

**Individual Assignment 3: Physical, Cognitive, and Emotional Task Analysis**

Task Analysis for a Spikeball Cut Serve

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**Introduction:**

Spikeball, also known as the sport of Roundnet, is a dynamic and rapidly growing sport that incorporates elements of volleyball and foursquare into a fast-paced and competitive game. Played with a small, circular net placed at about ankle level, teams of two aim to hit a palm-sized ball across the net in a way that the opposing team is unable to return it. Each team is allowed a maximum of three touches before hitting the ball back onto the net, and the objective is to make the opposing team fail in their attempts to return it. With an emphasis on teamwork, communication, and athleticism, Spikeball provides an accessible yet challenging outlet for players of all skill levels, making it a popular choice for casual gatherings and competitive tournaments alike.

Given that the goal is to hit the ball in a way that makes it difficult for the other team to return it, one of the predominant ways of achieving this comes from serving. Serving is the initial action that begins at each point of the game in which the server, a member of one of the two teams, stands across from the receiver and hits the ball into play. Servers are given two faults, otherwise, two opportunities to serve the ball from a 7-foot serving line and are additionally permitted one step from their starting position. Spikeball is one of the few sports that are serve-dominant; otherwise learning a great serve makes you all the better of a player as it acts as a fast and effective way of accumulating points. Learning a great serve, however, is a complicated task that requires several steps and parameters to consider. While most novices rely on hitting the ball hard and straight, elevated serving requires servers to consider factors such as spin, a consistent toss, ball contact, and receiver position and preferences.

For novices and experts alike, serving is a skill that requires consistent practice and can benefit from the insights and feedback from expert players. In order to understand the behavioral, cognitive, and emotional steps that go into serving, I conducted an interview with Evan Liao, the president and a seasoned player on the Tufts Roundnet team.

**Biography of Expert:**

Evan Liao, currently a senior at Tufts University, is studying Chemical Engineering and serves as the active president of the Tufts Roundnet team. While he enjoyed playing Spikeball

recreationally during high school and his freshman year of college, he has recently entered the competitive sphere of Spikeball and has been participating in local and regional tournaments for the last three years. In terms of skill rating, out of six divisions ranging from 1.0 - 5.0, Evan participates in the 4.5 Contender division. According to the USA Roundnet (USAR) website, in terms of serving, a 4.5 rated player “no longer relies on one strong serve but has two, three, or more serves in their arsenal or in the works. They serve with more speed and spin than 4.0 players and below. This player is able to notice their opponents strengths and weaknesses and base their serving strategy around attacking those weaknesses.” Accordingly, Evan displayed a dominant performance at the Spikeball Northeast Fall 2023 Sectionals where he and the Tufts top teams managed to secure first place amongst other colleges including Northeastern, RIT, UConn, Sienna and Yale.

Over the course of three years of competing, Evan has spent countless hours refining his serving skills and understanding various techniques that were beneficial in achieving greater spin, higher consistency, and accuracy in his serves. I consider Evan to be an expert given his extensive tournament experience and reputation within the club for having fast serves with significant spin. Rather than the typical powerful and straight serve characteristic of novice players, Evan’s serves focus on skillfully imparting spin on the ball causing it to change directions when it contacts the net. In comparison to typical serves that usually leaves the net at angles ranging from 0 to 15 degrees to the receiver, Evan's top-notch cut serves can veer as much as 45 degrees away from the net. This puts substantial serving pressure on the opposing team. Additionally, given his extensive experience, he understands his process well and is able to clearly articulate what sorts of actions result in an effective serve.

### **Summary & Discussion of Information:**

This section presents a summary of the main ideas extracted from the interview with Evan and a discussion of this information in the context of trying to better understand the task. Given that the nature of the task was a physical one that required a large space for demonstrations, the interview took place in person at the Gantcher Sports Center. While most questions in regard to the behavioral and cognitive aspects of the task led to very straightforward answers, questions about the emotional aspect were a little more difficult for Evan to explain.

