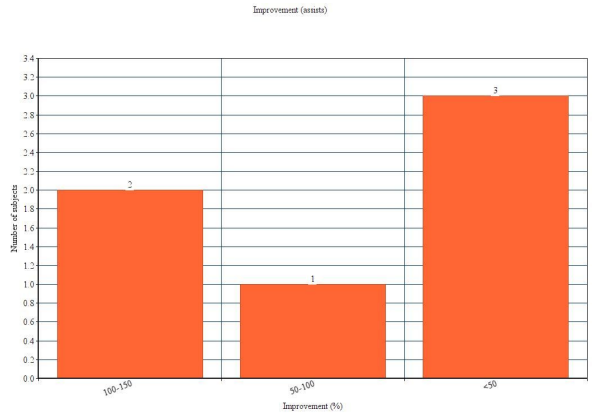


(graph for rebounds)



(graph for steals)





(graph for turnovers) (graph for assists)

In general, with the decrease in their reaction time, all participants except Desmond improved in 2 or more of the aspects above. It could be seen that in the rebound section, there was a significant improvement made by everyone, implying that the drills were effective for catching rebounds. However, under assists, the drills were unable to turn on our subjects' mind to react to it, as per our results. Notably, Duan Yang, who attained the best and most improved reaction time, was able to catch 4 more rebounds, 2 more steals and 2 more assists. Once again Desmond did not make any improvement. The other players had a substantially decent improvement in the other fields, therefore it could be interpreted that the overall decrease in their reaction time translated to better overall performance on court, reaffirming that the solutions were useful in helping subjects perform better.

Conclusion

In conclusion, it was discovered that one of the most efficient way of improving the reaction time of an individual is to allow a player to do a drill, which stimulate a real game situation, repeatedly with utmost effort and should be done weekly with daily practice. This would enable the sportsman to have an increased reaction to up his game.

The results exhibited this as most players improved significantly. However when a certain movement becomes a habit, it becomes quite unchangeable. This problem vividly shown in Keagan who encountered a problem when correcting his movements. On the other hand this obstacle is still overcomeable but it will take more effort to do it. Anyway our project has been effective so far. Based on the before and after drills results in-game, our players overall statistics has ameliorated. To conclude, to improve one's reaction time, one has to put in a lot of time and effort doing the drills our project group has designed to see greater results.

Significance:

A huge factor that would explain the disparity between Duan Yang's improvement in reaction time of 0.034 and Desmond's stagnant results would be practice. Duan Yang

participated in the drills seriously and consistently while Desmond was inconsistent and did them in a muddle. This is because the increase in practice effectively led to an increase of myelin in the brain, which makes it easier and faster for nerves in your body to carry the messages and signals that tell your body to move, thus Duan Yang could react faster. Desmond on the other hand, lacked myelin and yet, did not practise, leading to his slow reactivity. This means that with the right implementation, our project's research will be able to improve the reaction time of many basketballers, helping them to attain better statistics, leading them to victory. Skills the athlete learnt and polished can be applied to other sports example volleyball, netball, soccer, so long it requires a situation where one has to jump and execute a motion.

Of course, the solutions provided are not perfect and could still be further improved, effectiveness-wise. The drill targeting court awareness was lacking as seen in the unfruitful results for assists. Drawing from the subjects' feedback, we realised that what is different about this particular drill from the others was that the drill's set-up did not stimulate an in-game feeling or environment in subjects. To improve on it, the drill has to be tweaked such that it would resemble a game-like scenario. Overall, the subjects would have been better off if they were given a chance to play an actual game right after their exercise in order to ingrain this "quick reaction" habit in their style of play.

Acknowledgement

We would like to thank all participants for taking time and hard work to participate in our project, our seniors for their help in our solution design, and last but not least, our mentor, Mrs Ng for her great support and teachings in guiding us along this project from the discovery of this project topic, to the arrangement of finding our equipments.

References

Shen, J. (2014, October 16). Why Practice Makes Perfect: How to Rewire Your Brain for Performance. Retrieved from https://blog.bufferapp.com/why-practice-actually-makes-perfect-how-to-rewire-your-brain-for-better-performance

Effects of axon diameter and myelination. (n.d.). Retrieved from https://www.khanacademy.org/science/health-and-medicine/nervous-system-and-sensory-infor/neuron-membrane-potentials-topic/v/effects-of-axon-diameter-and-myelination

Freudenrich, C. (2007, October 19). How Nerves Work. Retrieved from https://health.howstuffworks.com/human-body/systems/nervous-system/nerve4.htm

Site Search. (n.d.). Retrieved from https://www.breakthroughbasketball.com/drills/basketballdrills.html

Clark, Z. (2010, September 01). Three Ways to Increase Reaction Time. Retrieved from http://www.stack.com/a/three-ways-to-increase-reaction-time

Lin, D. (1970, January 01). Analysis of Reaction Time Between High Performance Basketball Player and Ordinary Basketball Player. Retrieved from https://link.springer.com/chapter/10.1007/978-1-4471-4805-0_96