

How to Strafe

A guide by [@dokiww](#)

Everyone understands strafing as the basic tool for navigating around the map, but few understand that the same 4 keys and 8 possible directions are powerful tools that allow you to be more consistent in your fights, gain strong advantages over the enemy, and even recover a losing fight. The goal of this document is to highlight and explain these tools, to show you how to use them to their full potential.

Before we begin, I must thank @qqpeepo for helping with the creation of this document, this would not have been possible without their valuable help, and of course, everything here is just my personal understanding on strafe and dodge, and any further correction or advice is highly welcomed. This document is intended to be a community effort.

Now, I'd like you to think back to a time where you were fighting another player in a head-on one versus one, how did you move in the fight? Did you have any specific goals you were trying to achieve through your movement? Or were you just mindlessly moving? When it comes to strafing, a good player always strafes with intention, there is always a goal they are trying to achieve through their movement. The goal is ever-changing: To and away from cover, or to an advantageous fight, or to the next objective on the map, or the focus of this document - Winning fights by doing more damage and taking less damage consistently.

A good description of this comes from Sam (@400apm, the author behind one of the best pieces of material on the topic), where he describes a strong player as the "Artful Dodger":

"The artful dodger is a lazy old man. The artful dodger is a man of principle who is not afraid to go his own direction. He has an intention with every keypress. Every movement or lack thereof has a purpose in mind. The artful dodger is calm and confident in his convictions and abilities to achieve his goals. The artful dodger sees the dance for what it is. The artful dodger puts himself in situations where he has to do little, while his enemy must do a lot. His moves are not predetermined and do not follow strict rules that can be forced blindly. The artful dodger is fluid and merging, always adapting to his surroundings, at any point ready to recede or advance; but ultimately preferring to stay where he is if possible."

The language here may be quite flowery, however the goal of this document is for you to feel the same way when you are in a fight. With all the introduction out of the way, let's try to get into the mind of the Artful Dodger, and understand what they see.

Parameters

Even if both players are just fighting in the open with no cover, there are lots of signs available for them, constructing a context of the fight, a player who does not take in all the information available to them is then at a disadvantage. Therefore, before we discuss various strafe forms, let's first look into some of these parameters.

The first one is quite simple - Health. Suppose both players in the fight are shooting forward, directly at each other, and from the spectators point of view, they are both strafing towards the same direction, in what we call a "Mirror", the player moves left for us, the opponent also moves left for us, and vice versa. In this situation, the player that started off with less health will lose the fight, because of their decision that they made to go in the same direction.

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Another obvious one would be where the enemy's line of fire is. Paying attention to where the enemy is aiming is also very important in avoiding damage. If the enemy is shooting to our left, and missing, why walk into their bullets?

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Another would be the relative speed and distance between the players, in a 3D environment, it is easy to understand the impact of perspective.

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The same movements look smaller and slower when the viewer is far away. In addition, that same movement will look faster if the player is moving in the opposite direction:

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The motion is perceived from the player's perspective, if the player moves in the opposite direction, the relative speed will be higher as it is both the opponent's speed and the player's speed combined. All of this is perhaps obvious, but also consider the impact of such perspective on both players, the difference in relative movement also changes the amount of movement both players need to have in their aim in order to hit their shots. Given different contexts, the same strafes taken by the player may make aiming harder for themselves, or harder for the enemy, or for both.

Consider also whether the fight is symmetrical at every instant, it's rare that this is the case. There are lots of factors that can make a fight asymmetrical: We've discussed the most basic one - health, above, but there are many other factors that can make a fight asymmetrical:

- What types of weapons do they have? Tracking-based or clicking-based?
- Even if it's the same type of weapon, what's the firerate? What's the DPS?
- Are both players able to move at the same speed?
- Do both players have the same hitboxes?
- What kind of movement has the players shown thus far? Is there an established pattern?
- Do both players have the same amount of space to move in?

