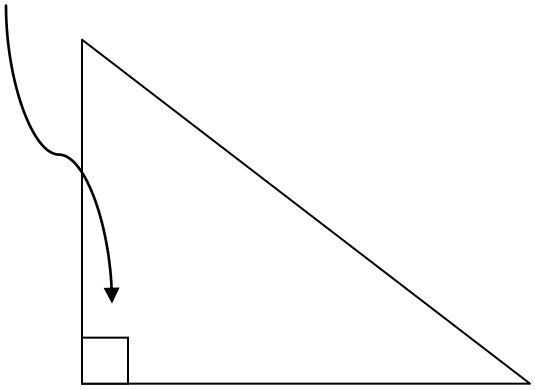
The Rule of Right-Angles: Exploring the term "Angle before Depth"

I'm a firm believer in playing an efficient game. Goaltenders can increase their efficiency in almost every category of their game, from positioning to angles, save selection to tracking, puck-handling to psychological processes, and many more. In this article I want to focus on efficiency in angles and positioning and unpack the term "angle before depth". What the term refers to is when following a pass and moving to a new angle, say from shooter "A" at the half-wall to shooter "B" in the slot, the idea is to get on your new angle as soon as possible, and then worry about how far you come out to challenge. If it's a quick play that leads to a quick shot like a one-timer, the goalie should arrive at that new angle as soon as possible to at least give themselves a fighting chance at being able to reach the shot, no matter where at the net the shot is placed. If depth is the priority (maintaining your "challenge" to the shot), goalies create a longer path to arrive at the new angle, and often don't quite get to the 'leading angle' in time for the shot.

This article covers a concept that is well known by goalie coaches and goalies everywhere, and I am by no means claiming to have come up with this "Right-Angle" *concept*. My goal with this article is to provide a clear explanation complete with diagrams to hopefully clarify what can be a challenging concept, especially when trying to implement it in to your game. I also believe that if anybody should be over-thinking during a game it should be the goalie coach and not the goaltender, which is why it helps to have some guided and simplified instruction on the ice when it comes to this concept to build the good habits, and have this movement pattern become more automatic in a game.

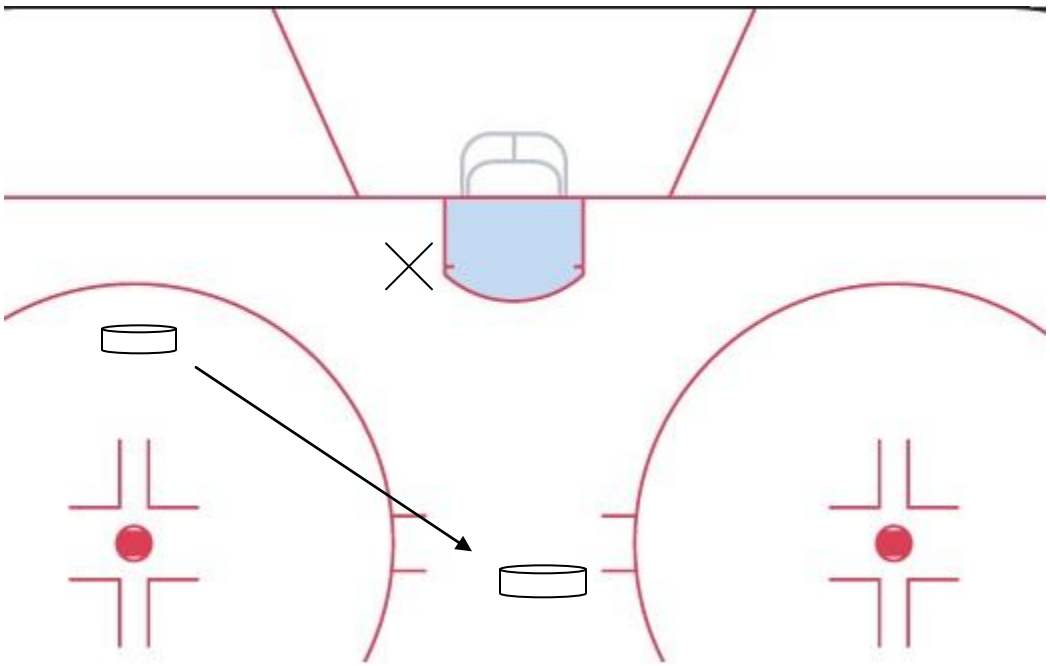
First let's touch up on some basic math, specifically trigonometry. Within trigonometry is something called the Pythagorean Theorem, which describes the relationship between the square of all three sides of a right-angle triangle. If it's been a while, a right-angle triangle is one that has an exact 90º angle as one of the three angles:



The remaining two angles will add up to 90, so the right-angle triangles can take a variety of different forms with lines of different lengths. This is important as the right-angle triangle is

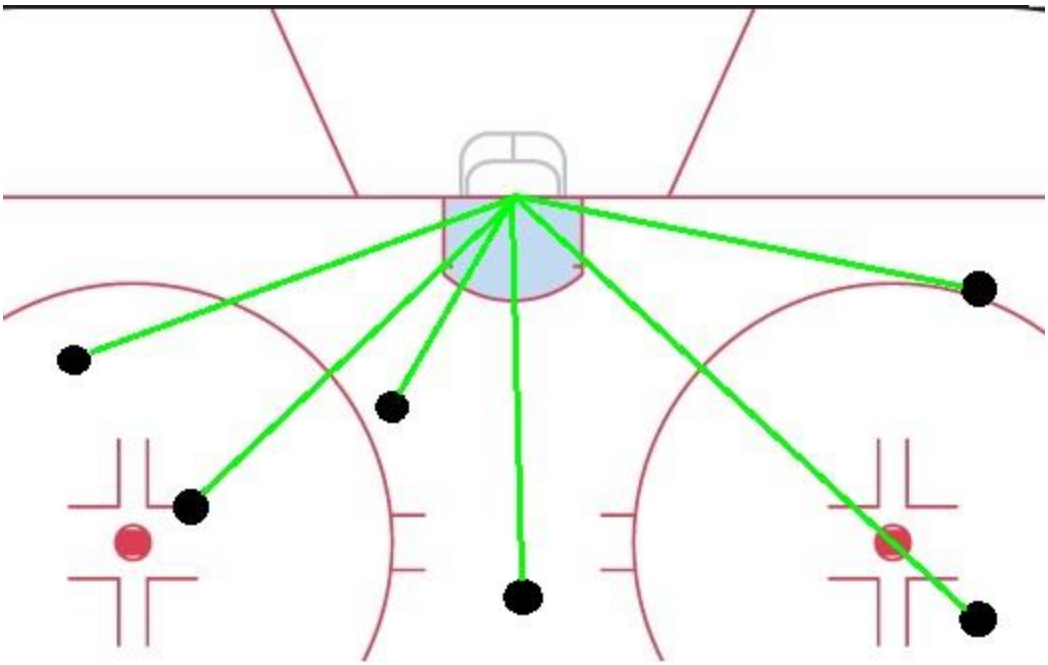
something that can be used on the ice to determine the best path to take to a new angle, as will be described shortly.

The second important feature of the right-angle triangle is the fact that it contains what's called a *hypotenuse.* The hypotenuse is just a strange word for the longest line in the right-angle triangle, and is always opposite the right-angle. This means that the two lines making up the right-angle can be any length you want them to be, but the hypotenuse that connects them will *always* be the longest of the three lines. This is also an important concept to keep in mind with regards to moving to new angles, and here is why:

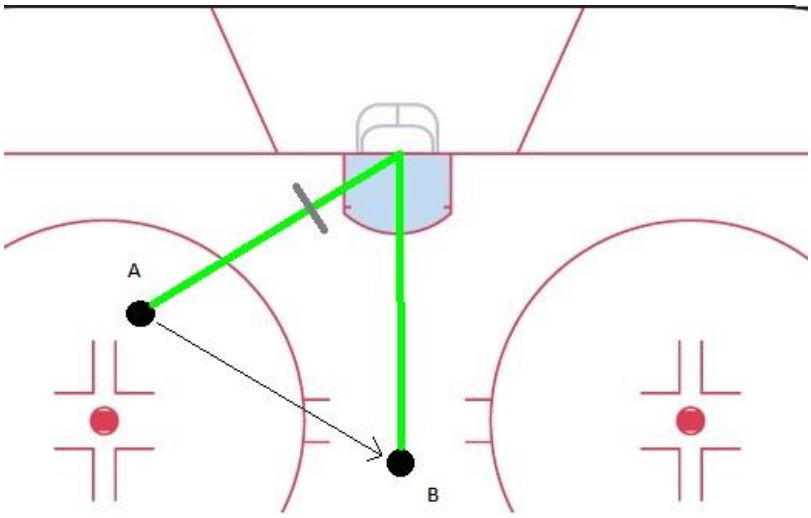


In the diagram above, the puck starts out at the bottom of the circle and is passed up to another shooter in the slot at about the hash-marks. Depending on the age, goalies tend to follow the pass in one of a few ways- (1) in a long arc that follows the shape of the crease, (2) on a path that parallels the path of the puck, (3) a shorter path to the middle of the crease, or any number of possibilities in between. Keep this idea of "different paths" in mind as you read on in the article.

