

# Pickleball Diagrams

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## -1 2024 Update

**Note:** Most of the strategy, tactical, and drilling content in this document was written between 2014 and 2019. While the basic ideas are still reasonable, advances in paddle technology and the increase in higher level / pro play and tournaments has significantly changed the skills and tactics that are needed to advance beyond 4.0/4.5 level play. I haven't (yet<sup>1</sup>) updated these notes to account for these changes but you should keep that in mind when reading.

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<sup>1</sup>maybe this would make for a good post-tenure project?

# 0 Personal Background

Hi! I'm a competitive pickleball player and certified PPR Coach from Uniontown, WA who likes to write and think about pickleball, even when I'm not on the courts. In my day job I am a faculty member in the math department at Washington State University and you can read more about my less entertaining work<sup>2</sup> on my [academic webpage](#). The appendix to this document describes some analysis I've done with collaborators that lies at the intersection of pickleball and my academic research. I also maintain two apps for pickleball: <http://picklebrackets.com> which generates mixed-partner round robin brackets and <http://pblapp.com> for running leagues and tournaments<sup>3</sup>.

This document started as a just an excuse to play around with the `tikzlings` package and is definitely not very polished or complete. The graphics and typesetting approach were inspired by [this stackexchange answer](#). The intended audience level is mostly intermediate players who are starting to think seriously about pickleball, so some baseline<sup>4</sup> knowledge is assumed. On the other hand, there is not a ton of discussion of things like how to hold your paddle, how to generate spin, or what good footwork looks like. Those are all important topics, and maybe they'll get a deeper treatment eventually, but for now you'll have to look elsewhere for that kind of advice<sup>5</sup>. If you find this document interesting or useful, feel free to reach out to me at [daryl.r.deford@gmail.com](mailto:daryl.r.deford@gmail.com). If you want to read more about pickleball, I highly recommend Adrienne Neary's book *Pickleball for our Age and pickleball for all ages* which you can download for free from [her website](#).

## 1 Outline and Contents

The next section describes some basic strategic elements of pickleball with diagrams highlighting some common shot patterns and options during the initial stages of a "normal" point. Throughout the diagrams [yellow](#) arrows are usually used to denote typical shots, while when there are multiple options [green](#) arrows identify easier shots, while [red](#) ones highlight more difficult or more aggressive shots<sup>6</sup>. Section 3 does more of these comparisons, highlighting that cross court shots are often simpler and easier to execute.

Section 4 takes a much deeper dive into common patterns and ideas in kitchen play. This includes shot selection and court positioning as well as locations to target and some competitive tactics. Section 5 discusses the practices of stacking (with diagrams), which is when players switch sides of the court early in the point in order to give each partner their preferred side. The next section wanders through some overall thoughts about high-level pickleball tactics and tries to draw some comparisons to other sports.

Section 7 tries to apply the earlier discussion and ideas to analyzing some specific points. These points came from a match in a regional tournament in Maine in 2016. Some context about the players and initial strategies are described to help motivate the point-by-point breakdowns. For each point I tried to highlight the key shots and moments, relating them back to the overall context. The videos of each point are linked in the opening paragraph. This can be a really useful way to evaluate your own gameplay - recording a few points on your phone and rewatching them later can provide a very different perspective on how you are moving around the court than the feeling when you are playing in the moment.

Section 8 starts with some advice about improving your pickleball skills with drilling and practice. The specific drills and schematics below should be interpreted with that discussion in mind. In particular, thinking about and alternating specific offensive/defensive roles of the practice partners can make a huge difference in making the drilling experience feel more like the intensity of competitive points. Team tactics and positioning aren't discussed a ton in these examples but it can also be very helpful to work on anticipation by practicing plays or scenarios together with a focus on lateral movement and communication. For example, in a drill on wide push dinks having the player hitting cross court signal their partner when they've hit a good enough shot to set up an ATP for the other team or an Erne for their team. The next section just has some blank court templates for you to design your own drills/plays.

The first appendix has summaries of some recent mathematical work analyzing the game of pickleball and empirical work using a large database of shot-by-shot descriptions of pickleball matches. I'm currently interested in extending this work to look at extensions of this work including: Analyzing shot distributions as a function of court position and shot type, Determining game and point winning probabilities as a function of serving rates and player ratings, Analyzing the fairness properties of King of the Court models compared to round robin or elimination brackets, and Developing complete brackets for mixed partner mixed doubles round robin formats, among others. The second appendix contains outlines for clinics.

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<sup>2</sup>Actually, [these notes](#) about the job academic job market are pretty funny.

<sup>3</sup>Enter "test" without the quotes and hit the "Go to league!" button to play around with the interface

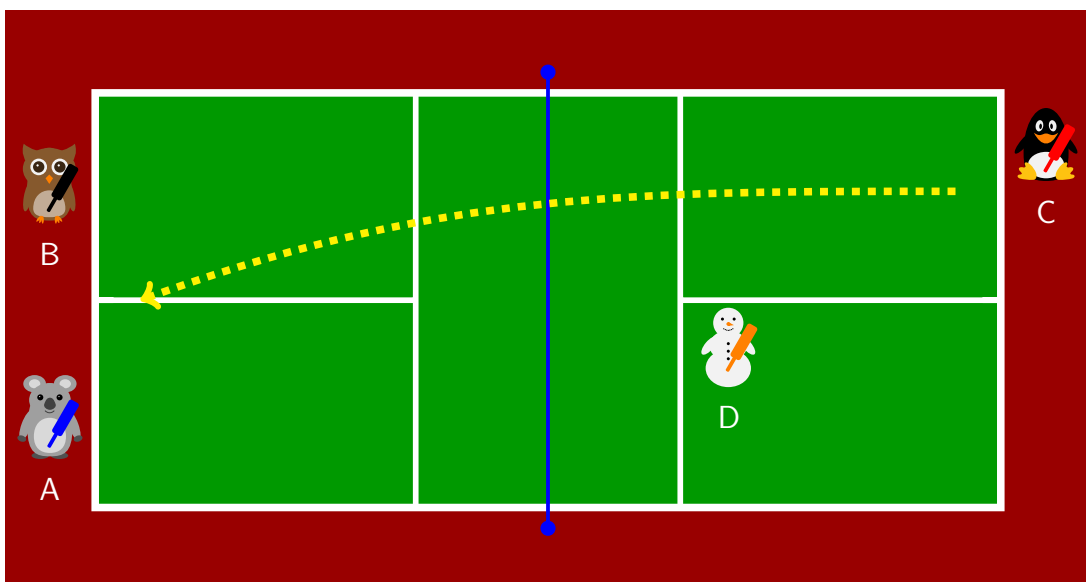
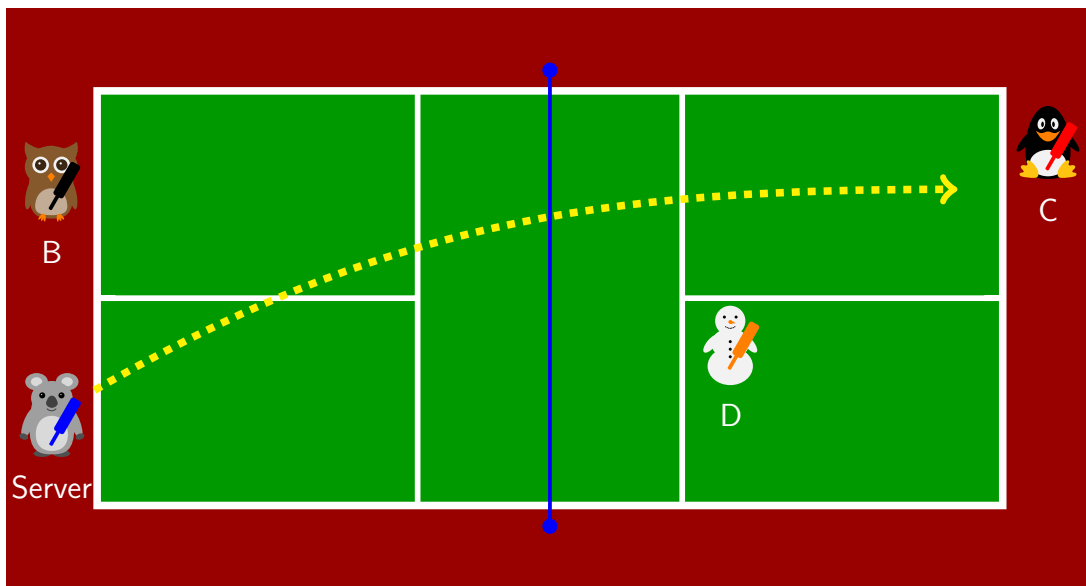
<sup>4</sup>pun very much intended

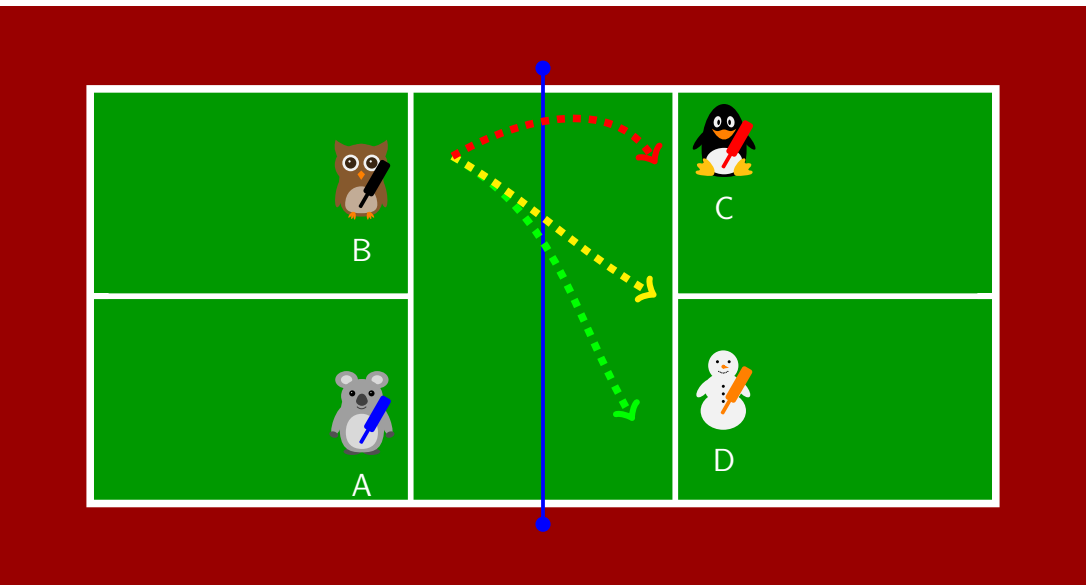
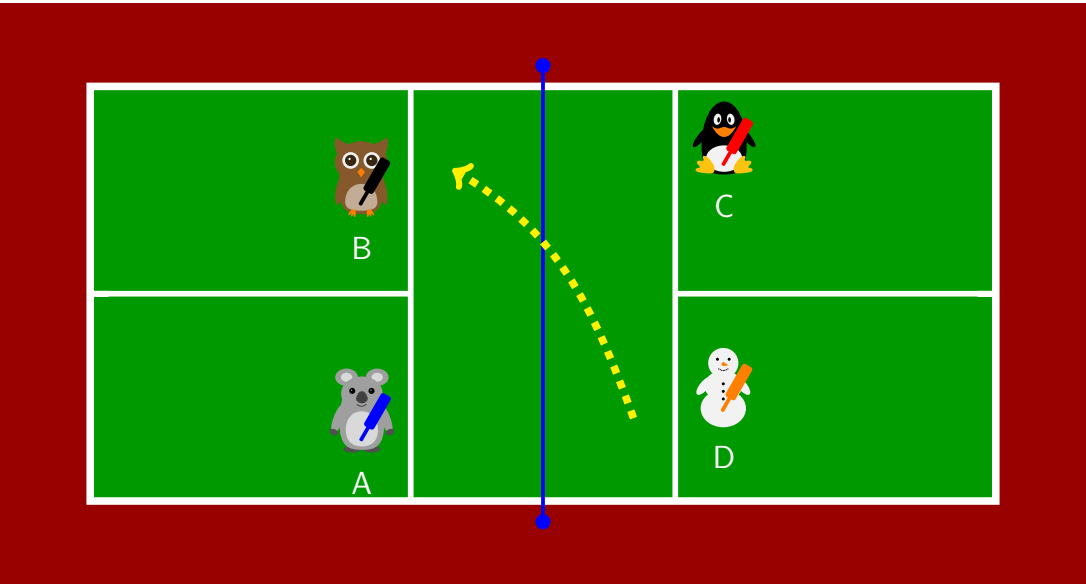
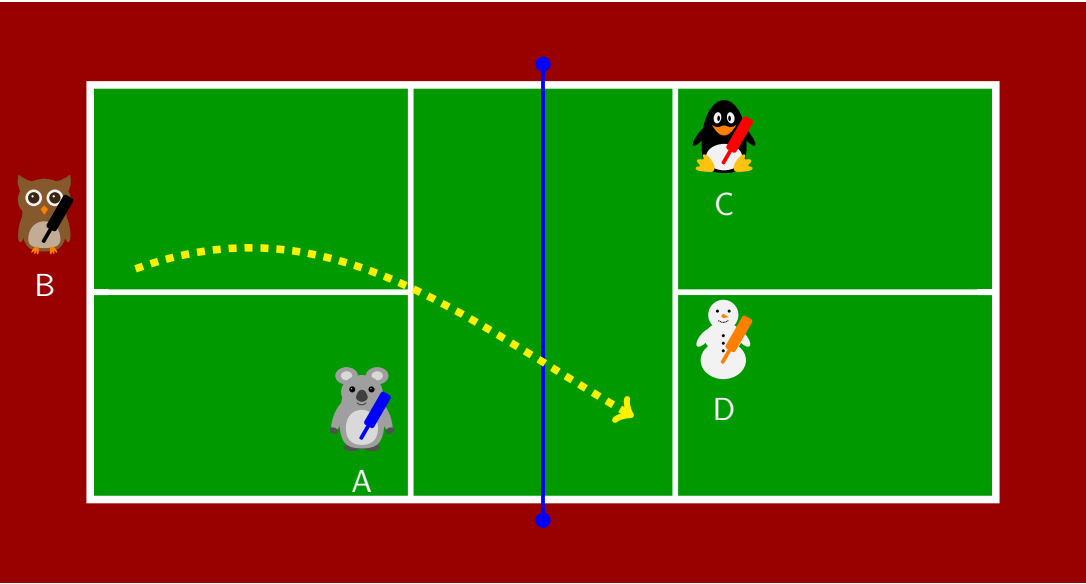
<sup>5</sup>or track me down in person