Much of his actions were largely routine and of habit which meant that he did not think of what sorts of feelings or emotions he would be feeling in the moment. After careful consideration, however, his way of thinking boiled down to him imagining himself as a beginner and thinking more deeply about the motivations behind certain actions. For example, when talking about taking a step before the serve, he mentions that this action largely comes down to the preference of the server and whether they are confident and comfortable with hitting the ball at that angle. In some cases, he might take a wider step and subsequently more difficult angle to hit the serve when his team is a few points ahead and he can afford to take risks. Otherwise, he tends to stick with a comfortable step which makes him feel more confident and safe with his serve.

The interview with Evan primarily shed light on the insights behind one of the more popular serves in the game referred to as the cut serve. According to Evan, a cut serve involves deliberately imparting spin on the ball, causing it to curve or "cut" as it traverses towards the net. One of the key characteristics of this serve involves carrying the ball as you make contact with your swing. This allows you to impart a combination of top and side spin and change the overall trajectory of a serve. Rather than simply swinging at the ball with an open palm, Evan noted that effective cut serve requires that you cup your hand and rotate your wrist as you carry the ball through your swing. While observing him perform the physical tasks, I took the opportunity to ask about the reasoning behind his decisions and actions. It became evident that, as an expert, he draws upon a wealth of experiences and knowledge that influence the choices he makes and the actions he takes. For example, before the serve, Evan could often be observed lightly cupping his hands around the ball just before he would toss the ball to hit. As I later discovered, his seemingly insignificant habit played a crucial role in how he shaped his hands around the ball to maintain a consistent grip for hitting it. Otherwise he mentions how he would lose a lot of control over how the ball would roll off his fingers.

During our discussion, Evan emphasized key elements critical to a successful cut serve. Firstly, he highlighted the significance of a consistent toss, stressing its role in ensuring accurate contact with the ball. Additionally, Evan underscored the importance of contacting the ball from the back, generating power, and rolling over the top to impart a corkscrew spin. In the broader context of understanding the task, Evan's insights revealed the strategic dimension brought by the cut serve, introducing unpredictability to challenge the opposing team in returning the ball

effectively. The technical precision required for a successful cut serve, encompassing consistent toss, powerful contact, and spin dynamics, became apparent through Evan's expertise. Moreover, Evan identified pain points associated with the cut serve, including the challenges of getting the right spin, achieving sufficient spin, and contact on the ball. Evan acknowledged the difficulty in achieving sufficient spin, indicating a continual refinement process for players that benefits greatly from deliberate practice. Overall, the interview provided a comprehensive view of the cut serve, offering nuanced insights into the skill and strategy involved with serving. Based on the interview, the main steps involved in hitting a cut serve are as follows:

1. Setting up to the serve line
2. Addressing the serve and having the receiver acknowledge it
3. Taking a step from the serving position
4. Shaping the hand in a cup shape
5. Lifting the serving arm
6. Tossing the ball up
7. Swinging horizontally at the ball with the palm
8. Rolling the hand over the top of the ball
9. Snapping the wrist towards the body
10. Follow through with the swing

### **Multidimensional Task Analysis:**

During my interview, I recorded the various steps and subtasks involved in hitting a cut serve in Spikeball. Below is a structured list of the behavioral steps of the task of performing the serve, along with each step's corresponding cognitive and emotional components (if there are any for that step).