The above are only some of the considerations that a player should have in a fight, there are, of course, more advanced and game-specific considerations that further influences a player's movement, such as going for advantageous positions (high ground, other types of cover), or backing out of the fight to regroup with their teammates, chasing various game

objectives, et cetera, but those are out of the scope of this document. Now, if you are aware of these considerations, what can you do with them?

Strafeaiming

As mentioned, there are uncountable ways that you can strafe in, however, let's suppose you have considered the context of the fight, and came to the conclusion that you can win the fight through prioritizing on dealing damage, ignoring the damage dealt by the enemy. There are many situations where you can come to such a conclusion: Having a sufficiently big health advantage, or confidence in being able to deal more damage than the enemy. Regardless, the intention that you have now, is to deal damage to the enemy, ignoring all other factors.

A key way that strafing can help in achieving this goal is what is called "Strafeaiming", where the player REACTS to where the enemy is going with their own strafes:

- The enemy goes left, the player goes right, and vice-versa (Anti-mirroring)
- The enemy goes left, the player goes left, and vice-versa (Mirroring)

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As said, the goal of strafeaiming is, to deal damage ignoring other factors such as damage taken. Most readers are familiar with this already, as this is one of the most common strafing forms, however, we should further look into the mechanics of strafeaiming in order to gain a better understanding.

With strafeaiming, the movement of the opponent is easier for the player to parse, and therefore, it is also easier for the player to aim, and deal damage to the opponent - strafeaiming creates a context that is easier to aim in.

In a mirror, assuming it is done perfectly, with no delay from the player's reaction time and given that the player is on target, the player does not even need to move their mouse in order to remain on target, since all of the aiming is done through their movement. Consider what this looks like on-screen - the enemy does not visually move at all. Even when we account for reaction times, the amount of visual movement is still low, making it easier for the player to aim at.

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With anti-mirroring, the enemy is moving faster visually, since the perceived speed is the combination of both the player's and the enemy's movement speed.

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Some may argue that the increased visual speed makes it difficult for both players to aim, while it is indeed harder than mirroring as there is more movement required to aim here compared to a mirror, antimirroring is still effective in reducing the complexity of the enemy's

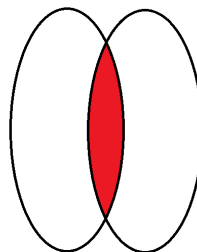
movement. In strafeaiming, the player's movement in terms of aim and strafe are both reactions to the enemy's movement, when the enemy changes direction, the player adjusts their aim and strafe direction in one singular motion, between direction changes, the enemy's movement (and the player's too! More on this later) is just a straight line, at a consistent speed, the player only needs to focus on being smooth and consistent in their aim in order to stay on target, without further direction changes from themselves increasing the complexity of perceived enemy movement.

Pay extra attention here to how, in both mirroring and antimirroring, the player is able to make it easier to read the enemy movement, making aiming easier for them, allowing for more consistent, and potentially higher damage output. However, let's take a step back, and revisit why we decided to strafeaim in the first place. Our intention here was to deal more damage consistently, and we came to this decision through our understanding of the context of the fight. What if, through the same understanding, we have a different conclusion? Consider the possibility that we do not have a health advantage, or that we aren't confident that we can deal more damage than the enemy (they may have aim assist.). Is strafeaiming still the right move? Like all strafe forms, strafeaiming is not always the answer, and there are always trade-offs. Now, let's discuss some of them.

A good way to understand the effects of strafeaiming in a fight is to consider it an invitation to an aim duel, with the same amount of health, the player with better aim will win the fight; If there's an asymmetry in health, the player with less health will have to deal much more damage than the opponent in order to win¹.

Next, notice that strafeaiming ignores other factors such as damage taken, which is not always desirable, in situations such as a 1v2, you may want to keep as much health as possible in the first fight such that you have a better chance of winning the second.