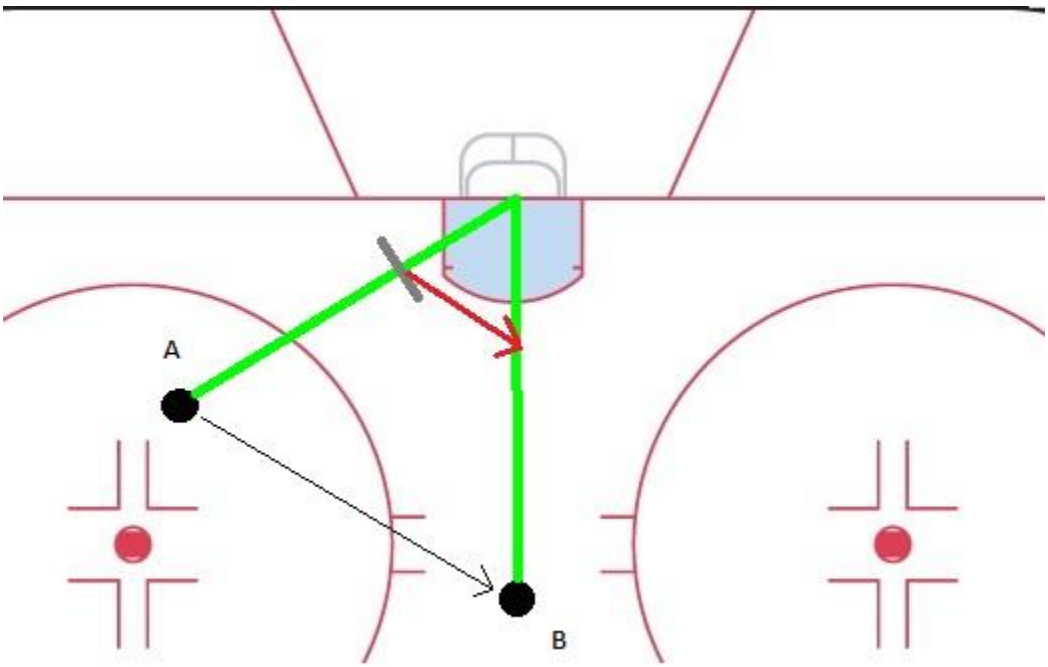
When goaltenders line up to a puck, they are actually doing some pretty serious math without even realizing it. Although often inadvertent, goaltenders are masters at real-world geometry. We can place a puck anywhere on the ice and have a goaltender line up to it, which they do by "getting on the angle", and "squaring up". To get on the angle, what the goalies are doing (sometimes without realizing it) is drawing an imaginary line from the puck, to the center of the goal line between the posts. This is the anchor point, and it stays the same no matter where the puck moves on the surface of the ice. For example:



All six pucks in the above diagram represent shots from random locations on the ice. For a goaltender to be on their angle, they want to have the imaginary line pass through the mid-line of their body (think bellybutton), which ensures they are covering as much of the net as possible and not leaving themselves with an impossible reach to any one side by cheating or being misaligned. And of course, to further cut down the angle the goaltender moves out toward the puck along the imaginary line. So let's view an example of the Rule of Right-Angles in action, and why I would argue makes the most logical sense to follow to increase movement efficiency, by decreasing distance travelled.



In the above diagram, the puck starts at point “A” and is passed up to point “B”. The green lines represent the imaginary lines that the goaltender must get centered on to be on their angle. The gray line on the point “A” line is the goaltender, who is outside the crease lining up to the shot and challenging the shooter. But now that the pass is made to a new shooter (potentially for a one-timer or quick shot), the goaltender must get over quickly to cut down the new angle. In other words, the goaltender must get from point “A” to point “B” as fast as possible. We’ve all heard it before how the shortest distance between two points is a straight line, and in this case that straight line must be at the proper angle to take the absolute shortest path possible. Here is where the right-angles come in to play:

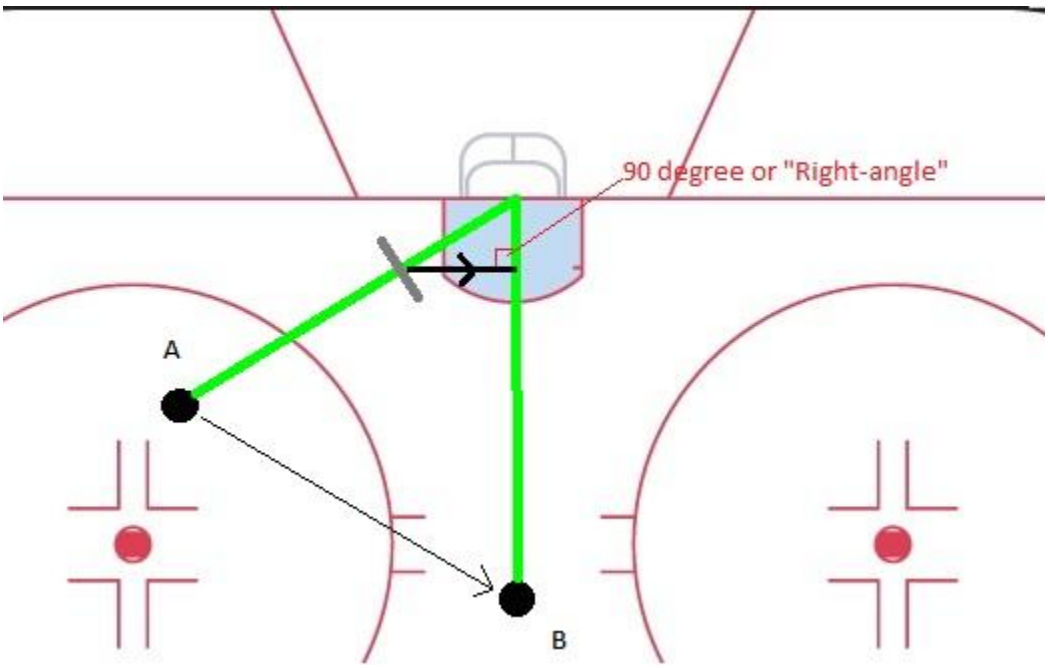


The goaltender moves along a path that will maintain their depth from angle “A” to angle “B”. Although they arrive outside the crease, they are intersecting the line of the new angle in such a way that they have increased the total distance covered by potentially several feet. In other words, the more a goaltender tries to maintain depth on the puck, the longer their path to the new angle becomes. It doesn’t always have to be about having the quickest feet when navigating around the crease if goaltenders can optimize their movement paths to travel along the shortest path. A fast goaltender can play even faster, and a goaltender with average foot-speed can play fast if they increase their efficiency.

The Optimal Path

The optimal path with regards to ‘angle before depth’ is the shortest path to the new angle. This isn’t exclusive to quick one-time plays either, as there’s something to be said for conserving

power wherever possible throughout the course of a game. Here is an example of what the optimal path looks like, and the reasoning and simple math behind it:



The above diagram shows the optimal path to take to the new angle. Mathematically, this is the shortest possible path a goalie can travel, one that intersects the line of the new angle (shot ”B”) at a 90º, or right-angle. Because this path is one of the lines that forms the right-angle, anything either above or below this line (towards the goal line or towards the top of the crease) must form the hypotenuse of this established right-angle triangle, as it will connect to the adjacent line forming the right-angle. From earlier in the article we know that the hypotenuse is the longest line in any right-angle triangle, so any path that is not along this right-angle intersection must be a longer line and thus, more ground for the goaltender to cover to arrive at the new angle. Depending on where the pass originates and where the shot is taken from, this added distance of taking the “hypotenuse” line instead of the “right-angle” line might be a difference of several inches, or several feet.

As stated before, you don’t have to be the quickest goaltender in the world if you are efficient. Of course once a goaltender arrives at this new angle, they should track out to challenge the shot if there’s time and the situation allows for it (eg. no back-door presence). This is the mathematical concept behind ‘angle before depth’.