<sup>6</sup>Think about stoplights

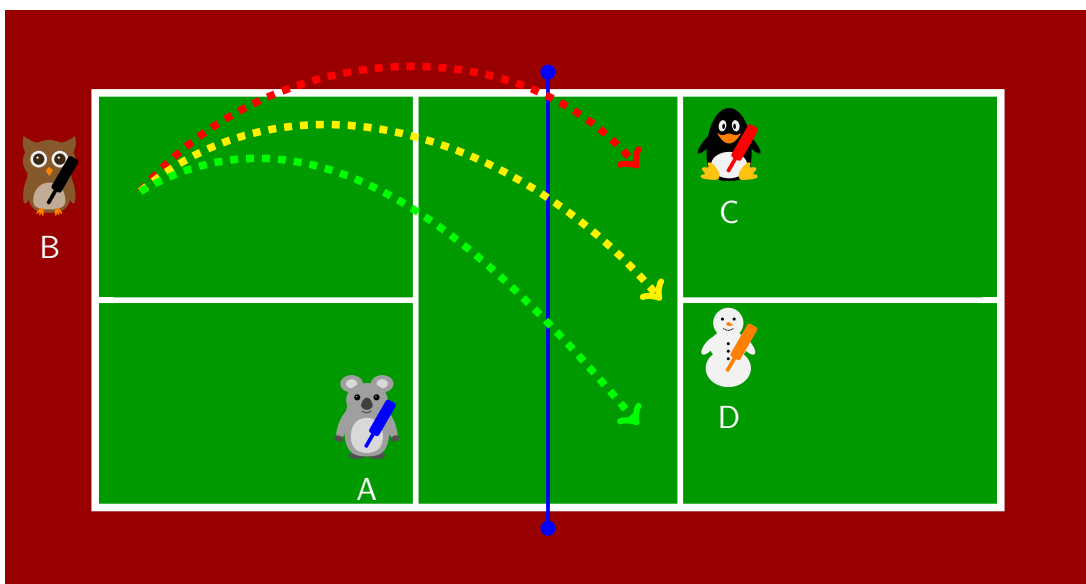
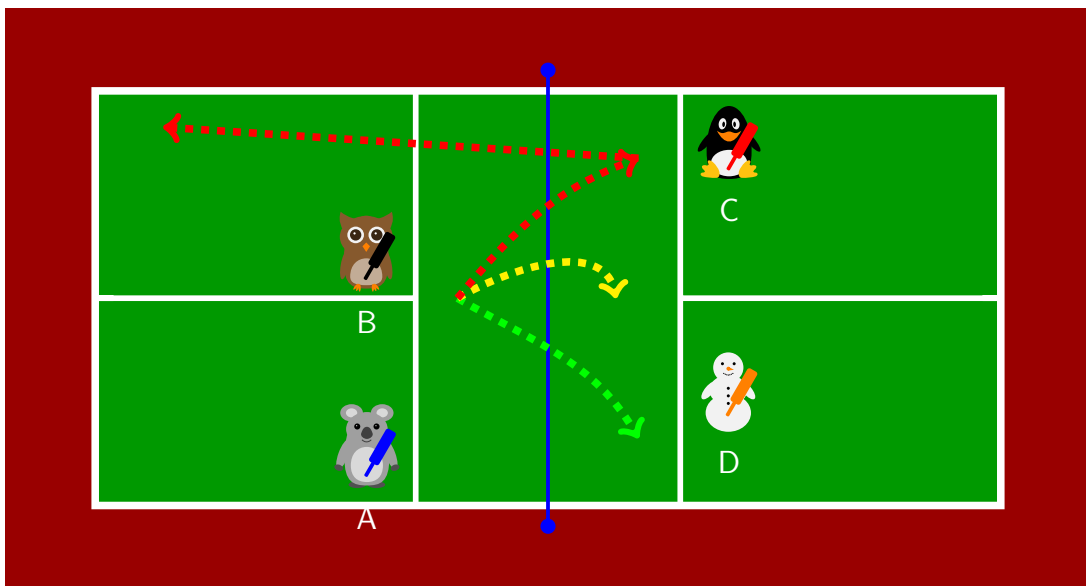
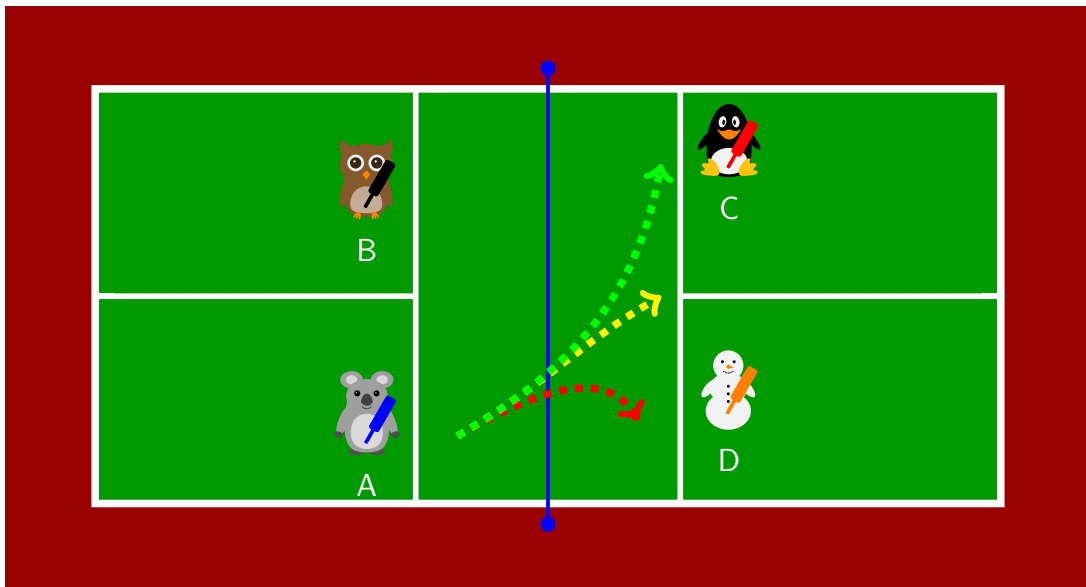
## 2 Basic Strategy

The standard game plan for most pickleball points is pretty simple: everyone wants to get to the kitchen! If one of your opponents isn't there yet, hit the ball at their feet until you win the point or they successfully arrive and the dinking portion of the point can begin in earnest. Hitting deeper returns up the middle is also usually a good idea since it forces your opponents to communicate, restricts their return angles, and makes it more difficult for you to miss the court. That said, a cross-court shot lets you hit over the lowest part of the net and provides some additional distance to get the ball down before your opponent can reach it. Once you are at the kitchen most of the action is lateral, as the cross courts shots are still safer and easier to control. There are more details and specifics in later sections but the initial set of diagrams on this page and the next walk through some of the default targets and positioning that start many competitive pickleball points.





### 3 Angle Selection



## 4 Kitchen Tactics

The previous discussion and diagrams are focused on how to set up a point and get to the kitchen but what is supposed to happen when you get there? This section talks about some of the main considerations and strategies for constructing points when all four players are at the kitchen. This article from PickleballKitchen: <https://pickleballkitchen.com/ultimate-guide-dinking-pickleball/> is also a relevant read (although their diagrams don't have cute animals attached!).

- **Basics** When you are starting out the goal is just to keep the ball in the court. Once you are doing that consistently, the next thing to focus on is placing the ball so that your opponents can't hit an aggressive shot. This is the other main point of dinking<sup>7</sup> and consists of several different components, including height and location. The first goal is to keep the ball too low to attack, both before and after it bounces. It isn't enough to just hit the ball softly, since if your opponents can reach out and volley your shots while the ball is above the level of the net you are still in trouble. Similarly, if the ball doesn't bounce above the level of the net it is hard for your opponents to both hit it hard and keep it in. Many of the topics below focus on selecting specific places to hit towards but general rules include things like hitting where your opponents aren't or trying to place the ball on their shoelaces.
  - **Shot Selection:** The first graphic in Section 2 highlights the three main types of dink we are considering: cross court, to the T, or up the line. The cross court option is the safest shot and is usually the default for extending the point. This target is the longest distance away from you, so it is easier to keep the ball in play and low. It is also easier to keep your opponents from volleying a return to this shot, since it shouldn't get near the player across from you and there is space to land it in front of your cross court opponent. Additionally, the fact that the ball travels farther means that you and your partner have additional time to recover and set yourselves up for the next shot. Hitting to the center of the court doesn't give you as much space as going all the way crosscourt but it does limit your opponents options for their return angles. Finally, the up the line dink is a more difficult shot, since you have much less space to get the ball down after getting it up over the net. It can also come back more rapidly and in general is more likely to be used as an aggressive rather than a passive shot.
  - **Footwork:** In addition to being mindful about where you hit the ball, it is important to keep track of where you are standing. After each shot, you should try to reset to a neutral position. To begin with this should be with your toes right up to the kitchen line, in the center of your half of the court. As you get more practice, you will want to also move side to side with your partner, sliding over to cover the middle if they are stretched out wide.
  - **Ending the point:** In a perfect world, you could simply keep dinking until your opponent makes an error. The best case would be for them to hit the ball out or into the net but sometimes your opponents decide not to cooperate fully ☹ Particularly as you play increasingly strong competition, errors will start to take the form of balls being left too high in the air rather than losing the point directly. Once you generate one of these shots, you have several options, including trying to smash a winner or resetting the point to continue dinking from a more advantageous position. Stronger players are also more likely to be able to return your smashes, so this decision isn't necessarily as straightforward as it initially appears...
- **Targeting Locations** Once you start to get a little more confident in consistently keeping the ball soft and low, a great next step is to focus on hitting towards specific places on the court, over and over again. A great way to practice this is to choose one of the approaches below for each point and try to hit every ball that you see to that spot before picking a new spot for the next point. This is also a good example of a level 0 strategy for match play if you get nervous in competitive points - just remind yourself at the beginning of every point that your plan is to hit everything e.g. cross court, to reduce the number of things you have to think about. As you get more comfortable playing points, you can start to expand your repertoire of shots and approaches, based on this initial foundation.
  - **Specific Spots:** To start with, just try selecting a spot on the other side of the court, like the T<sup>8</sup> or a spot one foot inside the left sideline and one foot inside the kitchen. Every time the ball comes to you during the point try to hit a good dink to that spot. This is a good example of a time when you might want to keep going back to the same soft shot even if you generate a weak shot from your opponents.

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<sup>7</sup>beyond keeping the point extended so your opponent gets another opportunity to make a mistake...

<sup>8</sup>where the center line intersects the kitchen line

- **Half Courts:** The next type of targeting is to pick one of the directions from the shot selection bullet above and consistently hit to that part of the court. Instead of trying to hit a specific location, the goal is to instead to explore the variety of shots that you can hit to a broader area of the court. For example, if you decide to dink up the line you can try to push the ball deeper and deeper to the space between your opponent and the outside of the court or mix it up by alternating between the backhand and forehand sides at the same depth inside the kitchen. If you are targeting the center you can either try to place the ball towards the same opponent every time or alternate between opponents. Cross court gives you more space to hit into and hence more variability in targets, so you can pick a quarter of the court to target instead.
- **Opponent Weaknesses:** A slightly more advanced strategy is to identify shots that your opponents struggle with<sup>9</sup> and try to feed them that shot consistently. A nice example of this approach is in this video of the semifinals of the Pandemic 2 tournament in Couer d’Alene: <https://www.youtube.com/watch?v=CVJvCaBDXCQ>. We had played the team earlier in the round robin and identified that one players backhand was much weaker than the other, so we went in with a plan to hit every possible shot to that side and eventually won.
- **Opponent Positioning:** Particularly when your opponents have mixed dominant hands, it can be useful to pick your spot based on the combination of shots that they will have available. The most natural example is when both players have their backhands in the middle, since that gives you a clear target where you opponents are likely to have weaker shots (this is exactly the situation that stacking is designed to prevent). However, you can also take this approach with same-handed teams that tend to favor one side or another, just make sure to talk to your partner about what you are doing before the point starts.
- **Maneuvering your opponents** Eventually, the goal will be to be able to use your dinks to move your opponents around the court and force them into awkward positioning so that you and your partner have clear angles on the court to hit winners through. A good general approach is that the more you can force your opponents to move the better, so hitting it where they aren’t can be a good way to set up a winner, since it is harder to hit the ball well when you are on the move.
  - **Cross Court** When you are hitting cross court, you have an opportunity to move the player you are hitting towards out wide, which can open up potential winning volleys for your partner. A common approach is to use a one-two punch, first hitting a short shot closer to the center to get them to move towards you and then a wider shot that forces them to retreat. When they are forced to retreat, their partner will need to move towards the center to cover the middle. If they don’t move, this gives your partner the opportunity to hit a winner through the center of the court. If they do move, the line in front of you is uncovered, which provides an opportunity to push them out of position as well.
  - **Down The line** When dinking down the line it is usually easiest to try to force your opponent back off of the kitchen line, rather than trying to move them out wide. The key is varying the depth, bringing them in and out until you can target their feet with a shot. As with the cross court play, you can also keep an eye on their partner - if they close too far towards the middle, a wide cross court shot will be difficult for them to cover.
  - **T** Targeting the center is a little different than the other two options, since both of your opponents are likely to be involved in the point, rather than hitting at one to move the other out of position. Here, the goal is to force them both towards the middle to open up winners out wide. The set up depends on how well your opponents communicate. If they are each trying to hit middle shots on their side you’ll usually have the best opportunity to hit a winner in the direction that you are moving<sup>10</sup>. On the other hand, if one player assumes responsibility for forehands across the center this provides you with an opportunity to attack that player’s backhand side if they hit cross court or to hit between the two players if they come back up the line.
- **Wrapping up:** This is just a brief summary of some ways to think about kitchen points and hopefully highlights why there can be so much depth and complexity to this part of a pickleball point. In particular, while it is possible to head into each point with a plan based on the approaches above, in real matches, your opponents will be trying to do the same things to you and our shots obviously don’t always go where we intend. This is all part of what makes pickleball so fun!

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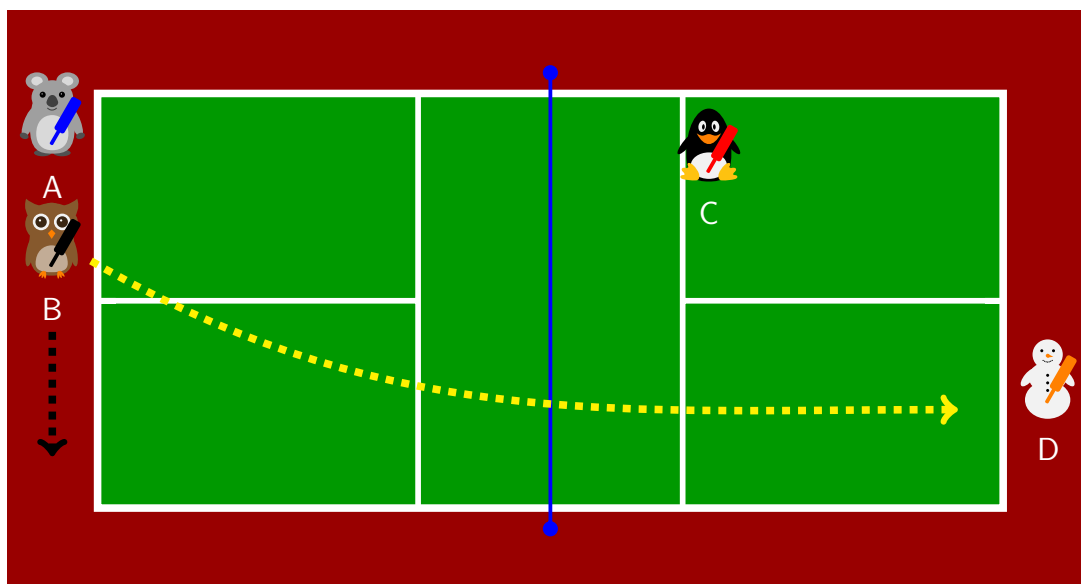
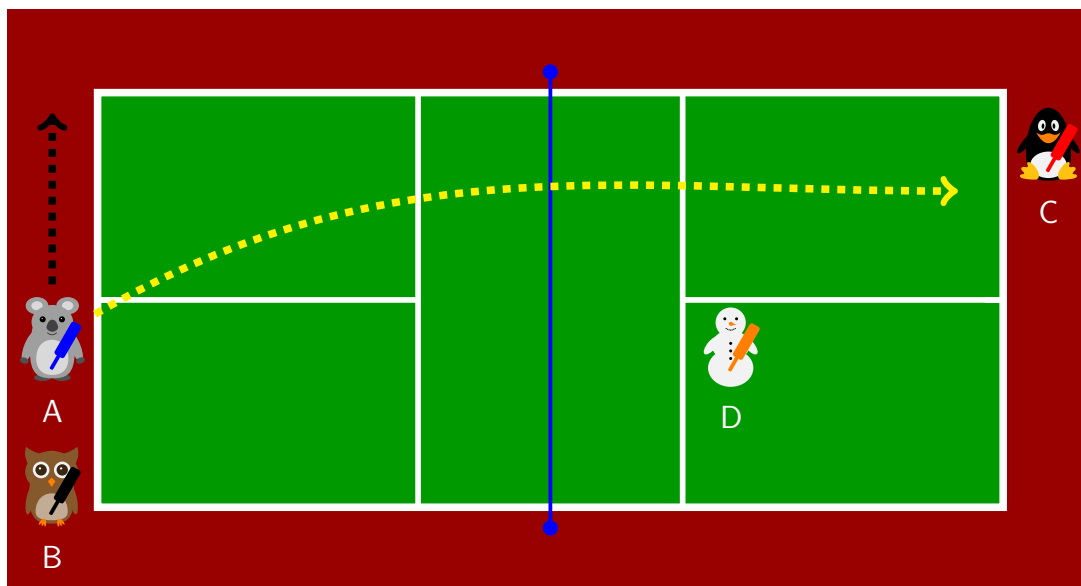
<sup>9</sup>For example, noticing that Player A has trouble hitting low backhands.