Furthermore, notice how with strafeaiming, you are always reacting to the opponent's strafe, this is an invitation for better players to exploit that fact, and strafe in a way that makes you an easy target. Consider the situation where you are blindly strafeaiming the opponent, the opponent, aware of your intentions, starts AD-spamming, doing many short strafes left and right. You, continuing to follow their movement, reduces your motion to this:



There's always a region, painted in red, where the opponent is able to land hits regardless of your actual location, since part of your hitbox is always in that region. As such, the opponent

¹ This is distinctively dangerous in controller-dominated games such as Apex Legends where out-damaging the opponent is much harder due to rotational aim-assist.

has used your strafeaim against you, gaining an upper hand in the fight by making your strafe easy to hit².

(Extra: Attentive readers may point out that the enemy in this case is ALSO just as easy to hit as they are AD-spamming, and make the case that the fight is symmetrical, this is not the case as there is a key difference – The awareness the enemy has here means they are in control, and can change up their strafe whenever they feel it is no longer viable.)

Dodging

It is then clear that there are a myriad of situations where our intentions won't be as simple as dealing the most amount of damage possible, we may have a health disadvantage, or we may want to avoid our strafes from being too easy to hit for the opponent. Under these contexts, we then look into dodging, another form of strafe that is often ignored by players, but is immensely powerful if done well.

The goal of dodging, as the name suggests, is to prioritize avoiding damage taken over dealing damage, the goal is very simple, but to achieve good dodge is much harder than it seems, with much more considerations than strafeaiming. Let's start off with a fundamental concept with dodge - bias.

Bias

Bias is key to understanding strafing as a whole, and can be understood as how much you move towards a direction over a period of time in the fight. Using the above AD-spamming as an example, imagine if the fight goes on indefinitely, the AD-spamming player will never leave their original position globally – overtime, they remain on roughly the same part of the map, therefore having no bias, whereas only holding A or D would have infinite bias. Bias can be seen as a (very) simple heuristic on how good a player's particular dodge was in a fight, consider this example.

<https://x.com/dokiww/status/1721509695607935345>

TODO: Video to be replaced, the crouch spamming here is not good.

Notice, from the enemy's point-of-view, there is always a direction that is being prioritized at any given point in time, and this introduces two effects, both are key to understanding the mechanics of bias.

² Rotational aim assist can further be understood as an aimbot that aims optimally, in such a situation, controller players often can underaim perfectly and deal damage at a level impossible for mouse and keyboard players.

1. The opponent must exert more effort in order to hit me, as overtime I move in a wider degree, the enemy must also have the same wider degree of motion in their aim in order to hit me³.
2. More importantly, bias is a great tool to achieve the most important thing about dodge: TO MAKE YOUR MOVEMENT AS HARD TO PREDICT AS POSSIBLE.

Reading

What is a read? As mentioned above, a good player always strafes with intention, reading refers to the act of understanding those intentions, which is key to aiming at the opponent in any given fight. Many players often consider aiming at the enemy simply as putting the crosshair on target, much like how they would in an aim trainer, however, from in-game experience and understanding of the enemy's intention, it is possible to predict and minimize the amount of motion in one's aim, ignoring the extraneous movements from the enemy. Reading as a concept is slightly out-of-scope as it relates to aiming, however, it is key in understanding what makes for a good dodge.

A great example using Apex Legends would be a "Ras" strafe, where the player jumps, and then does a circular strafe in the air. If we only consider the strafe itself, there is a lot of motion, both vertically and horizontally, this gives many players a false sense of security as they believe the amount of motion is effective in avoiding damage. However, this is not the case, similar to our discussion with antimirroring, the movement itself is actually easy to parse, because the motion in the air is predictable - a simple circle in the air, and since the opponent has far less control over their movement as they would on the ground, we are then able to have a much more confident read on them, as we are certain on how they are going to move. This lets us be more consistent in our damage output since the difficulty in aiming is now just executing the motion with our mouse. In simpler terms: Reading is to know WHERE to aim at, mouse control is the HOW.

There is much more to be written on reading, in games such as Valorant or Apex Legends, when players change directions in their strafe, there is first a deceleration and then acceleration in their movement speed, often accompanied with specific animations in their character model. All of these are further signs for the player to read, and get a better understanding of the enemy's intentions and movement. Regardless, let's not get off topic, and focus back on dodging.