<b>Step #</b>	<b>Behavioral Tasks</b>	<b>Cognitive Tasks</b>	<b>Emotional Tasks</b>
1	Position feet at seven-foot service line	Identify the service line and ensure that both feet are positioned behind it	Worried about being positioned slightly on the service line and having a fault called

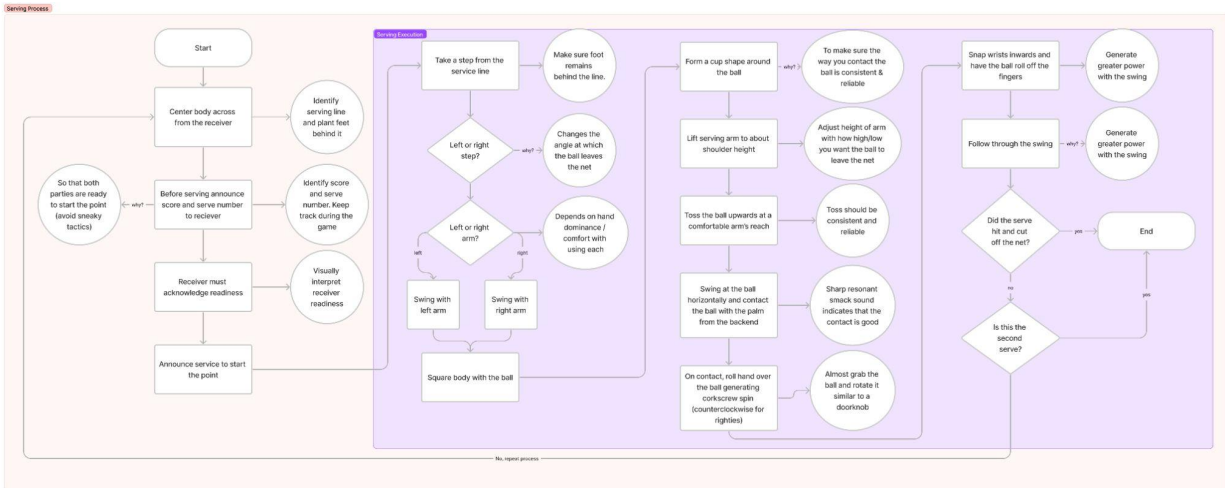
2	Center body directly across from the receiver's body	Approximate one's center of mass to the opposite of the receiver	
3.1	Before serving, the server must announce to the score and serve number to the receiver	Keep track and remember current score and serve number (serve 1 or serve 2)	Can feel frustrated and pressured when score is incorrectly remembered and announced
3.2	The receiver must verbally acknowledge readiness and the server must then announce "service" to start the point	Visually interpret readiness of the receiver via a gesture or verbal announcement	Could feel annoyed when receiver takes their time to acknowledge the serve
4	Take a single step from the service line	<p>Ensure that stepping foot is behind the service line</p> <p>Other foot must maintain a single point of contact with the floor. It can pivot but not be lifted</p> <p>Decide on whether to take a step to the left or right</p>	<p>Determining where to take a step might offer a slight competitive edge and confuse opponents with where and how the ball might come off the net</p> <p>Server must also consider their own confidence and preferences with hitting the ball at different angles</p>
5	Square body facing the ball	<p>Server should consider distance between the ball and whether it is within reach</p> <p>Look at net and ball and make sure that you know how far and where the ball should hit the net</p> <p>At this point, server should decide on what kind of serve to execute</p>	
6	The server should form their serving hand into a cup shape that fits around the ball	Decide on what grip is most effective for a server based on different biomechanics	Can be difficult and frustrating to figure out what sort of grip is most effective at contacting the ball. It is a process of trial

		Based on previous knowledge/experience, a server can make out a “good” ball (texture, inflation levels, grip) and decide on how to go about contacting the ball	and error
7	Lift serving arm to about head high to allow for greater momentum with the swing	Depending on how the server might want the ball to come off the net they might want to adjust the height of their swing (lower swing comes off the net at a lower angle and vice versa)	
8	Toss the ball upwards at a comfortable arm’s reach	Toss should have a consistent height to ensure that you are able to contact it effectively and accurately	Making a bad toss can immediately mess up someones serve therefore causing frustration and annoyance. Similar to the feeling in basketball of preparing to shoot and having the ball slip out of your hands, tossing a ball too short or far can interfere with your overall swing
9	Swing at the ball horizontally and initially contact the ball with the palm from the backend	<p>Server should aim to contact the ball where the finger meets the palm. The majority of the power is generated from pushing the ball from the back</p> <p>If a sharp and resonant “smack” sound is produced when the ball makes contact with the server’s palm, then we know that the contact was good</p>	<p>Can be frustrating contacting the ball as it could hit the wrists, fingers, thumb or just entirely miss. Any slight deviation from the palm results in a “slipped” hit</p> <p>Enjoyable and satisfying to hit the ball square with the palm. A correct contact provides immediate positive feedback via a loud crack</p>