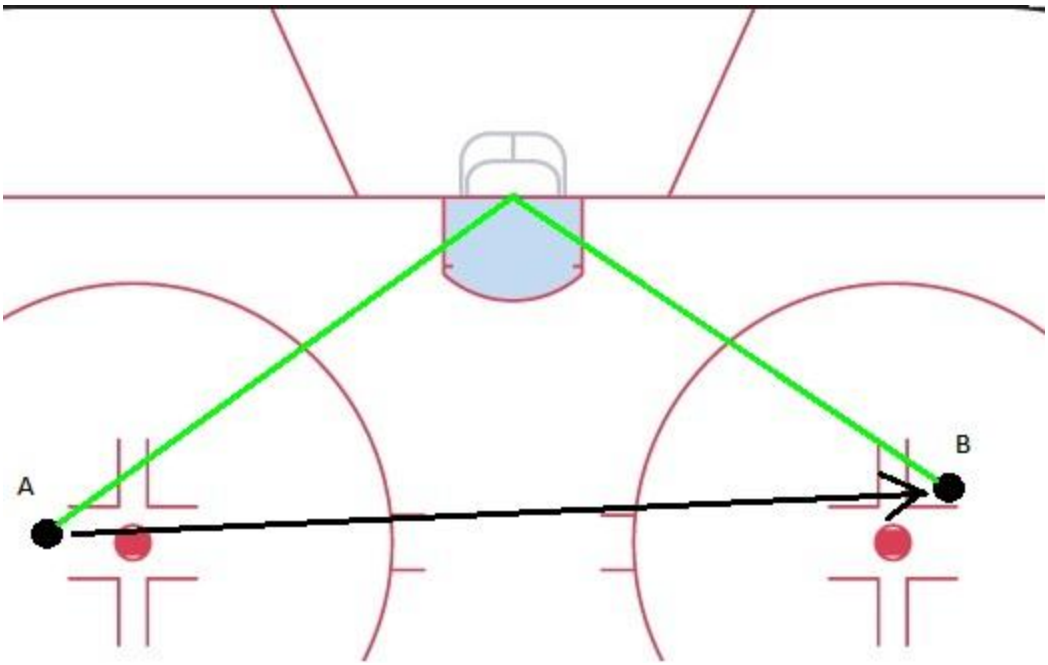
Tracking out and re-gaining the depth is important as well and I am by no means suggesting that every goaltender starts to play a deep game like Henrik Lundqvist, but this concept may be one of the many things that makes him so successful as he moves with increased efficiency throughout the course of a game. Even a smaller goaltender like Jaroslav Halak rarely plays outside of his crease while the play is in his defensive zone, until he gains depth by challenging a

shot. Most of the movement following the puck as it's moved around the zone is done by taking short lines within the crease, which allows him to arrive at the new angles early and well before the shot is taken. Once a player looks like they are about to shoot, by all means track out to cut down the angle if the play allows for it.

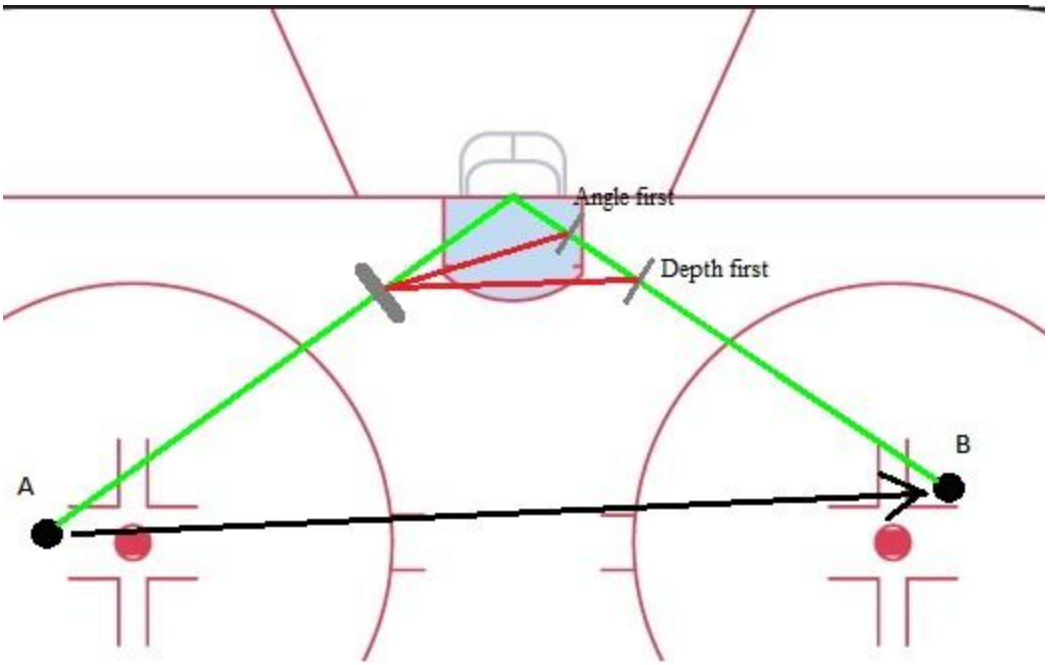
I feel this optimized movement is especially important when killing a penalty. Penalty-kill units are structured to keep the puck on the perimeter until a play can be made by the power-play unit to get a high quality shot. With so much of the PK being perimeter puck movement with the killers putting themselves in the shooting lanes, goalies can afford to utilize this angle-before-depth-type movement when following the passes to reduce the total distance travelled during a PK. Two minutes of explosive movement in the form of shuffles, T-pushes, butterfly slides, C-cuts, etc. is physically taxing, so it's important to optimize this movement and not expend most of the energy tracking the perimeter passes before a shot is even taken. Again it's all about efficiency, arriving early to set the feet and read the play to increase the chances of making the big save once the shot comes.