Again, the reader needs to keep in mind that the amount of bias is merely a heuristic, and having a lot of bias should not be the goal as it does not always make for good dodge. Imagine if someone constantly strafes to the left, stuttering back to the right occasionally, in the vacuum of a second, such a stutter may throw the enemy off, but repeatedly doing the same stutter? It now becomes readable for the enemy, since the intention to go left is clear from the established pattern. The exact same move to "dodge" is now less effective,

³ Against mouse and keyboard players, this introduces more strain on their aim, increasing their chance of missing me, and against controller players, I have a better chance of walking away from the region where aim assist is active.

because the original goal of the dodge - Making your movements hard to predict, has been lost.

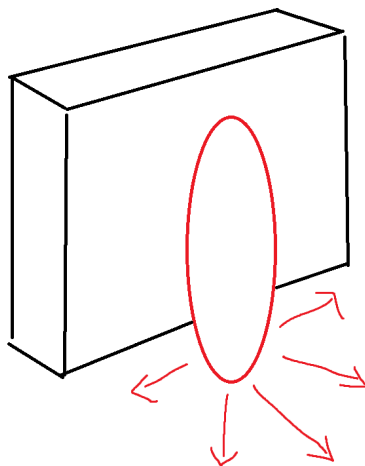
Similarly, the anticipation of movement is the same as the anticipation of no movement, this is why sometimes, AD-spamming, or even standing still, can throw off an opponent expecting large biases, there are contexts in which having a bias is not always optimal.

Many players, in learning how to dodge, often over-focus on trying to achieve a “correct” amount of bias, but there’s no such optimal amount. It is on you as the player to develop the sense of how much is needed in a given situation, and get a feel for it. Always consider the context of the fight, and never chase simple heuristics like bias, as once a metric becomes a goal, it ceases to be a good metric.

The above is a very basic overview of dodging as it relates to avoiding damage, there is much to be said about dodge, and we will be returning to the topic later. However, let’s keep our train of thought going. Notice that a bias allows you to reposition yourself on the map, this not only is relevant in dodging, but equally important in opening up possibilities for the player to gain different types of advantages, let us look into some of them.

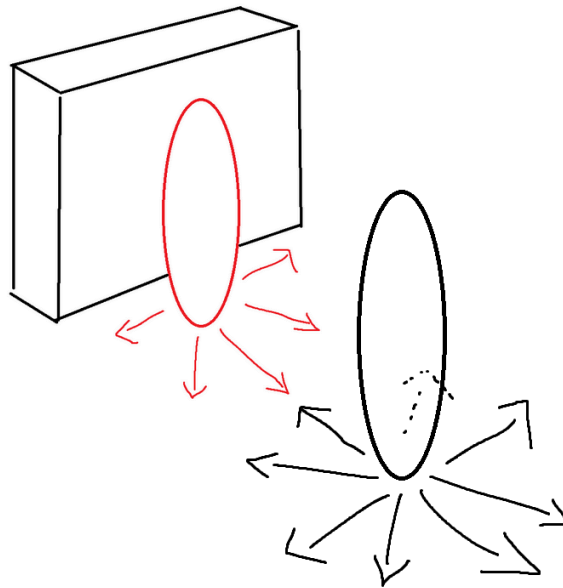
Positioning

There are many situations where just based on the positions of the players, there already exists a power imbalance before any damage is exchanged. Some of these are obvious - consider the enemy has their back against the wall.