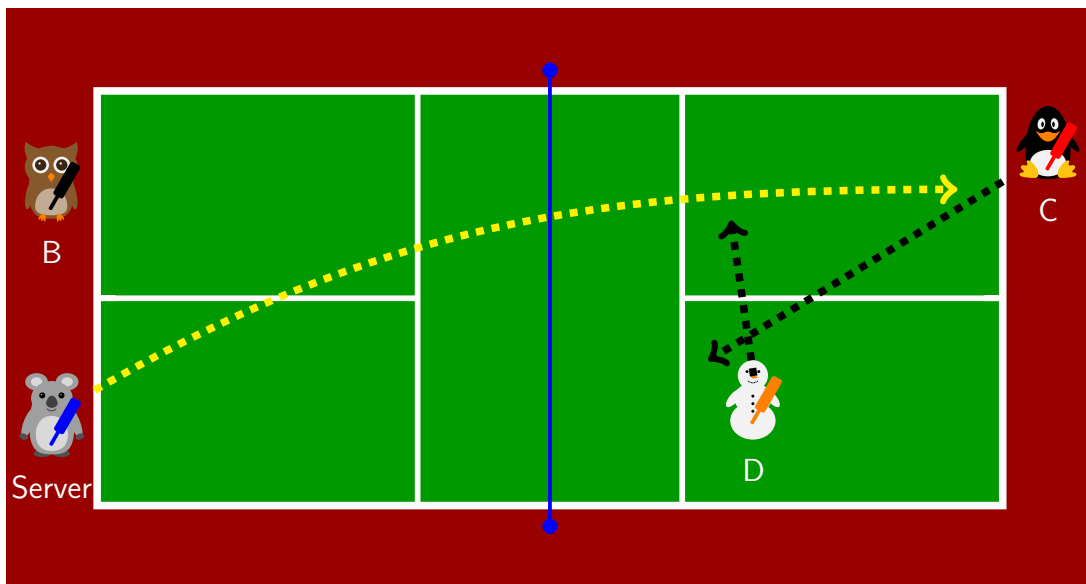
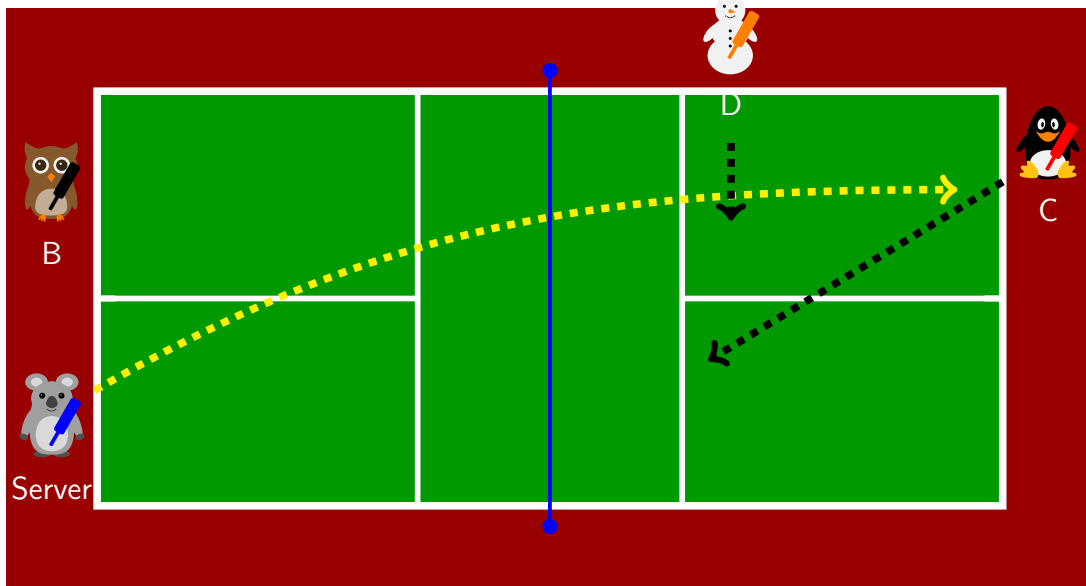
<sup>10</sup>Or for them to eventually make a mistake, with both players assuming that the other will get it! particularly if you hit the ball a little higher.

## 5 Stacking

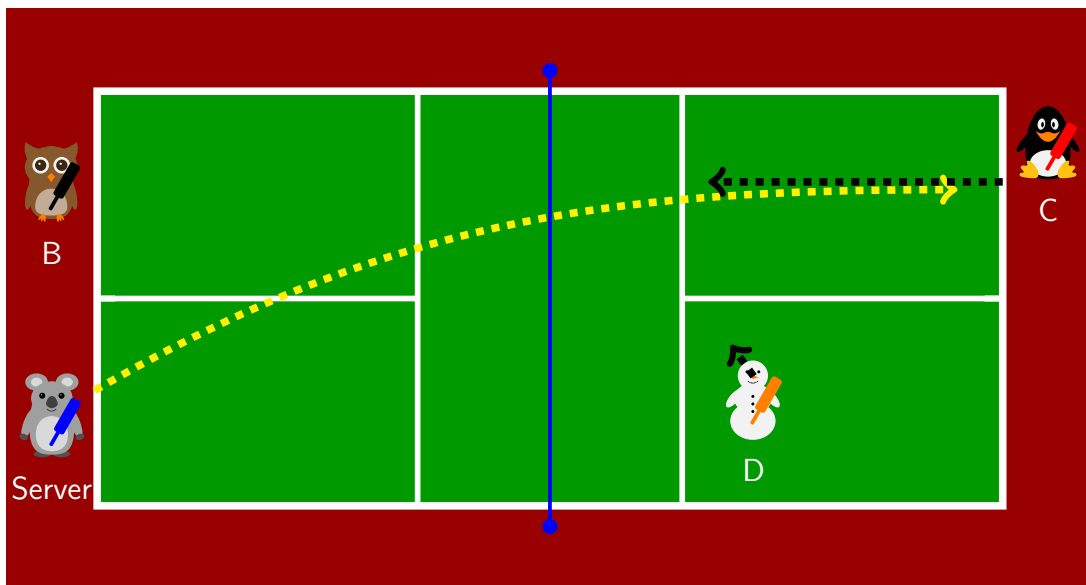
The usual purpose of stacking is to place the stronger player's forehand in the center in order to make poaching more efficient and to allow that player to cover a larger proportion of the balls. It is also useful for partnerships with mixed hands so that both forehands can be in the center on every point. In the diagrams below players A and C are right handed and B and D are left handed. The standard way to setup places the left-handed player in the right court initially (i.e. Lefties serve first). Thus, there is only a need to stack on odd-numbered points.

While serving, stacking simply consists of having both players line up on the same half of the baseline with the server stationed towards the center and responsible for covering the (initially) empty side of the court. On the return, the player who isn't receiving has two choices. One option is to line up outside the court next to the active service box. In this case, after the return both players simply slide into their normal positions. The alternative is to line up in the standard position and then use hand signals to communicate whether the players will switch places or remain after the return. Diagrams of these options are presented below.





or<sup>11</sup>



<sup>11</sup>depending on hand signal

## 6 Personal Pickleball Philosophy Preferences

Like most racquet and paddle sports, outside of the very top of the professional levels more pickleball points end on errors than winners. As a convert from tennis, I tend to analyze pickleball relative to the baseline it provides.<sup>12</sup> It wasn't until Roger Federer started demolishing people<sup>13</sup> that it was common for anyone even on the pro tennis tour to finish a match or a tournament with fewer errors than winners and it is still far from the default. I didn't bother to look up recent stats for this but last time I was paying attention the averages were something like 20ish percent more errors than winners for pros and mentally translating that stat down the ladder to your local courts suggests that focusing on consistency rather than trying to blast the ball past people will lead to more wins.

That said, in tennis it is possible to overpower people, and even at the professional level, there is always someone who hits harder with more spin than you can. Pickleball on the other hand is a game of consistency. At high levels, you can enter every point with a plan to wait out the other team by hitting the ball as softly and in-control as possible until they make a mistake (it turns out that there is a pretty hard limit to how hard you can whack a whiffleball). Instead of trying to overpower people the goal is to instead outlast. This is such a different viewpoint on what it means to 'win' that it usually takes converted players from other games a significant amount of time to adjust (badminton, which has a similar playstyle at some levels is sometimes an exception), if they ever do.

Each point of both pickleball and tennis begins with a crosscourt serve into a 'service box' (although the tennis box is the front (near the net) half of the court and the pickleball box is the rear). Tennis serves are aggressive overhead spikes that are frequently loaded with spin and attempt to win the point outright (and indeed, tennis matches and scoring as a whole are centered around the advantage possessed by the server). Pickleball serves, on the other hand, are required to be hit underhand, below the waist, with the wrist above the paddle. This means that instead of trying to win the point immediately, the goal is to simply begin the exchange. Because aces are so rare in high level competition (as well as the bouncing rules discussed below) the serve is frequently the least impactful shot of the initial exchange.

The service return admits a similar comparison. In tennis, the pace and spin of the serve set you up to take a similarly aggressive whack to attempt to regain control of the point and neutralize the server's advantage. For pickleball players, the goal of the initial stage of the point is to establish physical positions near the 'kitchen' (a seven foot zone extending outwards from the net where players are not allowed to volley) line. The returner's partner will already be standing at the line but because the service box runs to the end of the court the returner needs to cover approximately thirty seven feet to be in position for the next shot. One of the biggest mistakes that beginning players make is to try to hit the return hard in an attempt to force an error but as pointed out previously, you just can't make a whiffleball go that fast and so all you are doing is robbing yourself of time to make the 15' sprint (the faster you hit it, the faster it comes back...). Instead, what you usually want out of a return is a fairly slow ball (but perhaps with plenty of spin) that lands deep in the court and gives you plenty of time to get to your position without needing to dash to the line.

The return strategy is supported by another pickleball rule, that the return of serve must bounce on the server's side of the net before it can be played. This rules out the type of serve and volley approach that would otherwise dominate the game because both players on the server's side are forced to wait at the baseline for the return before approaching the net. This is also the reason for wanting a deep return above, as a short return allows the serving side to come forwards more easily, which is exactly what you want to prevent. Instead, the serving team should be forced into the position of both standing at the baseline, looking at their opponents who are standing at the kitchen, when preparing for the ultra-important third shot.

The third shot is really what separates strong pickleball players from intermediates. From 22' away you need to be able to lightly drop the ball over the net and into the kitchen, in such a way that your opponents are not able to reach out and volley the ball. As with the return, the goal is to get to the kitchen line but with your opponents already there, it requires significantly more control and dexterity to land a shot that you can follow in, as the other side no longer has to wait for the ball to bounce. A successful third shot is a work of art, floating enough to allow both you and your partner to follow it for the 15' to the kitchen, while not bouncing high enough to allow your opponents to return it aggressively.

Upon the successful completion of the third shot, the point has now entered the mid-game of soft net play, where tactics and footwork become the key virtues. From my perspective this is the best part of a pickleball point! I frequently recommend to players at all levels to enter each point with a plan to work at this stage of the game - this is a great way to accomplish your goals and improve your skills, no matter the level of your competition.

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<sup>12</sup>still no apologies for the pun.

<sup>13</sup>Ok, increases in racquet technology probably helped too.

## 7 Gameplay Commentary

As an example of the concepts above, I'm going to provide some analysis of some specific points from a 4.5 tournament match from several years ago. The videos of the individual points can be downloaded here: <https://www.dropbox.com/s/4yqqtr8etazhr6y/PBvids.zip?dl=0>. Besides me, the other players are my partner Owen, and our opponents Matt (white hat) and Art (no sleeves), who are all excellent players and delightful people. This was just after I had started playing seriously but the three of them played together a lot and were very familiar with each other's playstyles. You can watch the full match here: <https://www.youtube.com/watch?v=a8Kv1rnEt9k>

Here are some things to look for in all of the points below:

- **Angle Selection:** There are a lot of good examples in these points of the difference between cross court and down the line dinking. Cross court shots are generally safer and more defensive, since there is more space to hit the ball into and the extra time it takes to get there means that you (and your partner) have more time to reset your footwork and positioning. Up the line shots are more difficult, since you have to get the ball up and down in a smaller amount of space and your opponent gets to hit the ball back to you more rapidly.
- **Daryl's Defaults:** My main goal for a lot of these points was just to keep hitting consistent cross court (backhand) dinks. I was the weakest player on the court and so just wanted to keep the ball safely in play and allow the points to develop.
- **Stacking Setup:** Owen is left handed, so we stacked both serving and receiving to place both of our forehands in the center (and to support my desire to hit cross court dinks). Art and Matt are both right handed and only stacked on the serve, using hand signals on the return side. One thing to keep an eye out for is who chose to hit third shots when the ball was close to the middle. Matt had the forehand on their side, so their default was to allow him to take the shot, even on balls that were a fair distance onto the other side of the court. Owen and I both had forehands, so decided shot by shot.
- **Two on One:** Our main strategy was to set up points where we could play aggressively two on one against the player directly opposite Owen. If you look at our default positioning my right foot is right up against the centerline, while Owen stands in the center of his box and is constantly looking to hop over the sideline for an Erne.
- **Communication:** The audio isn't great for these clips, so it doesn't really capture the fact that each team is constantly checking in with each other both between and during the points. On a couple of these points I hit an aggressive third shot, instead of a more normal third shot drop. In each case, Owen and I decided on this before the serve and once the return was on the way, I confirmed that I was going to hit a hard shot so he could prepare for their return. In general, the more you can do to let your partner know what you are attempting the better. Even something as simple as announcing which side of the court you are targeting with your third shot can help you stay on the same page.
- **Approach Timing:** Owen and I trusted each other to hit good third shots, so once one player committed to hitting the shot, the other would rush up to the line to get ready to attack any weak shot forced by the third. Matt and Art prefer to move together, waiting until they see a good shot to approach. This keeps them in a couple of points where otherwise a weak third shot would have given us an angle to hit a clean winner (cf. 14).

Here are the breakdowns and key features of some of the individual points:

- **Point 1:** This was a great first point for the match. Art hits a great third shot to Owen's backhand and then some excellent dinking gets underway. About halfway through the point I manage to force Matt back off the kitchen line and get to hit a forehand at his feet to try and keep him back to press the advantage but he hits a great shot up the line and immediately closes up to reset back in place. The point ends when Matt goes for a very aggressive shot on his backhand (a surprise, given the previous shots in the rally) aimed right at Owen's right shoulder, where it was too awkward to handle. Great way to mix up the pace!
- **Point 2:** After a false start with a ball on court, Matt makes a nice fifth shot to my backhand to approach. Note that I was crowding the middle which opened up his shot because the third went to Owen and we were trying to put pressure on that side of the court. This time, the aggressive shot went to Owen's forehand and they weren't able to handle the return pace.

- **Point 3:** Owen provides a nice example of pressuring an opponent up the line here. After Art handles the first couple of shots by getting the ball back outside to Owen's backhand, Owen resets with a cross court shot to prevent him from taking advantage of the positioning. The final shot clipped the net but probably would have won the point anyway.
- **Point 5:** To begin with, this is just a fun point overall! This is also the point where the audio would help a lot to explain our positioning since Owen and I were talking (shouting) after every shot. Since our opponents were only stacking on their serves, we decided to attack the center when we were serving when they were on an odd score and you can see that almost every (non-between the legs...) shot goes to the T. The final shot is a great poach and a big part of the reason for stacking with both forehands in the middle.
- **Point 6:** Although this point didn't count because of the ball behind the court, it is another good example of attacking the middle since they weren't stacking on this side and setting up a two on one point.
- **Point 8:** This was my favorite point of the match at the time. Matt hits a nice approach on the fifth shot after Owen keeps him pinned back with a deep fourth. Once we settled into the cross court backhand dinking, I was in my element and completely content to keep going until he made a mistake.
- **Point 10:** On this next point, I do go for a deeper, more aggressive fourth shot but Matt handles it nicely. He also uses his forward momentum from that shot to drive through the winner. Neither Owen and I were ready at all for him to hit an aggressive backhand volley, just like the first point, this was another great example of mixing up the pace. We assumed that he would hit a soft backhand to set up some net play rather than immediately going for the winner.
- **Point 11:** This point is all about positioning (and a really awkward fourth shot from me). Matt and Art move together really well as a team, so it isn't enough to try and get them out of position on a single shot. Starting at 10 seconds in the clip, Owen gets a deep shot to Art's forehand and Matt slides to the center to cover. This gives me space to force Matt off the court to his backhand which forces Art to cover the T. At 16 seconds, you can see that Art is fully committed to the center with his feet and shoulders rotated towards Matt's side of the court. Owen recognizes this and hits another shot out wide and it takes Art another couple of extra steps to get in position which causes the error. Something else that is interesting to notice about this point is that both times our opponents were in trouble they went up the line instead of cross court, which gave us the opportunity to press the advantage, since the ball came over more rapidly.
- **Point 12:** Another positioning example. This point starts with a great serve by Art. Since we are stacking on the return it puts us in an awkward position of trying to get out of each other's way. Once again, the two on one play against Matt brings Art across the T to cover the middle and Owen is able to get the ball past him out wide. This time it didn't lead to an immediate error but rather a weak shot that we were able to play aggressively.
- **Point 13:** Art takes the momentum with a great third shot and Matt hops outside immediately to keep the pressure on Owen. Owen's lob is actually a nice option here but Matt makes a great play, moving from outside the lines to hop up and smash it.
- **Point 14:** Matt and Art display really nice patience here after we get an overhead off of a weak third shot. Once we are all at the kitchen everyone is still hitting pretty aggressively (we haven't settled down from the smashing part of the point). The final shot is an ugly slap shot that hits Matt's left shoulder (he deserved it for point 1), although I was actually trying to aim up the middle. Just like the earlier points, everyone was expecting a soft dink (particularly after the ball bounced) so changing the pace a little worked out.
- **Point 15:** Two points this time, since they fit together really nicely. For the first point, since Owen was already at the kitchen line when Matt went to hit the fourth shot, he was already looking to poach while Matt was still looking at the ball. When Matt's ball floated close to the middle, it was all over. On the very next point, Owen is looking to poach again but this time Matt recognizes the setup and hits a great shot out wide to keep it out of his reach.
- **Point 16:** This final example highlights several of the key features of the whole match. Matt and I end up in an intense cross court point with me trying to slide to the center and push him further back into a two on one situation. Eventually Matt hits a great backhand volley up the line and Owen hits a shot that just misses being a clear winner by inches.