10	On contact, the server should roll their hand over the ball generating corkscrew spin (right to left spin for right-handed players)	<p>Server should envision the spin similar to opening a doorknob counterclockwise (if right-handed)</p> <p>It helps to almost grab the ball (not catch), wrap your hand around it, and carry it through with the swing</p>	<p>Incredibly intricate and difficult motion to replicate which can lead to frustration</p> <p>Frustration with getting the muscle memory down for wrapping around the ball</p>
11	Snap the wrists inwards towards the body to create additional spin as the ball flicks off the server's fingers	<p>Almost like slapping an object, a server's wrists should curl inwards</p> <p>The ball should feel like it is rolling/flicking off of the fingers. If it simply contacts the palm, minimal spin will be generated.</p> <p>If the ball appears to not have the correct spin when it leaves your hand, adjust how you might be flicking it</p>	<p>Difficult to interpret and mimic without watching slow-motion video</p> <p>Satisfying when the ball rolls off the right way and can visibly be seen with counterclockwise spin (the black and yellow patterns on the ball allow you to see this)</p>
12	Follow through with the swing in order to carry over all the momentum and generate more power	<p>Make sure that you are using your entire body and rotating the hips with the swing</p> <p>Make sure that your other arm is clear of the swing</p>	<p>Can be difficult to initially swing with a lot of power as it drastically reduces accuracy.</p> <p>Feeling happy when a serve spins off the net. More satisfying when it results in a serve that is not received by the opposing team</p>



Using the insights and information gathered from the table above, a flow chart was created to map out the task's behavioral and cognitive components. Cognitive components are indicated in circular containers whereas behavioral components are by rectangles.



## Discussion of Automation & Machine Learning for Novices & Experts:

### *Automation and ML/AI for NOVICES:*

Novices learning how to hit a cut serve stand to gain significantly from the integration of automation, machine learning, and artificial intelligence. One key area of improvement lies in skill assessment and personalized training. Automation can be employed to develop tools that assess novices' initial serving skills, focusing on elements like ball control, spin, and accuracy. On the other hand, machine learning algorithms can analyze serving patterns and errors, providing personalized feedback and generating targeted training plans to address specific weaknesses. Real-time feedback is another advantage, achieved through the integration of sensors or smart equipment that automatically captures serving data and machine learning algorithms that can provide immediate and actionable feedback. Additionally, a virtual coaching assistant, powered by automation and machine learning, can guide novices through serving drills, adapting coaching strategies based on individual progress, learning styles, and areas that need improvement. Gamification elements like a leaderboard between friends and point systems can also be integrated to make the learning experience more engaging for novices.

### *Automation and ML/AI for EXPERTS:*

Experts aiming to refine and optimize their serving skills in Spikeball can leverage similar tools and insights provided by automation, machine learning, and artificial intelligence. A key area where experts may benefit would be in performance analysis and using video and posture tracking technology to understand what sorts of techniques are most effective at generating particular elements like spin, power, and accuracy. Automated systems can capture detailed performance metrics and machine learning algorithms can additionally identify subtle variations in serving techniques that might result in better or worse serves. Predictive analytics for opponent strategies involve automated systems recording and analyzing opponents' responses during matches, with machine learning anticipating reactions based on historical data. Customized training regimens can be created through automation, considering an expert's specific strengths, weaknesses, and goals, with machine learning continually assessing performance and adjusting training plans dynamically. To encourage innovation in serving strategies, automation can simulate various scenarios, while machine learning analyzes the effectiveness of novel approaches, providing insights for experts to incorporate into their game.