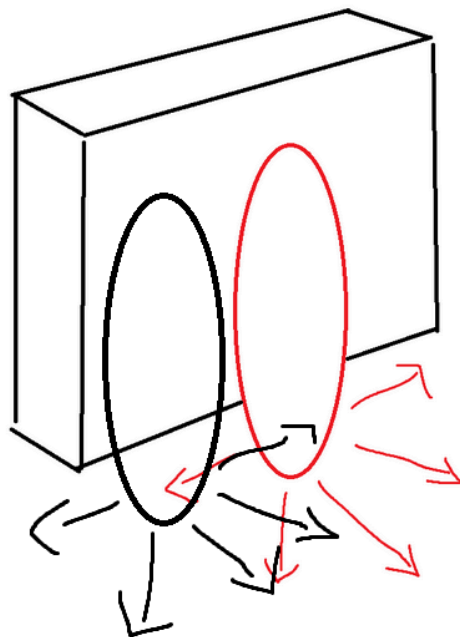
The enemy is of course, unable to move backwards, the amount of space the enemy has is limited compared to how much you have, how to exploit this fact? Let’s look at some potential plays.

This is one of the possible plays:



Standing in front of the enemy, when it comes to strafing left and right, both players can strafe at their full speed, no one has an advantage as the wall has no effect here.

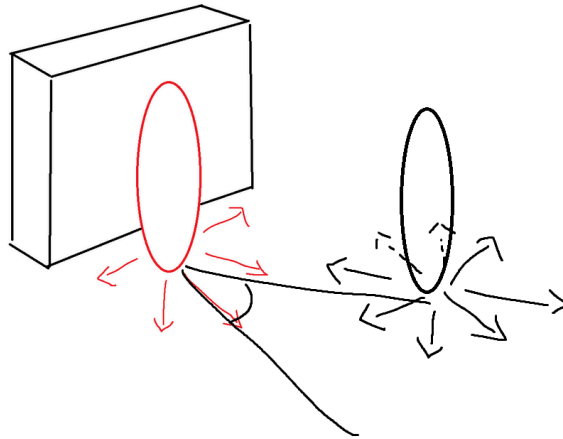
This is another possible play:



On the wall with the enemy, similarly no one has an advantage, because both player's space to strafe are equally limited.

Now, suppose the player is at an angle with the wall, the player has all possible space to strafe towards, if the enemy is looking at the player, he will not be able to press A and D and move at the same speed as the player, since the direction they look in will lead to them strafing into the wall, limiting their strafe speed. This means that simply through standing at

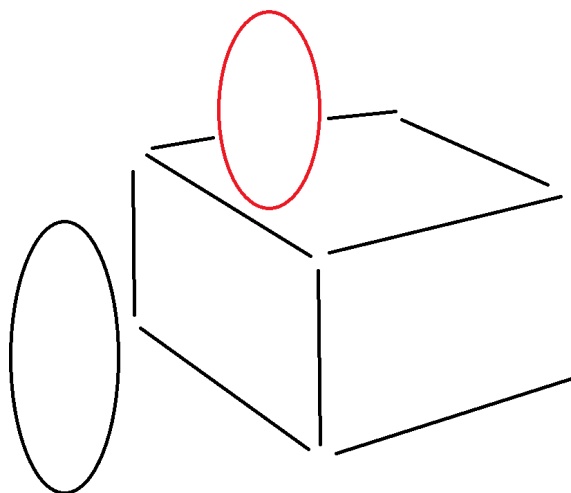
an angle, the player can leverage the enemy's limited strafe space and gain an advantage, and this is just one of the many examples of what is known as "geometrical positioning".



Due to the variety of the positions that exist in-game, it will not be possible to list all of them, instead I would like you to keep in mind that all of them will have to do with the player's available space in strafing, and how much of their hitboxes are visible.

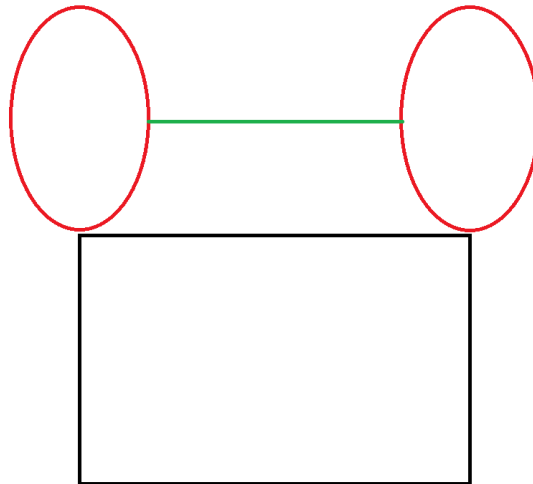
Here is another example regarding strafe space, one that many players fail to recognize.