## 8 Sample Drills

It sounds silly to type out loud but the best way to get better at pickleball is intentional practice, as in the famous Vince Lombardi quote: “Practice does not make perfect. Only perfect practice makes perfect.” Most of the points that you experience during recreational play (and many of the shots that you hit during those points) aren’t ones that are helping you develop your game. At the same time, one of the common sources of inefficiency in ‘practicing’ is reinforcing shots that you are unlikely to want to repeat in a real match. As a simple example, a common warmup/drill situation is to practice third shots by standing on the baseline and having a partner return the balls from the kitchen back to you. While getting a sense for the shot and building some muscle memory can be valuable, rarely in a match do you want to stand flat-footed on the baseline and stay there after hitting a third shot drop. Instead, the entire point is to use the extra time provided by the soft shot to get up to the kitchen line without your opponents being able to attack your feet. This is a good reminder that practice can be more useful if you are thinking about how you are actually likely to use each shot in practice.

I try to keep this idea in mind while designing and working through drills by focusing on situations that arise in competitive play<sup>14</sup>. A regular drilling session usually starts with warming up each of the four basic dink positions (forehand/backhand and crosscourt/down the line) before moving on to the same four configurations for deeper drop shots and approaches, focusing on consistent footwork and placement. Focusing on footwork also includes practicing where you should be going next after you hit each shot. Returning to the third shot example above, you might think about making sure you are stepping towards where you want to end up along the kitchen line after each practice shot or even just energetically preparing for the next one.

One way to help provide some intentional depth even these simple warmups is to alternate aggressive vs. defensive roles with your hitting partner, with the aggressive player trying to proactively move their opponent around or force them off the kitchen line, while the defensive player tries to reset the pace, keep the ball centered to avoid giving up attackable angles, and play balls close to the net. The defensive player should also feel free to ‘bail out’ of a rally by attempting to hit a very safe shot to the opposite court (that would be covered by their opponents partner), if they feel like they are being overwhelmed. Learning to recognize when you are performing these roles in competitive points and proactively deciding how to transition between these approaches can be a real ‘level up’ in your pickleball development.

For example, if the players are dinking cross court on the backhand side the aggressive player might be trying to push their opponent out wide while moving their position closer and closer to the center line on each shot, attempting to set up a comfortable winning volley up the middle. In response, the defensive player may be trying to hit a tight angle close to the net to force the aggressive player back<sup>15</sup> or might instead try to cut the ball up the line in order to get some breathing room and try to re-establish their position. On the other hand, the aggressive player might try to alternate<sup>16</sup> between balls to the sideline and balls up the middle in an attempt to push the defensive player away from the kitchen, hitting more volleys than they normally would, while the defensive player might hit shots from the middle towards the sideline, instead of trying to mirror the shots they are receiving.

After the standard start, it is frequently nice to spend a little bit of time hitting some serves and returns, pepper volleys, and speed up / resets. The last one is usually played down the line with one partner alternating<sup>17</sup> dinks with drives and the other partner attempting to reset everything. Once all the main areas have been covered it is time to work on some specific shots or tactical situations. Some examples are presented in the pages below but there are lot of potential variants depending on what you are specifically trying to improve.

Trying out these kinds of variants can also be very useful in helping develop court awareness and individual tactics. Something concrete that you can take away from these types of exercises to recreational play is the idea of having a plan for each point. Just taking a couple of seconds before the serve and deciding “when we start dinking I’m going to try to hit every third ball a little deeper in the center of the court”<sup>18</sup> can help provide some extra focus and reinforce the ideas you’ve been drilling. This can also be a really valuable technique if your rec play often features very heterogeneous skill levels. Whether you are dominating everyone or getting clobbered, you can always try to plan and focus on a single shot, position, piece of footwork, etc. per point to try and stay engaged, even if the level of competition isn’t a perfect match for you.

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<sup>14</sup>Self-indulgently, I’ll mention that one of my pet peeves is constraints in drills that focus on overly-specific placement rules (e.g. ball must land in the kitchen) rather than whether or not you’ve hit a good shot for the situation you are experiencing.

<sup>15</sup>at which point in a real match the roles might swap...

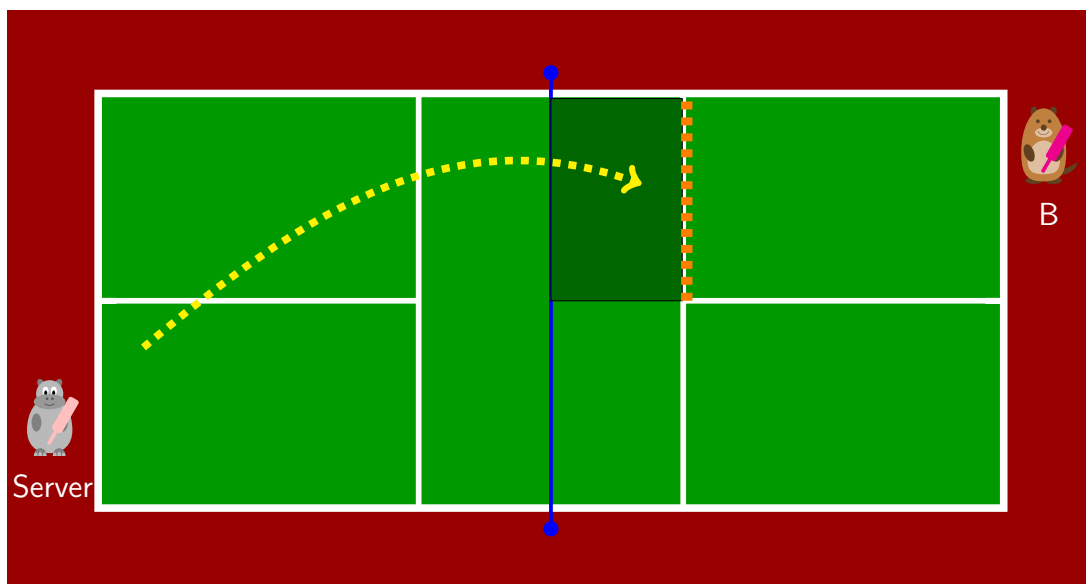
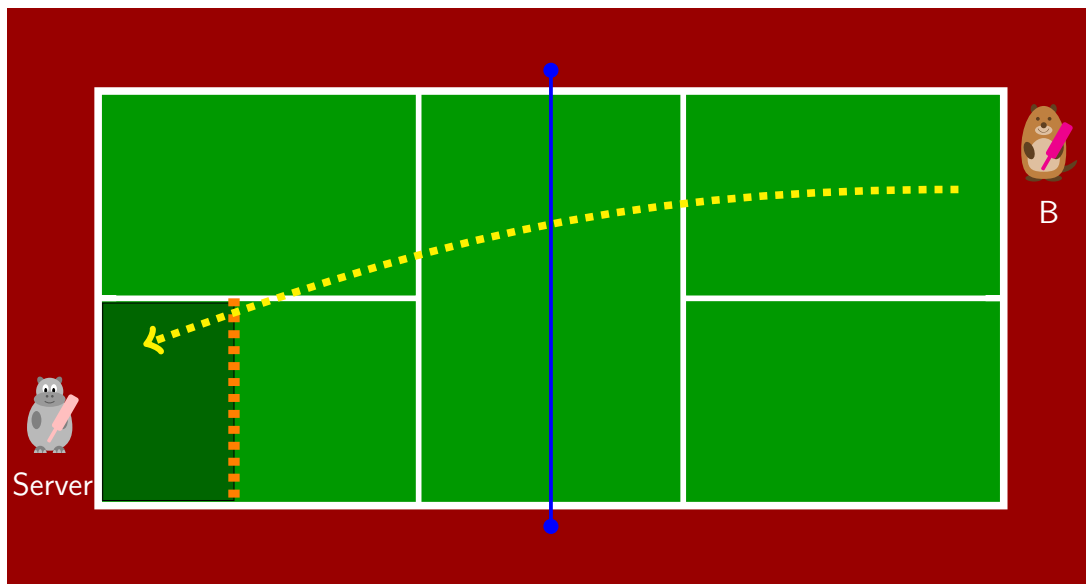
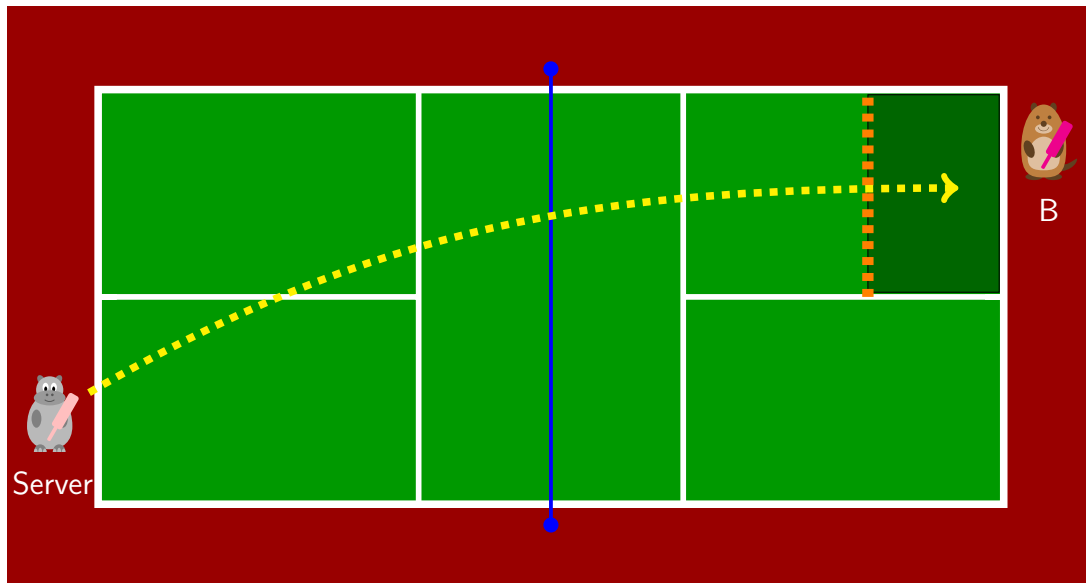
<sup>16</sup>Maybe by setting up a pattern like 2 wide 1 middle 2 wide 1 middle...

<sup>17</sup>Not necessarily every other ball, but also not attempting to drive every single shot

<sup>18</sup>or whatever

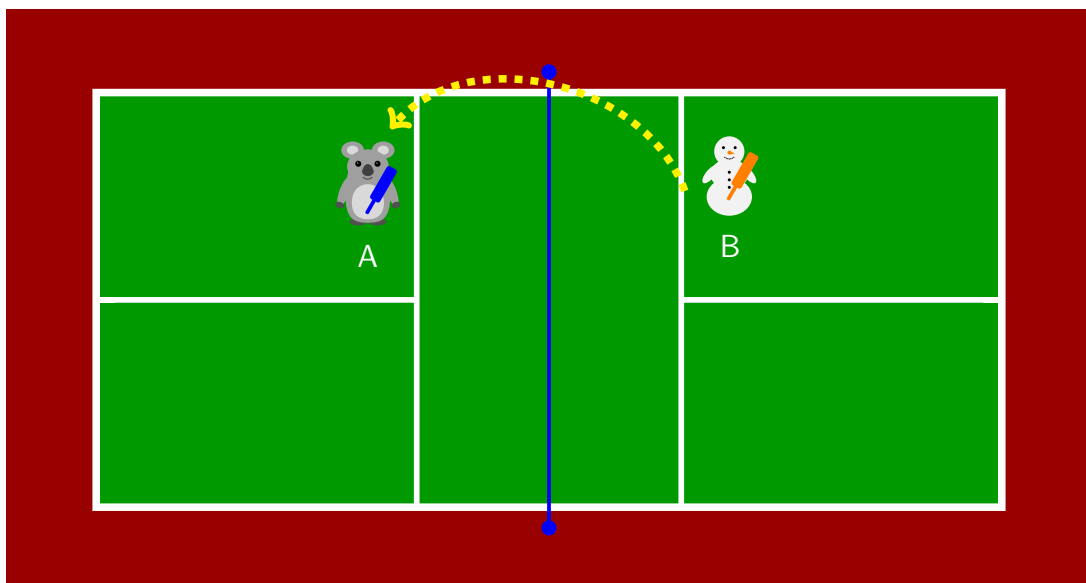
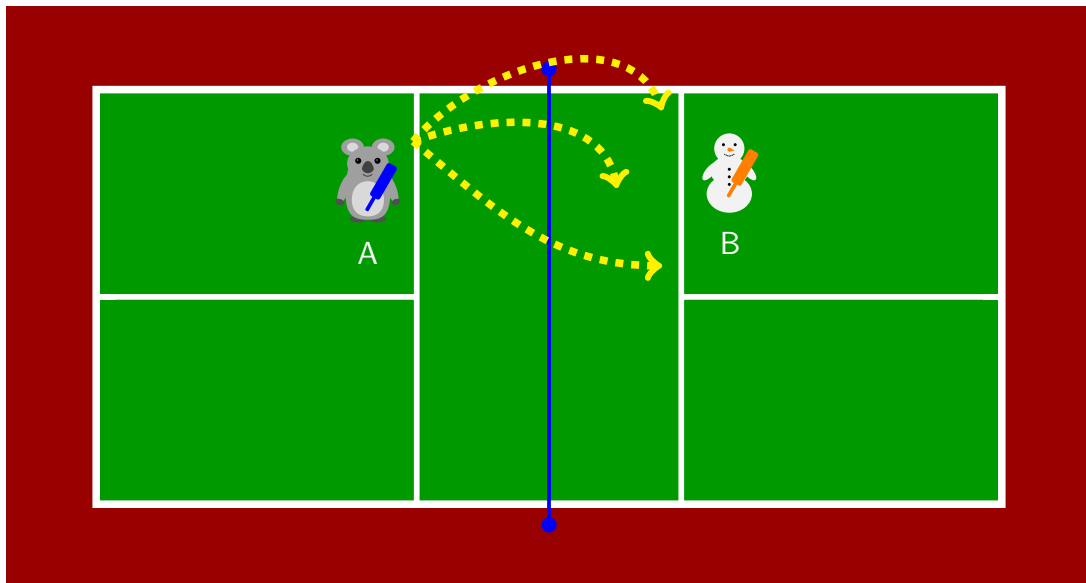
## 8.1 Drill 1: First Three Shots