### **Developing an Aid:**

Using the insights and information gathered from the task analyses, I set up an informational instruction manual outlining the key characteristics of a cut serve. The instructional manual serves as a comprehensive guide for novice Spikeball players looking to master a cut serve. The guide systematically breaks down the key elements involved in executing a successful cut serve, emphasizing precision and control. It provides step-by-step instructions, starting with proper positioning and body alignment, moving through hand formation and arm elevation, and concluding with the crucial aspects of ball toss, swing motion, and follow-through. Additionally, the guide offers visual aids of key steps of the serving process meant to provide visual reference for what each key step of the phase looks like and how it can be replicated. Due to the complexity of specific actions, particular attention is given to how the ball is contacted and flicked. This is because reproducing this action without practicing the motion can be challenging. The guide aims to demystify the complexities of the cut serve,

providing novice players with accessible and actionable insights to enhance their serving skills (see Appendix A).

*Applicability:*

This guide is designed with the practical needs of novice Spikeball players in mind, offering a structured and easy-to-follow roadmap to master the cut serve. Whether players are just starting their Spikeball journey or looking to refine their serving technique, the guide's applicability lies in its ability to instill fundamental skills. Novices can benefit from the guide's emphasis on proper body positioning, hand formation, and spin generation, all crucial components for a successful cut serve. The guide's step-by-step approach encourages players to develop a consistent and controlled serving motion, contributing to their overall performance on the Spikeball court. By providing clear instructions and visualizing techniques through relatable analogies, the guide fosters an accessible learning experience. As players engage with the guide, they gain valuable insights and practical tips, enabling them to confidently incorporate the cut serve into their gameplay repertoire.

## Appendix A: Visual Aid

# How to Hit a Cut Serve in Spikeball

a cut serve involves deliberately imparting spin on the ball, causing it to curve or "cut" as it traverses towards the net.



### 1. Positioning:

Stand at the service line with your feet shoulder-width apart.

### 2. Footwork:

Take a single step around the service circle to increase the angle of the serve.

### 3. Body Alignment:

Square your body, ensuring that you are facing the ball directly. Locate the net and aim your serve accordingly.

### 4. Hand Formation:

Form your serving hand into a cup shape that comfortably fits around the ball. This grip will facilitate better control and a consistent contact.

### 5. Arm Positioning:

Lift your serving arm to approximately head height. This elevated position allows for increased momentum during the swing.

### 6. Ball Toss:

Toss the ball upward at a comfortable arm's reach. The toss should be vertical and in line with your serving hand.

### 7. Swing Motion:

Initiate the swing horizontally, moving from the backhand side. Aim to make initial contact with the ball using the palm of your serving hand. This contact point is crucial for imparting the desired spin on the ball.

### 8. Spin Generation:

Upon contact, roll your hand over the ball for a corkscrew spin (right to left for right-handed players). Envision opening a doorknob counterclockwise. Almost grab the ball, wrap your hand around it, and carry it through with the swing for optimal spin.

### 9. Follow Through:

Complete the swing with a controlled follow-through, ensuring that your arm extends fully in the direction of the desired target on the Spikeball net.

### 10. Accuracy:

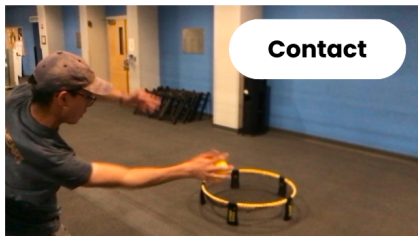
Aim for accuracy by directing the ball to a specific area on the Spikeball net. Adjust the angle and force of your swing accordingly.

### 11. Practice:

Practice the cut serve repeatedly to develop consistency and precision. Pay attention to the feel of the ball and the spin generated with each serve.



Toss



Contact



Flick



Follow-Through

## A Closer Look at the Contact and Flick