Many players love taking a small high ground, and standing close to the edge, the height discrepancy and the position of the player on the high ground only hides their hitboxes by a negligible amount.



It is then obvious that they do not have any meaningful advantages over the player on the ground, however, he is also at a less obvious disadvantage.

Look at the enemy's available strafe space, he can strafe to any point on the top of the box, however, consider the possible locations where it is possible to land a hit on them. From the perspective of the player on the lowground, it looks like this:



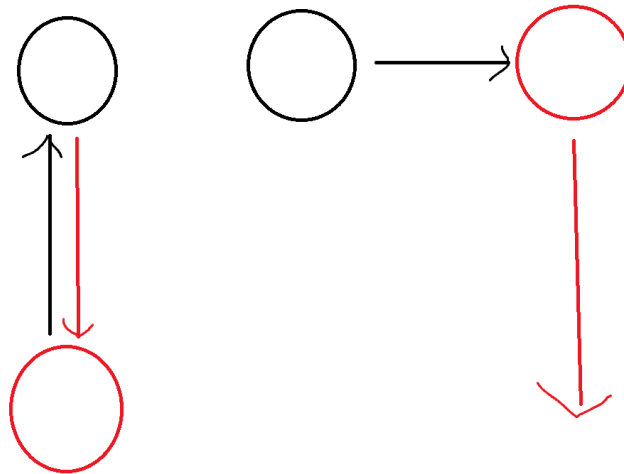
The player can simply aim at any location on the green line and land a hit, any further movement from the enemy means they will walk off the box and have a clear, predictable path in the air as they fall, with no additional opportunity to move. Such a position is another example of geometric advantage, where you gain the upper hand from leveraging the enemy's position, or from the enemy limiting their own options. Now, think about what's wrong with standing in a doorway in a fight?

So far, we've covered quite a few basic concepts in strafing, many of these ideas are presented in isolation - we consider one player's actions, or the position of both players at an instant. However, as Sam said, these fights are a dance, and only seeing the fight from one perspective or from one point in time is not enough, so let's look into some further concepts involving the actions of both players.

Angles

Bias is not only key in making the enemy do more work in hitting you, avoiding damage, it is also another key tool in gaining another type of geometrical advantage - Angles.

Let's define the angle between 2 players as the gap between the direction the players are looking at, 2 players looking at each other directly would be 0 degrees, and one looking to the side while the other looks at them is 90 degrees:



Consider what the same strafe looks like in both situations, in the former, the visual speed would be the full strafe speed of both players, but in the latter, the enemy can press A and D as much as he wants and there will still be no visual movement (Other than a slight change in the size of his hitbox thanks to perspective, but it is negligible.). This is another type of geometrical advantage that can be gained through the interaction of both players.

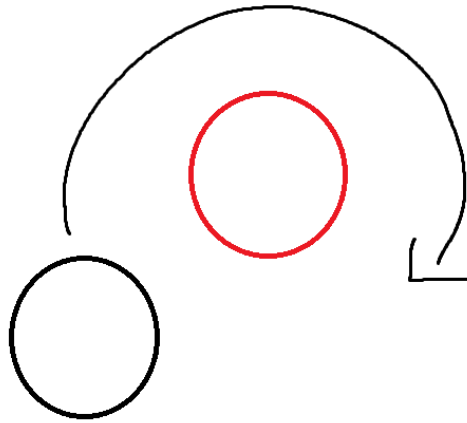
A 90 degree angle gap is extreme, used here to illustrate the effects of angles, such a big angle is not realistic to achieve through strafing only (It is possible through flanking, or if the enemy is very unskilled.), but the effects on perceived movement speeds remain for smaller angles, even a 15 degree angle is an advantage to the player, not only does this mean the enemy is missing, it also means you have an easier time hitting them as their perceived movement speed is slower.