**Variants:** Switch servers and sides, target different drop locations, follow in return

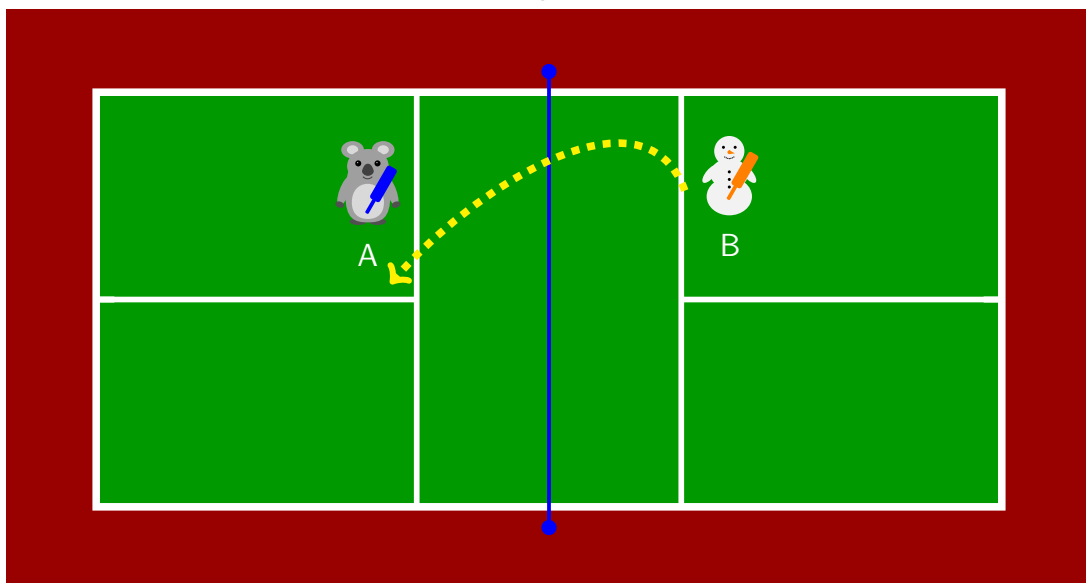


## 8.2 Drill 2: Working the Dink

**Variants:** Down the line vs. crosscourt, player B focuses inside or outside, vary depth of triangle

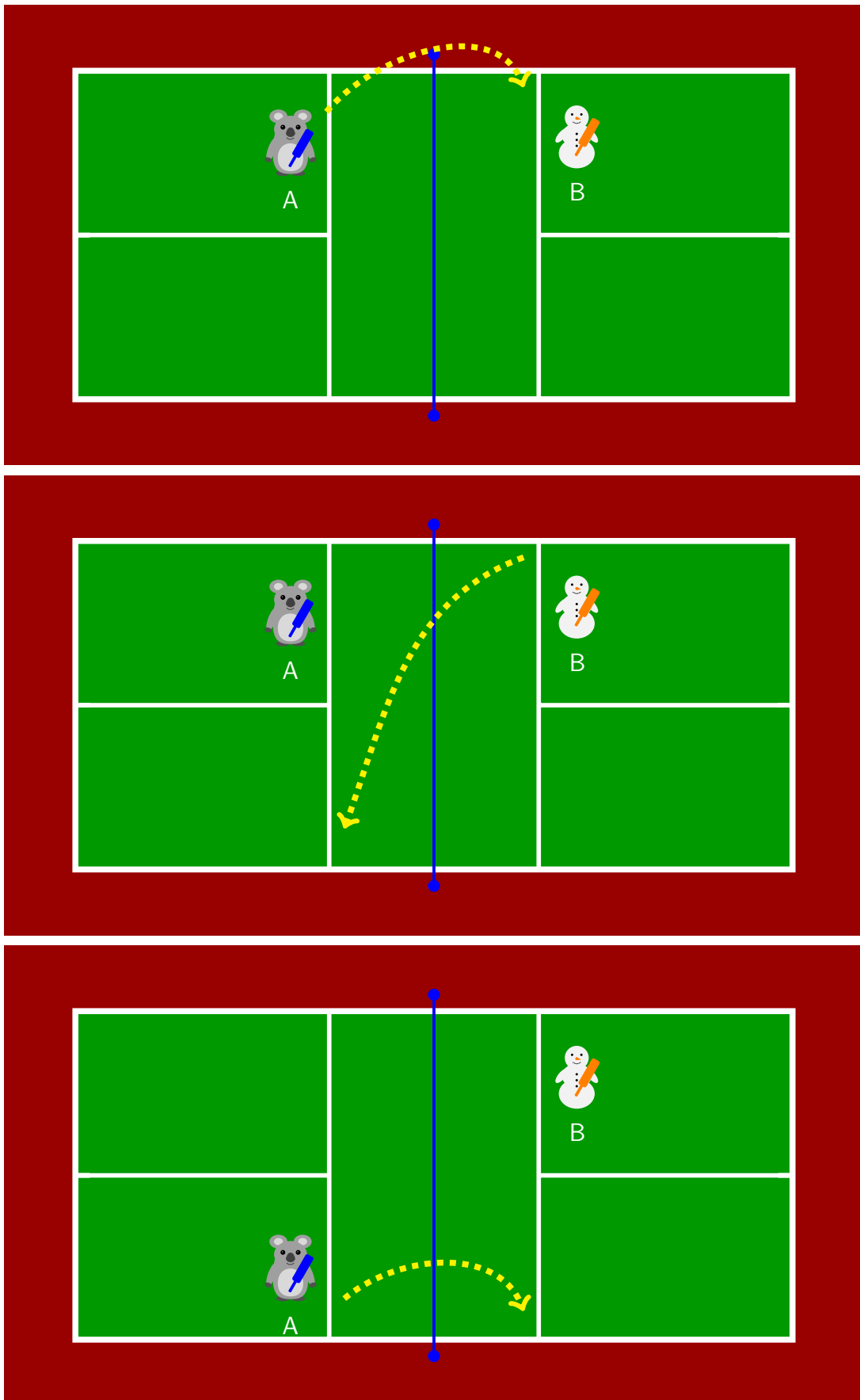


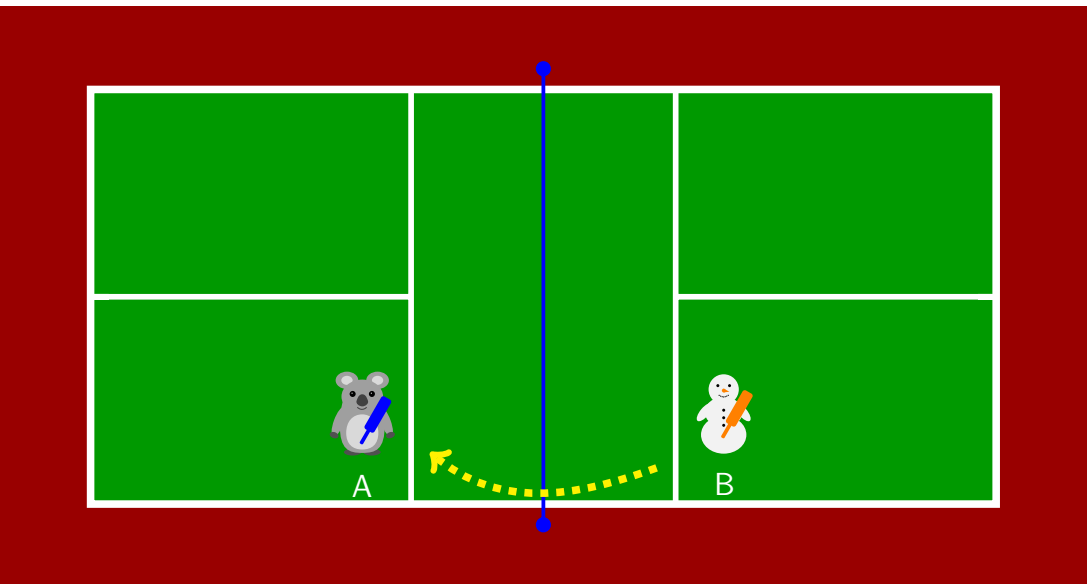
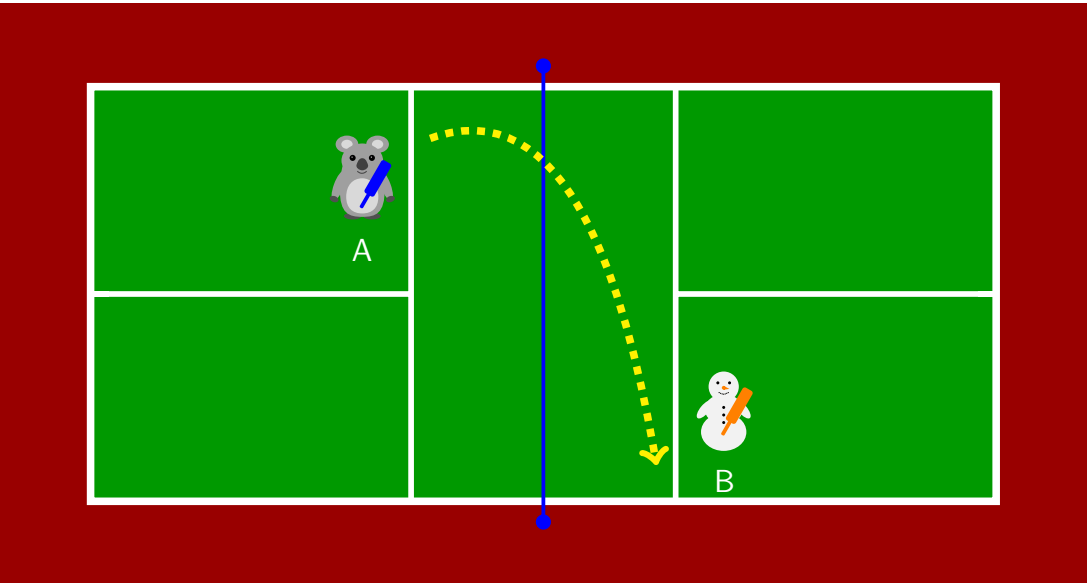
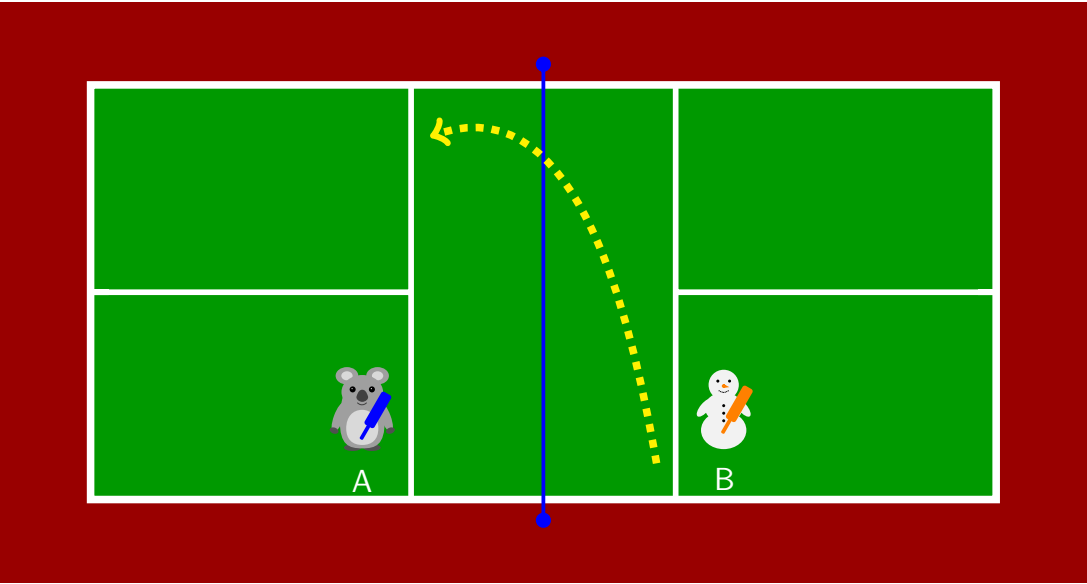
or



### 8.3 Drill 3: Running the Kitchen

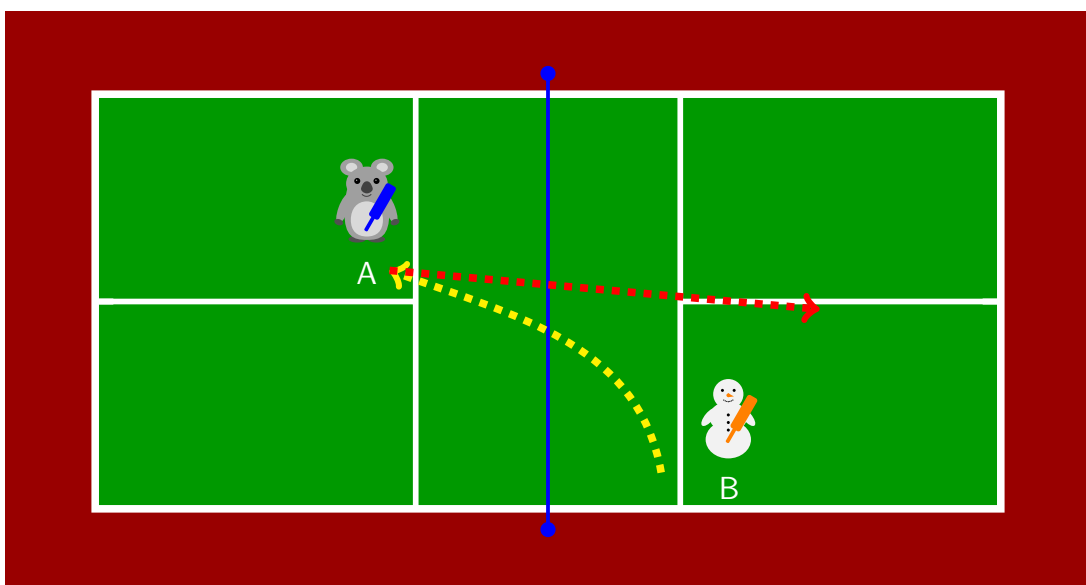
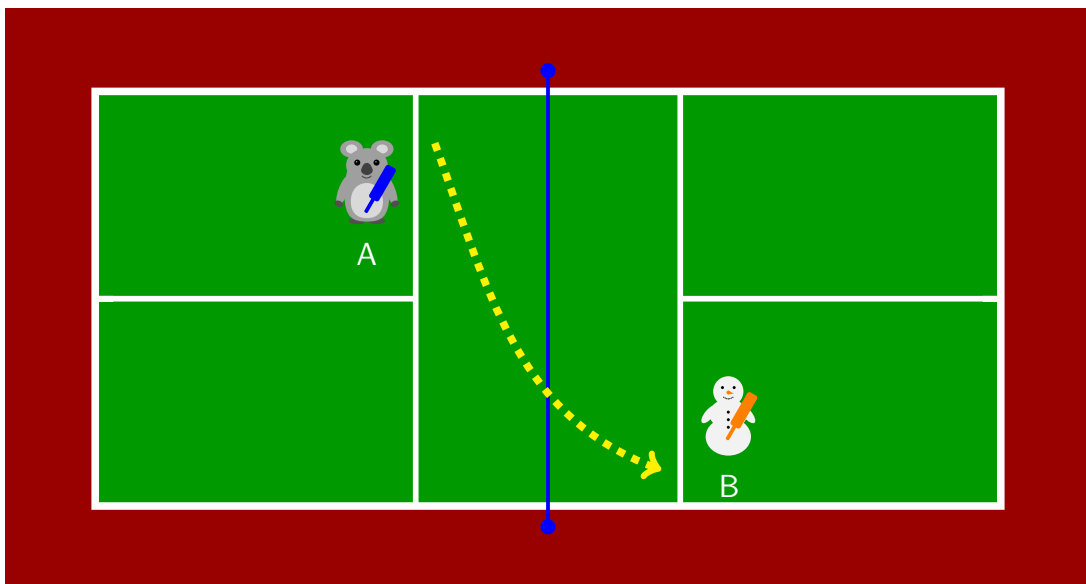
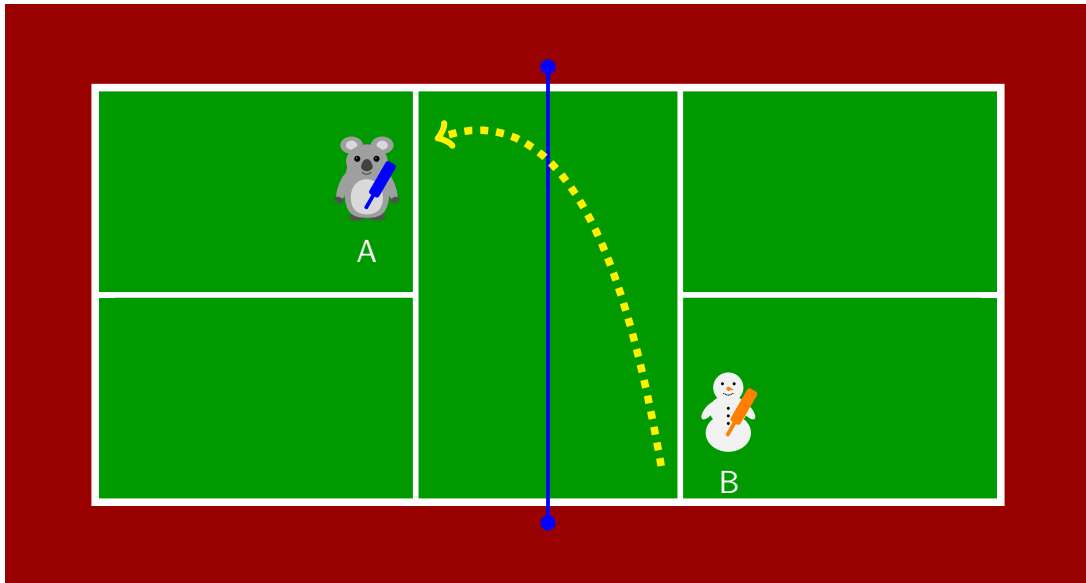
**Variants:** Switch aggressive vs. defensive roles, two (or more) shots per position, add center target on both sides