I have found that goalies naturally do a fairly good job of taking close-to the optimal path to the new angles, but if they are going to be off it usually means they have chosen to maintain some depth on the puck and have under-rotated before pushing to the new angle. Alleviating this means getting slightly more rotation before the push to the new angle, to intersect the new angle at a right-angle. Taking the extra split second to rotate further will actually save the goalie time in the overall save process when the added rotation allows them to arrive at the new angle sooner, set the feet, and maybe even track out to challenge if the play allows it.

There are situations where the "Rule of Right-Angles" doesn't always apply. For example, longer cross-ice passes like from one faceoff dot to the other. Have a look:



In the above diagram, the two green lines form an angle of 90º or greater at the goal line, so for a goaltender to be out challenging on line “A” it doesn’t make any sense for them to arrive at line “B” at a right angle, as they would end up doing a complete 180º rotation and end up inside the net, not exactly an efficient or logical movement pattern. In this case there are a couple of things to keep in mind: Longer distance passes like this mean more time to get across. They also mean a greater distance for the goalie to cover, so I believe the biggest thing to keep in mind is the pre-movement rotation. Rather than making a long distance even longer, goalies should focus on rotating enough to arrive at the new angle at close-to a right angle, erring on the side of gaining depth (the alternative being ending up inside the net). Depending on the play, this might mean aiming for the far post, or if there’s time arriving a bit further out. For the short passes, maintaining a lot of depth may mean increasing the path by a matter of inches. For these long passes, maintaining a lot of depth will mean increasing the path by a matter of *feet*. The diagram below will map out two different paths, one has depth as the priority and the other has the angle as the priority:



The “Angle first” path would be a result of a fairly large rotation before the push, and has the goaltender arrive at the new angle inside the crease. The “Depth first” path requires a smaller rotation, and has the goaltender arrive at the new angle at the same distance outside the crease as where they started. Scaled up (calculations and measurements available upon request), the “angle first” path is about 14 feet, 5 inches long where the “depth first” path is about 19 feet, 3 inches long. Maintaining depth in this case adds almost 5 feet of extra distance to be travelled! In a case like this where the shot is coming from so far off center, the available net to shoot at is greatly reduced and the goaltender is likely overlapping with unnecessary coverage, where the “angle first” path has them in a good position to reach any puck with the reduced available net behind them. Not to mention maintaining depth in this case would greatly open up the back-door options, and require another very long push in a very short period of time to have any chance of making a save, where the reduced depth position is in a much better place to act on back-door plays. By taking the shorter more efficient path, a goaltender hasn’t guaranteed a save but they have made the good choices which greatly increase their chances of making the save, which is something we can control and something we need to do.

I hope these concepts make sense and don’t complicate movement patterns too much. It is no doubt adding to the cognitive load of a goaltender to have to think about intersecting imaginary lines at 90º angles during play, but the habits that arise mainly due to focusing on getting an extra rotation actually arise fairly quickly. We all have those systems practices where the players work on special teams and goaltenders can go for a while without a shot, so this is a good time to think about getting on to the new angle more efficiently when following the passes. I have found it also helps to spray paint some lines on the ice originating from the middle of the goal line and

extending out to the faceoff dots and up the middle of the slot, and to just have the goaltenders do simple movement drills following a pass from one line to the other, focusing on intersecting the new line at a 90º angle then gaining depth by tracking outward if there is time and the play allows for it.