The advantage gained from getting an angle is also temporary. The enemy will be certain to readjust their aim and nullify the angle, but if you were to notice the angle gap and capitalize accordingly, a significant health advantage, or even a kill could be obtained.

Another point of consideration here is the possibility of achieving such an angle - if you are far from the enemy, your visual movement speed is low, and it is very unlikely for the enemy to be off target by so much that a meaningful angle gap can be acquired. Similarly, if the enemy has great aim (or assisted aim), it is also harder to gain an angle on them since they will be on target, or close to the target more often.

Circling

Remember the situation where the enemy has their back against the wall, and we leverage their limited strafe space for an advantage? There also exists a way for the player to gain an advantage in the fight simply by strafing in a way that limits the enemy's space, consider circling the enemy up close:



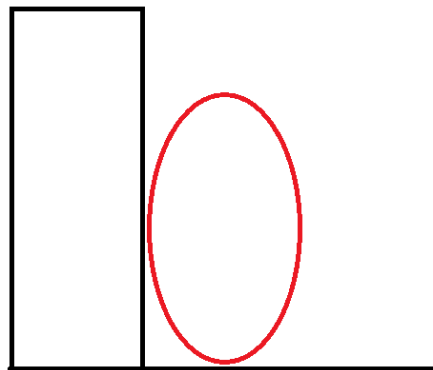
The enemy's space to strafe is lower because of how you have approached them, by walking around them as such, if they are unaware of what is happening, any strafing they perform will have a limited effect since they are constantly trying to shoot at you, meaning their look direction changes, constantly changing their actual strafe direction. You have gained an advantage simply by having more space than the enemy.

And of course, the enemy can also simply walk into you, or back out of the circle, nullifying your attempts - again, the fight is a dance, and the enemy can also move accordingly.

Regarding dodging, again, the goal is to again make your own movements hard to predict for the enemy, but what if you can play with the enemy's expectations to avoid further damage?

Conditioning

This is what we call conditioning: playing off of the enemy's expectations in order to avoid damage, a classic example is a player standing next to a wall:



From above, the player's strafe space is limited, which puts him at a disadvantage. Observant players may keep this in mind, expecting the enemy to walk away from the wall in order to escape the disadvantageous position, aiming next to the enemy and waiting for them to walk into their crosshair for easy damage. However, this means that they are not aiming at the enemy currently - this can be abused for an advantage.

<https://streamable.com/1e8wx1> (To be replaced with a gif)

There are many ways to condition the enemy, such as taking an extremely strong bias and switching it up in order to juke the enemy, intentionally letting yourself get circled in order to get the enemy to strafe predictably, or even not moving at all. Even more extreme examples would include things like strafing similarly multiple fights in a row, and then changing it up the next fight as you build up the expectation from the enemy. However, notice with some of these, you are playing in a less than optimal way, intentionally giving the enemy the advantage at times, these will then of course, never work every time, but they are important to keep in mind for when you are in a disadvantageous position.

Another type of conditioning exists in the form of controlling the enemy's strafe. When fighting against good dodgers, many players often find themselves overwhelmed by the difficulty of aiming at the dodger, and subconsciously start to mirror, or antimirror the dodger in order to make aiming easier for themselves, some may even consider themselves dodging while doing this, as their movement in a vacuum, without considering the context of the fight, is "good". The dodger has then, control over the enemy's strafe, and good players often can notice this, and use this to their advantage, as they have confidence that the enemy will never attempt to gain any meaningful angle over them and simply shoot forward for damage⁴.

The opposite of this also exists: Imagine you apply pressure on the enemy by strafing very close to them, many players would notice the opportunity to gain an angle over you or even try circling you by immediately taking a long strafe, this is the "correct" play to make on unsuspecting opponents, however, you are not unsuspecting, and through this you have created a brief opportunity where the enemy is holding one direction for an extended period of time, allowing for good damage. Of course, the enemy can also be aware of your intentions, and play accordingly... Do you see how the fight is a dance yet?