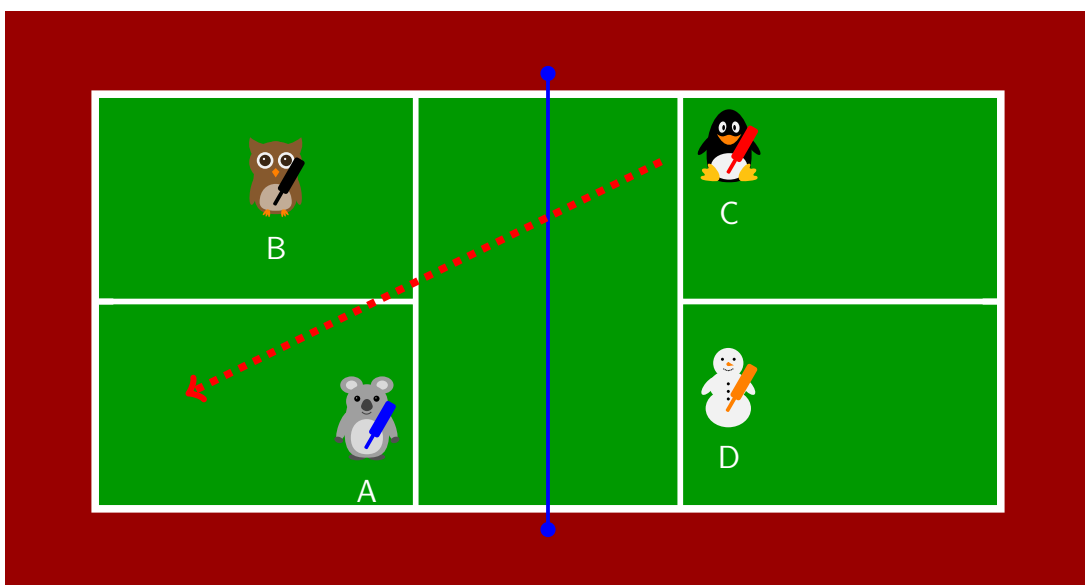
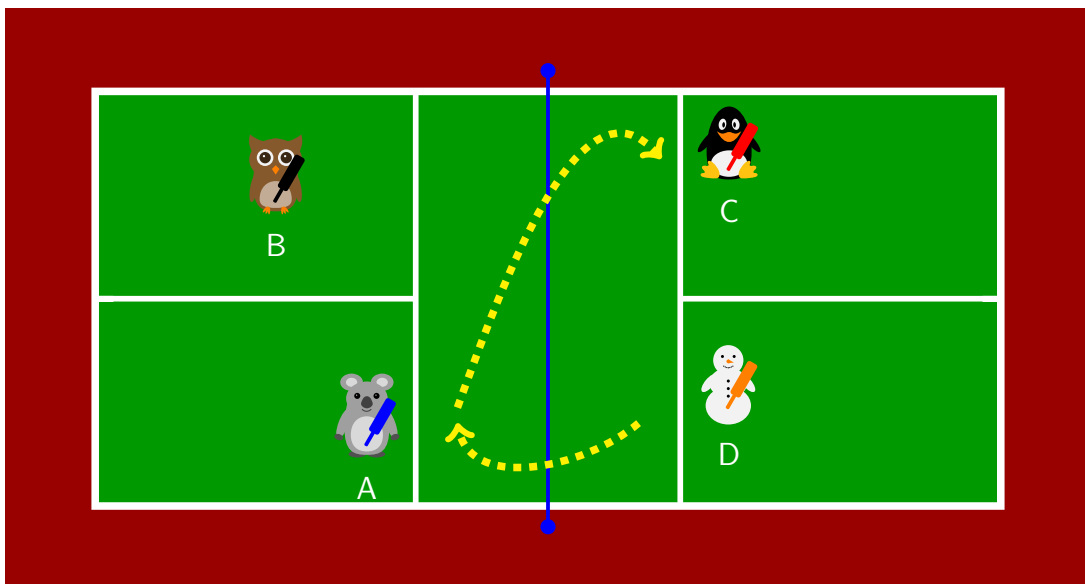
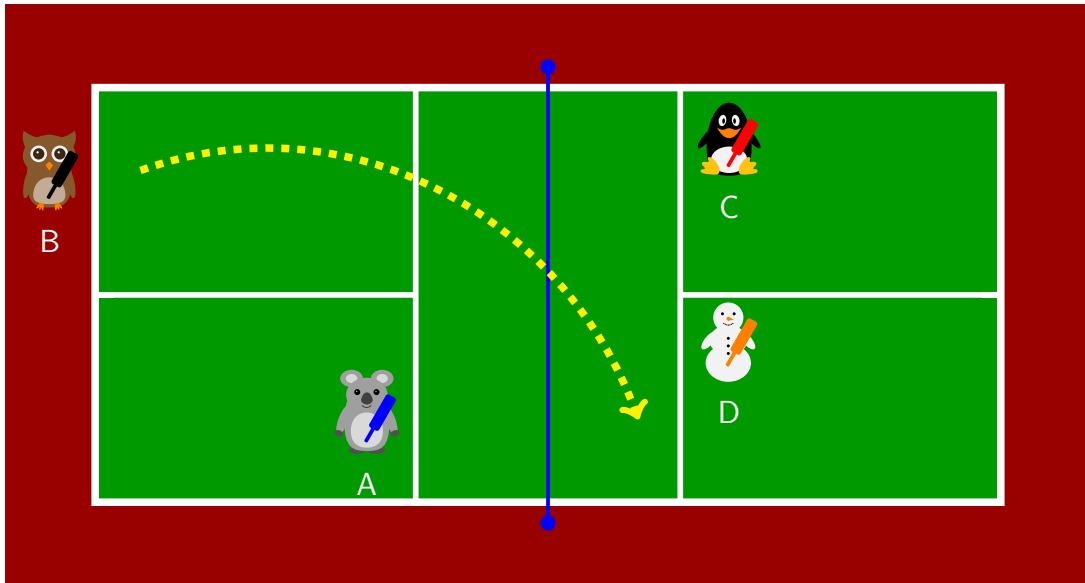
## 8.4 Drill 4: Finishing Down the Middle

**Variants:** Number of crosscourt dinks, lob instead of drive, third shot drive or soft to center



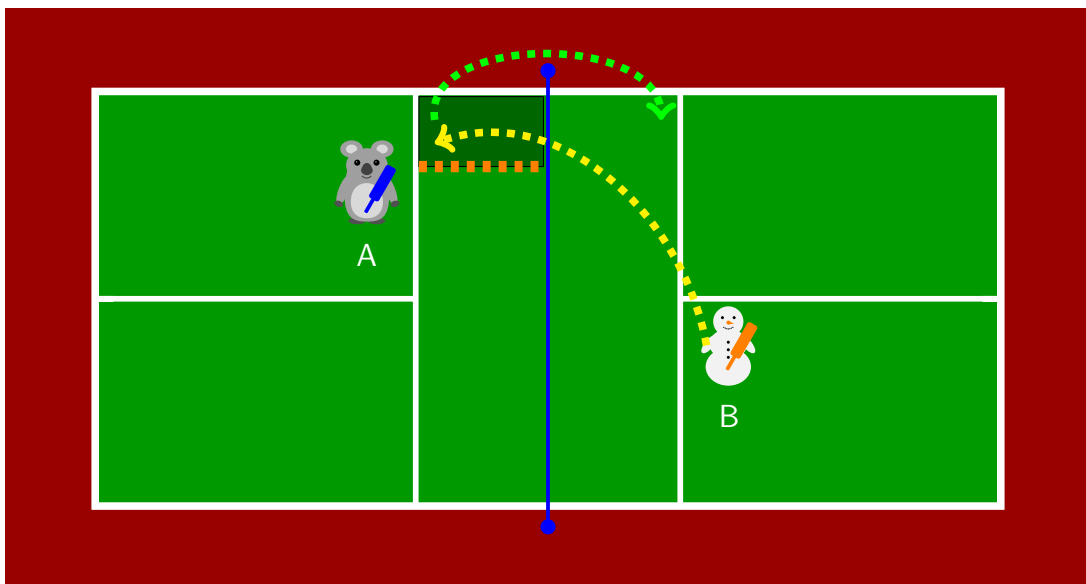
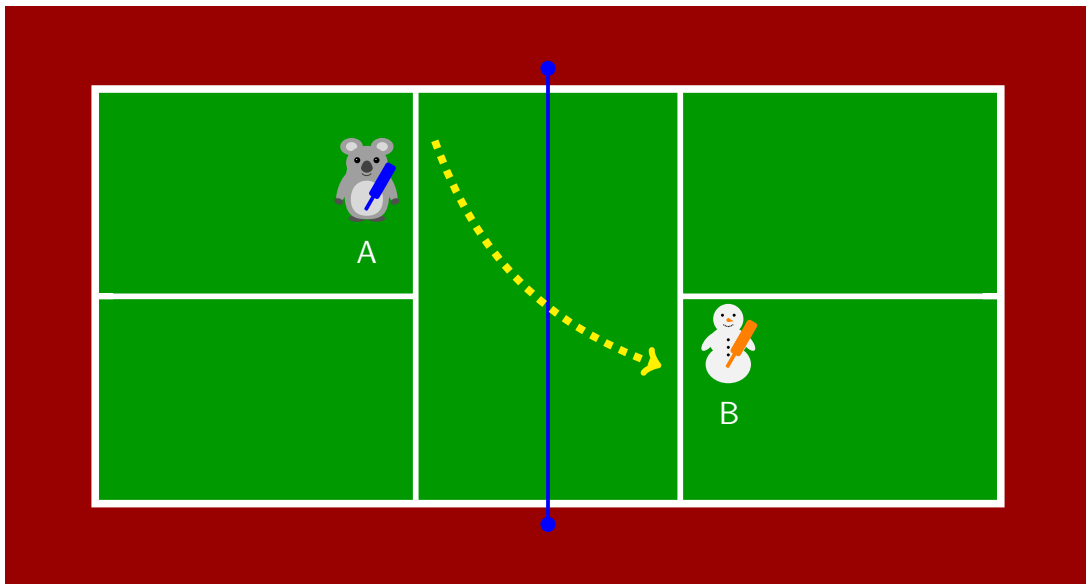
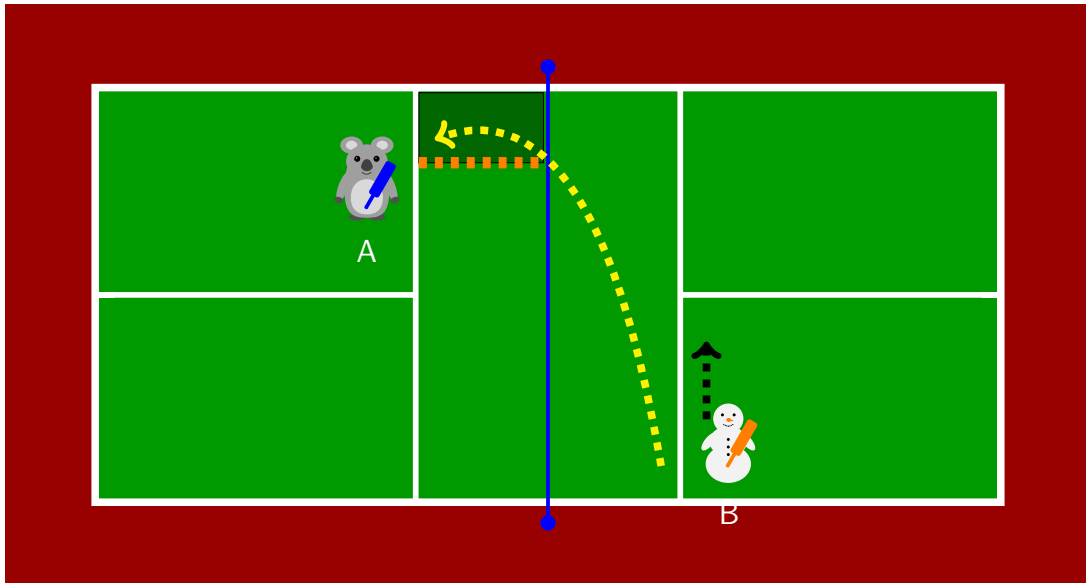
## 8.5 Drill 5: Splitting the Difference