Conditioning also extends further than just through controlling the enemy's strafe. Consider weapons that require less uptime on target such as shotguns or burst-fire weapons. With such weapons, most players, even the average casual, would often pace their shots in order to be more consistent - spamming mouse1 as fast as possible can lead to more misses. It is then another potential tool that can be used by the dodger, holding a direction just long

⁴ A common example for weaker players is them being overwhelmed by AD-spamming, causing them to also AD-spam in an attempt to mirror the opponent and minimize the amount of aiming needed, making aiming difficult for them and also opening themselves to unnecessary damage as mentioned in previous sections. Often, taking a long strafe instead is the correct move, as this drastically increases the amount of aiming the AD-spammer needs to do, considering the degree of motion they must make, and their own direction changes further increasing the difficulty in aiming.

enough where the enemy feels confident to shoot, and changing direction right before the shot is fired. Of course, one is never able to time these strafes perfectly every time, but it's something worthy of consideration.

Real games often have various mechanics to add depth to the game, a common one is crouching - For this, it is easy to see why it can be sub-optimal, a slower strafe speed, and the displacement of the head hitbox can often turn would-be bodyshots into headshots. Many games also allow you to modulate your movement speed, from basic mechanics like sliding, to intricate movement systems like the one available in Apex Legends. All of these are further tools a player can use to give themselves incredible possibilities in dodging.

https://x.com/xz_PANIC/status/1829556576354713710

While these abilities are dazzling, they would not be as effective, or be effective at all without a good understanding of strafe and dodge, a player with strong fundamentals can still easily defeat opponents who know the "tech".

<https://www.youtube.com/watch?v=0lAdTlzdflj>

I want to end our discussion here with a few words on improvement. We've covered quite a few concepts on strafe, while the theory is good to know - many players often underestimate the utility and power of dodge, either by failing to recognize the depth of the topic, or by the simple fact of never seeing good dodge for themselves. With that being said, do not let the understanding of the words here cloud your judgement.

What does that mean? Upon losing a fight, it is often easy for one to give themselves an explanation using the knowledge they already have, in our case it would be saying things like:

"I got angled", "I didn't have enough of a bias", "I allowed the enemy to condition me"

And so on. Are these sometimes the case? Of course, but do you know when it is not? True understanding can never come from just "knowing" things, rather it is the intuition built from getting a feel on things, a poor dodge should immediately feel unconformable, a strong opponent should feel overpowering, and there is no way to experience this building of intuition other than to simply play with clear focus.

People often treat improvement like a patient going to the doctor: A player who lost may think to themselves: "Next fight I will be focusing on angling the opponent", then do exactly that, losing focus on their aim, dodge, and so on. When it comes to mechanics, even in our extremely simplified 1v1s, there are so many variables that it is impossible to list them all, and even more impossible to consciously know them all, the most you can do is to feel the game, getting a sense of what feels right and what does not, do not limit yourself to what is written here.

Therefore, there is no way to improve but to repeatedly put yourself in real fights where you are punished for mistakes⁵, acquiring intuition through trial-and-error. There also exist more rigorous environments such as R5reloaded for Apex, LG duels for Quake Live, or TXCXX for Overwatch, where you can have focused practice by limiting the amount of variables. While the practice methods are varied, the correct mindset remains the same: Focus on areas to improve, always be critical of your own play, and push yourself outside of your comfort zone. This essay for the most part is merely a discussion on concepts, a single focused session in-game is far more valuable than repeated readings of the words here.

With enough dedication and practice, you too can become a great player:

<https://www.youtube.com/watch?v=-n2BeG36m1s>

Good luck, and thanks for reading!

⁵ Many people overextend themselves into aimtraining, a low-pressure environment purely focused on mouse control, and erroneously conflating it with in-game aim, since the motions are similar. This leads to many players having mediocre mechanics in-game despite having otherwise stellar mouse control due to having poor reading.