**Variants:** D hits to B's feet instead, B feeds to C initially, A attempts to poach



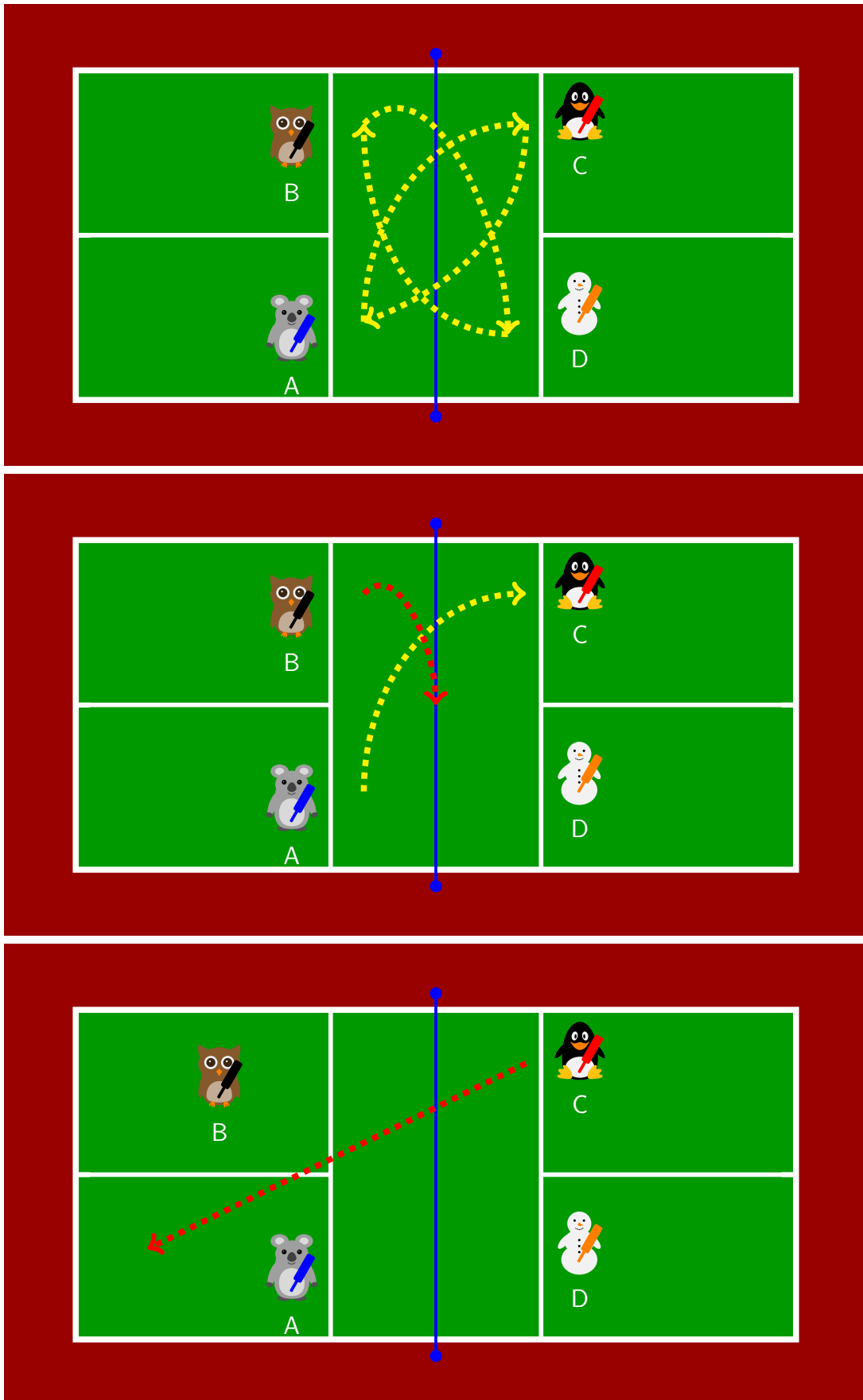
## 8.6 Drill 6: Pushes and Bailouts

**Variants:** Number of crosscourt dinks, shift bailout position, both players crash to center after crosscourt



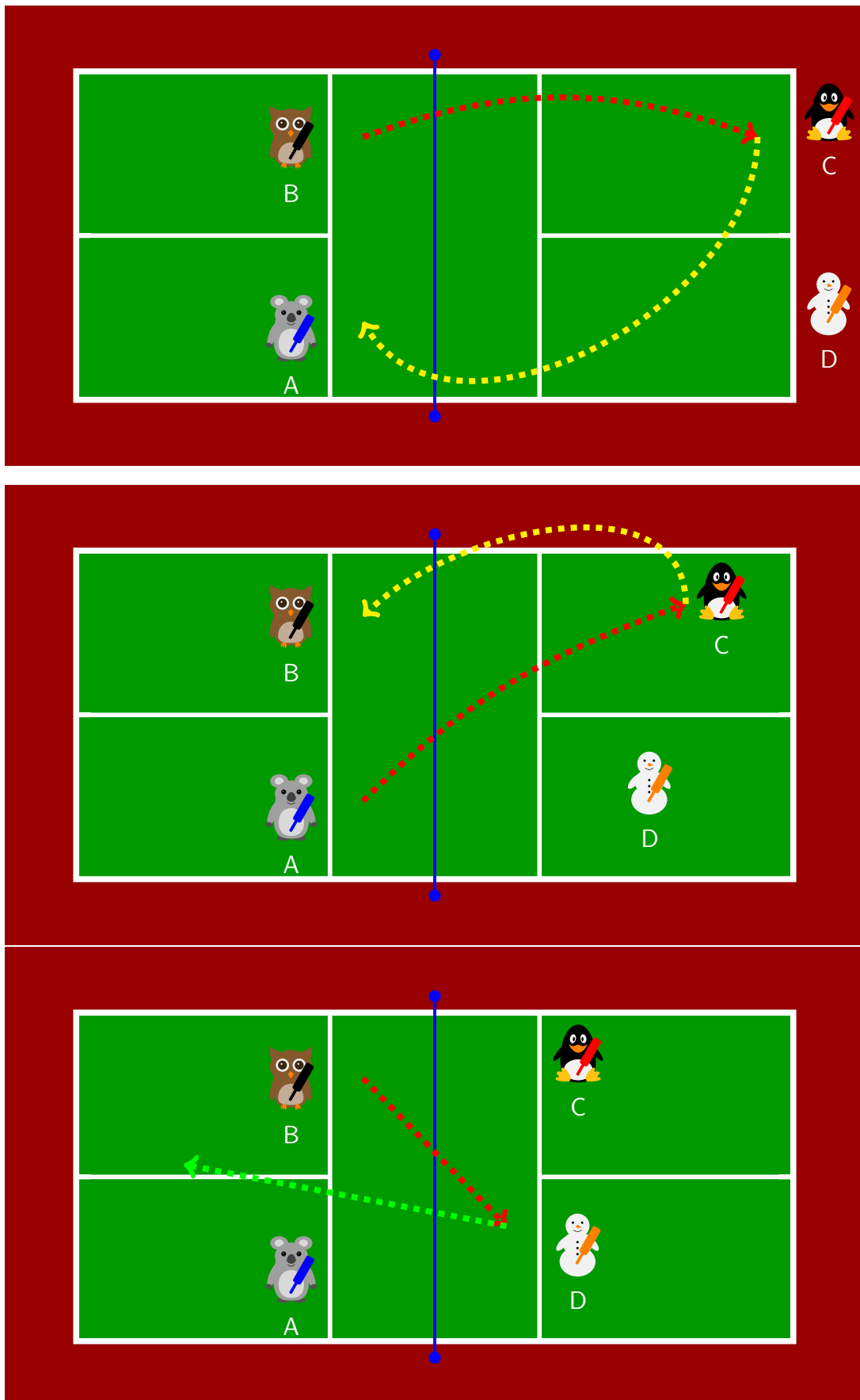
## 8.7 Drill 7: Dingles

**Variants:** This is a game I learned about from Collin Fehr. Start dinking crosscourt with two balls. Then when one ball leaves play, all four players play out a point with the remaining ball.



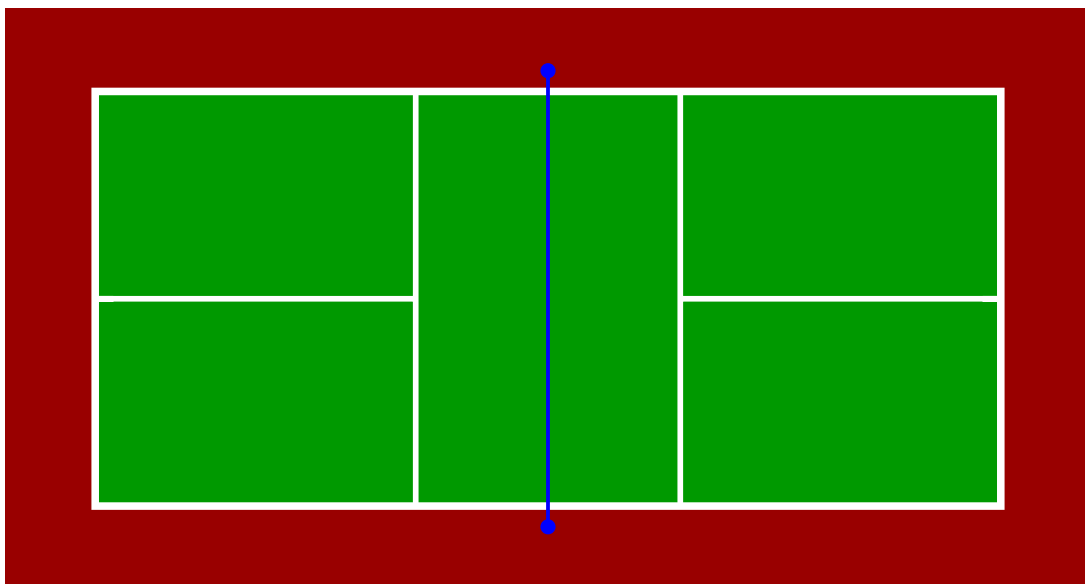
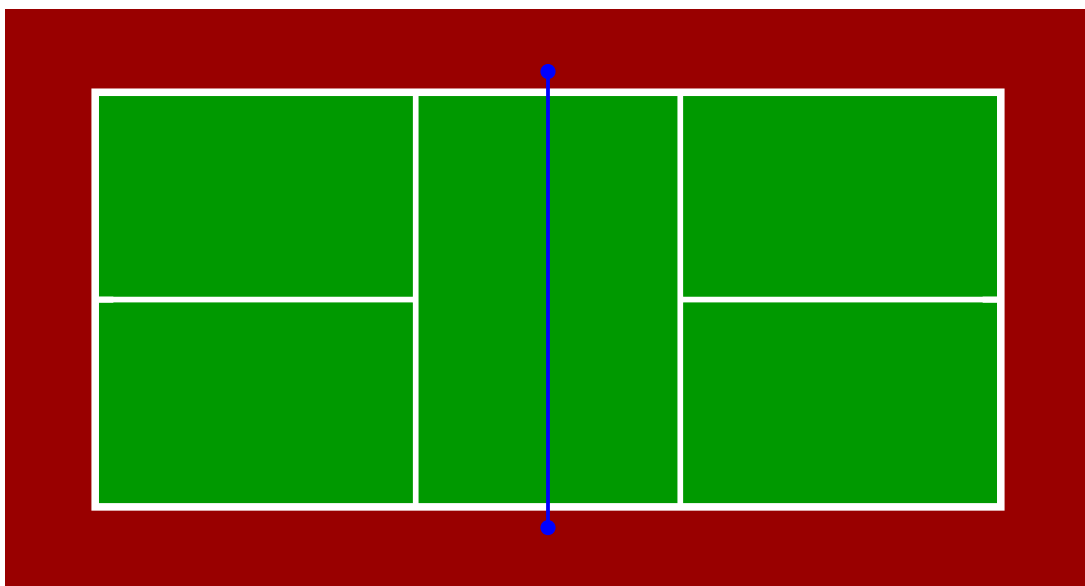
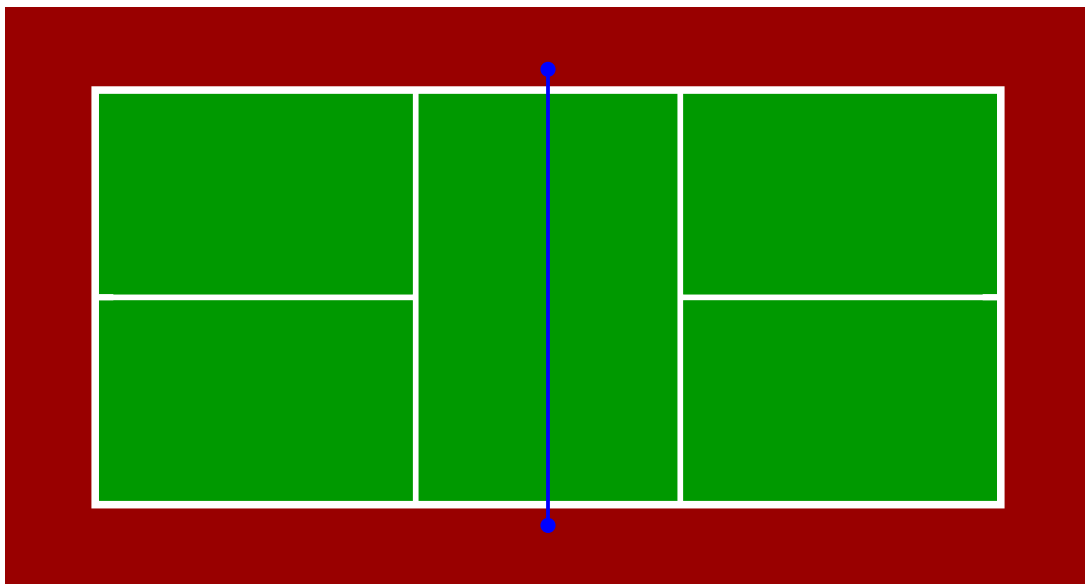
## 8.8 Drill 8: 7-11

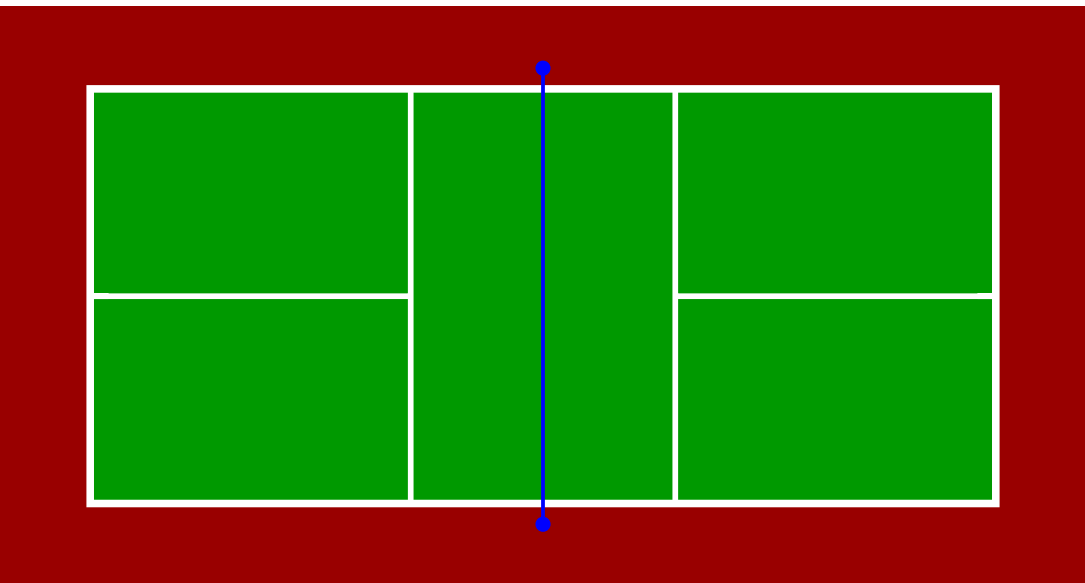
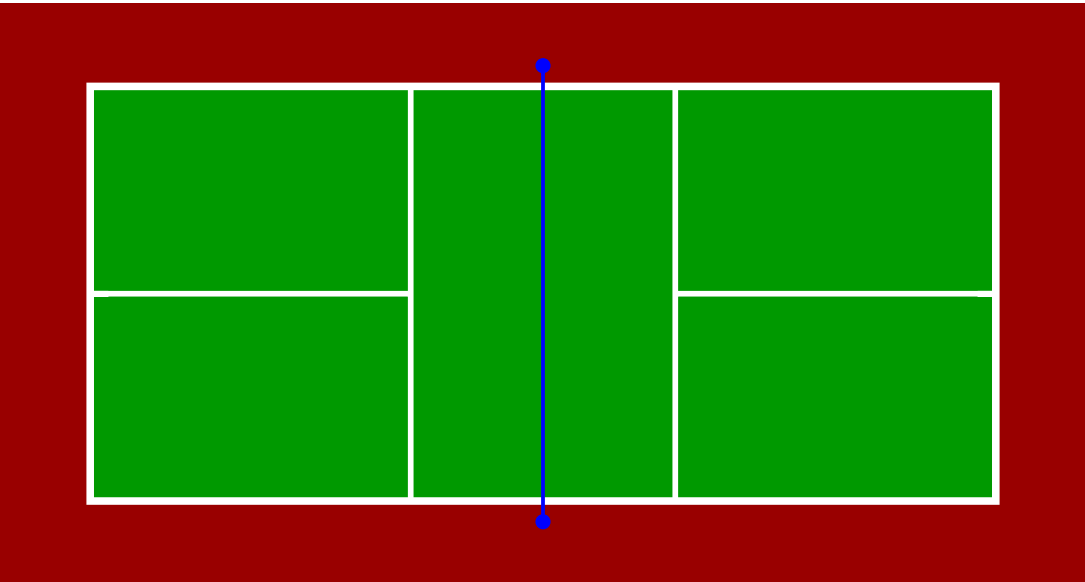
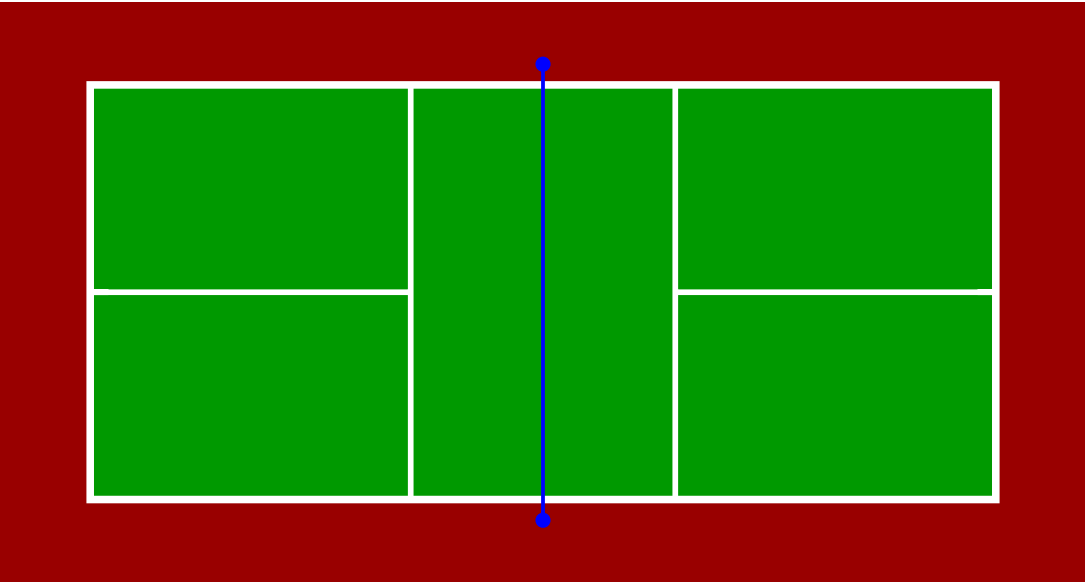
**Variants:** This is another common game to work on transition skills. Feed from kitchen to baseline - the baseline team (sometimes constrained to only approach one step at a time) only needs 7 points to win.



## 9 Blank Court Diagrams

For drawing your own diagrams:





# A Appendix: Academic Work

## A.1 Should You Choose To Serve First?

In tournament play one of the teams<sup>19</sup> is asked to choose whether they would like to serve first, receive first, or pick one side of the court to start on. If the initial team chooses a side, the secondary team chooses whether they would like to serve or receive. On the other hand, if the initial team chooses to serve or receive the second team chooses the side. If your team wins the coin flip, there are several strategic considerations that might inform your decision. This is particularly true given that in doubles the team that serves first only gets one service fault before a side out, the service pattern is less symmetric than other racquet sports like tennis.

Together with Dr. Stewart Ethier (University of Utah) we studied the question of **Does the first-serving team have a structural advantage in pickleball?** We study a model of doubles where each team has a fixed probability of winning a point that they serve. This allows us to derive winning probabilities for side-out scoring of games to different values (11, 15, 21, etc.) as well as the modified rally scoring rules as used in the MLP and a hybrid scoring method that we introduced combining the two.

It turns out that while tennis is symmetric (and easier to analyze, since each game has a fixed server - see Figure 1 for a comparison of the possible scoring patterns once a game reaches a tie for both sports. ) the expected server advantage of a pickleball match under this model depends on the number of points in the game. We derive some (gigantic) formulas for these exact probabilities, showing that for side-out scoring the first-serving team has a slight disadvantage in games to 11 and a slight advantage in games to 15. In both cases this is for games where the expected probability of winning a point when serving is in the mid-40s, which tracks with data from professional matches, described in more detail below. It is also true that the difference of the game-win probabilities from 50/50 is very small - on the order of 0.000000001. Given the small magnitude of these differences, the analytic approach is required as the number of simulations required to distinguish these from even would require something on the order of  $10^{16}$  samples.

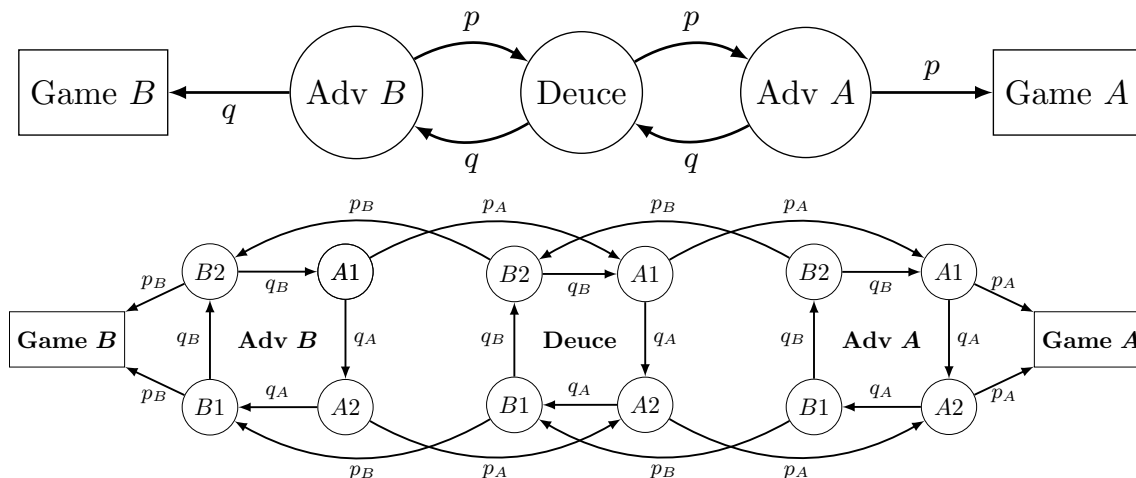


Figure 1: The deuce games of tennis (top) and pickleball (bottom). Thanks to David Beecher for generating these figures.

The situation for rally scoring can also be understood in terms of a giant rational function but it can be summarized more efficiently by saying that the first-serving team has an advantage if Team A's probability of winning a rally is greater when Team A serves than when Team B serves. This is natural but it is also true that the size of the advantage in this system is much larger than under the side-out system, even when the winning probabilities are equal for each team and even when the games are played to 21 rather than 11 points.

We also looked at expected length of games under the two systems and the variance in those lengths. The average number of points played displays a much wider range of possibilities as a function of the relative service strengths for side-out scoring as opposed to rally scoring. Near 50/50 the expected game lengths are very similar between the two formats but across all parameters rally scoring has a significantly lower variance, which is one reason to prefer that system. If you want to see the full set of equations or more details, look at the paper linked in the second paragraph above.

<sup>19</sup>Selected by flipping a coin, or spinning a paddle, or choose an even/odd written on the back of the score sheet, etc.

## A.2 Preliminary Point Analysis Data

This section contains some joint work with a student based on data from the [pklmart database](#). We initially set out to validate the results from the previous paper but also ended up exploring a bunch of related questions motivated by the structure of the data. As a preliminary matter before we get to the plots I often motivate the usefulness of drilling by pointing out that in rec play you spend at least as much time chasing the ball and forgetting the score<sup>20</sup> rather than actually hitting balls. Looking at a collection of about 10,000 pro-level points the average rally length is only 8.6. Similar results from that dataset include the fact that the team that first speeds up the ball only wins the point 48.6% of the time and that a little over two thirds of points end in errors rather than winners<sup>21</sup>. These stats suggest (like most coaches do) that players should focus on consistency and minimizing errors and that developing a strong defensive reset game can be very valuable.

Next up, we validate the parameter selection and the results from the paper described in the previous appendix. Figure 2 shows how the average on-serve point winning percentage varies across player level, as well as the likelihood that the first-serving team wins the game when playing to 11. As expected from the theoretical results, for point winning percentages around 42% we expect the game winning probability to be very close to 50%.

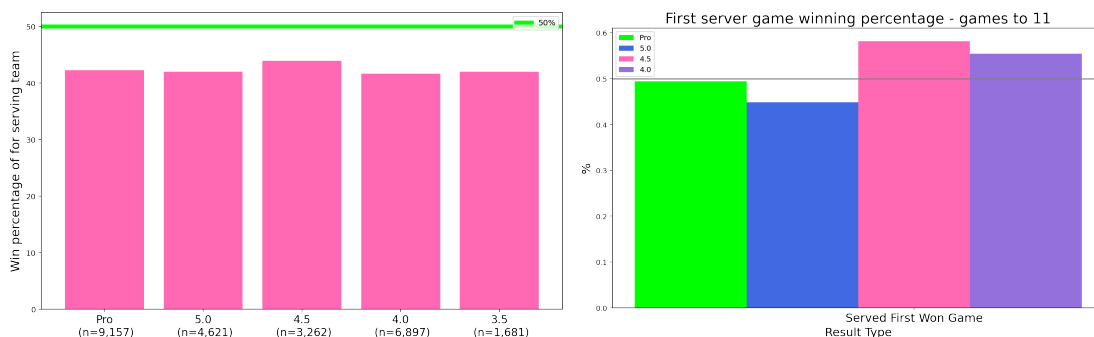


Figure 2: Point winning probability for a serving team by ranking (left) and match winning probability for the first-serving team by ranking (right).

The next figure shows that the split between drop and drive for third shots varies significantly between levels. We also looked some at how this differs across different points in a given game - the pros are remarkably consistent (their ratio of drops to drives is constant on the first point or the tenth but the other levels have a large amount of variance).

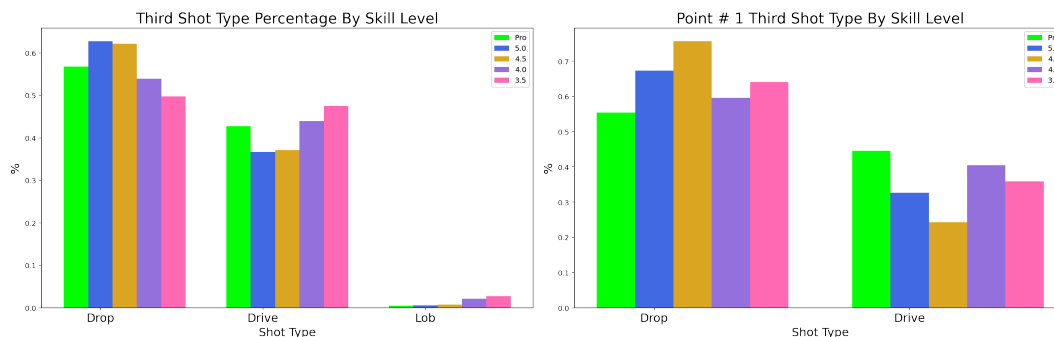


Figure 3: Breakdown of third shot types by skill level.

Next up is a breakdown of the four cases for the serving team in terms of the first point and the entire game. Just looking at the pros, it appears to be a 5% gap in favor of winning if you win the first point or losing if you lose the first point. The figure also shows the number of points in the initial serving run and the corresponding win probabilities for the first server. The last plot suggests some of the difficulty with this analysis and dataset - the sample sizes aren't really large enough to be conclusive for some of the score pairs with higher values. None of these results are particularly surprising and the results aren't

<sup>20</sup>@happens to everyone

<sup>21</sup>There are caveats to both of these results, since characterizing exactly what counts as a speed up and disambiguating unforced vs. forced errors is not an exact science. That said, the generic points these motivate are reasonable, regardless of the exact numbers.

adjusted by skill level within the rating categories (DUPR levels or something like that) but it was a fun first pass.

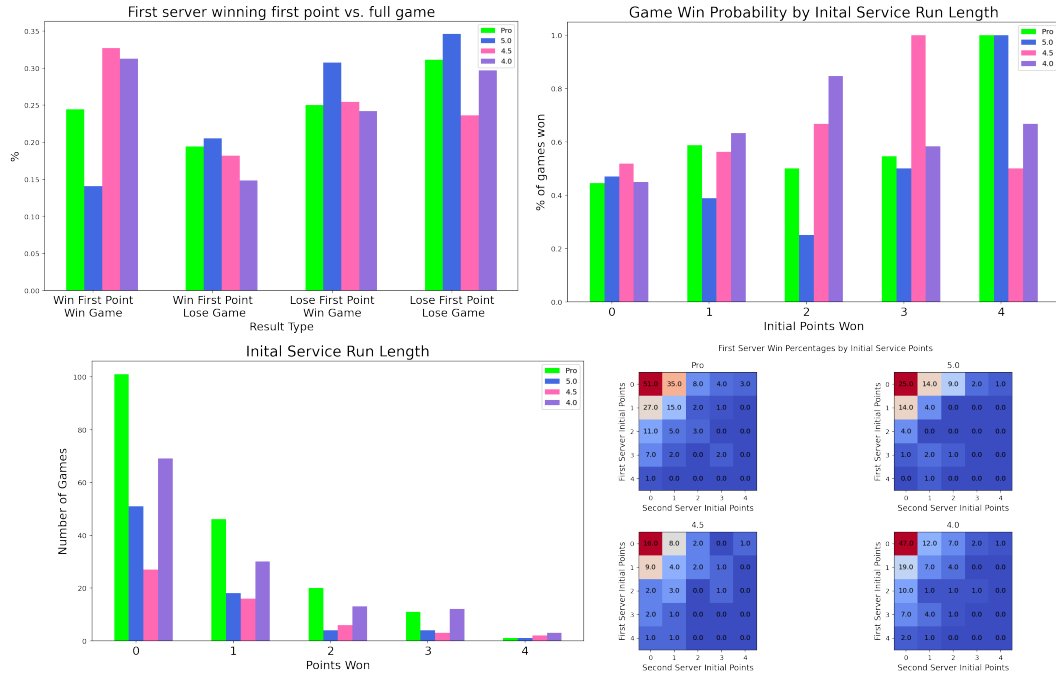


Figure 4: Exploration of relationships between the number of points scored by the initial serving team and the game win probability.

Finally, we've also started looking at the positioning of strokes from individual rallies but don't have any preliminary conclusions yet (the points marked are where the player was standing when they hit the ball). The lower set of figures shows the relative likelihood of hitting or setting up a winner from a fixed position on the court.

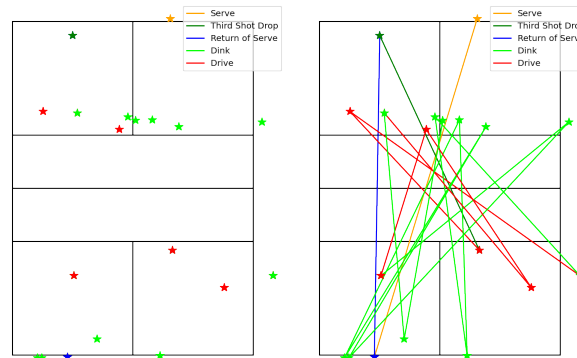


Figure 5: Positions of shots within a single pickleball point

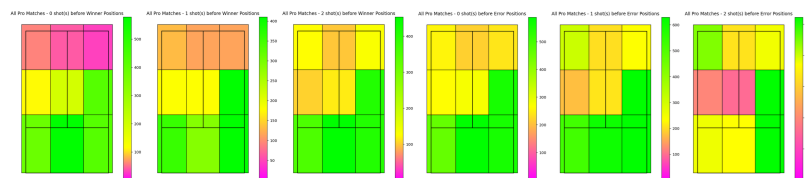


Figure 6: Court position counts of winners and setup shots in pro matches

If any of this inspires any interesting follow up questions for you definitely feel free to let me know - I'm always interested in trying out new experiments.

## B Appendix: Clinic Outlines

### B.1 Beginners

- Stretch
  - Arm Circles
  - Core Rotation
  - Lunges
  - Side-to-side toe lifts
  - Arms across chest
  - Hamstrings
- Intro discussion
  - Friendly sport and community
  - Easy to learn to keep ball in
  - Local courts and groups to play with
- Get feel of paddle
  - Grip (Continental)
  - Bounce on front
  - Bounce higher or lower
  - Competition
  - Back side then alternate
  - Whack! As hard as possible
- Move up to NVZ
  - Toss ball back and forth
  - One person tosses other hits back
  - Both dink (bounce in kitchen)
  - Most dinks in a row (compete)
  - Switch to crosscourt
- Game with point in NVZ (rally)
  - Rotate around positions
  - Play to 7
  - What did we observe?
- Serves:
  - Explain rules to start point
  - Drop & Volley serve rules
  - Alternate returns
  - 2-bounce rule
  - Serve to targets
- Start of point positioning
  - Rules discussion
  - First three shots practice cross court
  - Play rally points, rotate spots
- Scoring
  - Shout out scores
  - Rotate through full points
  - Dingles with real scoring for practice
- Wrapup Discussion
  - Review Concepts
  - Next Steps
  - How to improve

## B.2 Intermediate

- Stretch
  - Arm Circles
  - Core Rotation
  - Lunges
  - Side-to-side toe lifts
  - Arms across chest
  - Hamstrings
- Intro discussion
  - Practice over rec play
  - Average length of points 8.6
  - Lots of (intentional) reps for improvement
  - Consistency over power
  - 2/3 points end in errors
  - 48% of speed ups eventually win
  - Throughout - cooperate then compete
- Paddle bounces
  - Individual then together
  - Most bounces, highest bounces
  - Alternate sides, etc.
- Dinking Drills
  - Start up the line
  - Forehands
  - Backhands
  - Alternate/Triangle
  - Add competition between pairs
  - Observe how mentality changes
  - Dinking pattern and triangles
  - Rotate court/partners/roles
  - Switch to crosscourt - same sets
  - Figure 8 dinks
  - Then Dingles!
- Court positioning
  - Follow the ball together
  - Cover 2/3 of the court
  - Look for 1-2 punch
  - Dink wide hit middle - drill
  - Why dink cross court?
- Serve targeting
  - 5 serves each side per person
  - 1 point in
  - 2 points behind line
  - 3 points in box
- Return targeting
  - Same as serves
  - Then try both at once in pairs
- Third shot targeting
  - Now add NVZ target
  - Net player feeds cross court
  - Both targets live
- Drop Dingles (or 7-11)
  - Put all three together with bonus points
  - Advance one step at a time
- Tactic: Drop crosscourt then poach
  - Alternate feeder (2nd shot)
  - Alternate roles
  - Start in serving formation
- Volleys
  - After warmup one dink one volley
  - Speedup off bounce/reset
  - Volley dingles
  - Observations?

B.3 Colton 9/15/24 Results

B.3.1 Round Robin

Player	1	2	3	4	5	6	7	Wins	Loss Points	Seed
Brian	6	1	11	6	11	11	0	3	7	6
Randy	8	11	8	11	11	3	11	4	17	3
April	9	11	11	6	4	11	9	3	28	4
Alice	11	7	11	11	11	11	11	6	7	1
Katie	11	11	8	1	11	2	9	3	20	5
Rick	9	1	3	11	1	2	11	2	16	7
Justine	11	7	3	1	4	3	0	1	17	8
Elizabeth	11	11	11	11	1	11	11	6	1	2

B.3.2 Shootout

