Jump Shot Training Utilizing Auditory Reinforcement

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ABSTRACT

Recently, the ability to shoot as a basketball player has become increasingly vital with a much more statistics-oriented playing style where teams want players at every single position to stretch the floor. While resources devoted to physical training and keeping bodies in shape have progressed significantly, the way players practice shooting has not changed even though the number of threes has increased tenfold! In this experiment, we looked at how an auditory reinforcement simulator could affect three different individuals and their shooting by giving them different sounds from the simulator. Their shooting was recorded and we derived some correlations that may have implications on a higher level if we had the technology to track specific body movements and have the sound react to that.

Keywords

jump shot; basketball; rhythm; instruments; players; auditory reinforcement

1. INTRODUCTION

The majority of shooters simply just put on a favorite playlist of theirs and then put up a ludicrous number of shots. This is where I feel an audio-centric interface could greatly benefit the time shooters have to put in to perfect their form. We see that specific audio can greatly benefit a person's ability to engrain something into their subconscious muscle memory, and I feel that by putting sounds into players ears that mimic their shooting motions, we can have them adapt to new shooting forms much more quickly. Even in the NBA, we see players who struggle to actually develop a natural shot from what world-class shooting coaches teach them by redeveloping their shot from the ground up, notable examples recently including Ben Simmons and Markelle Fultz. The fact that professional players could spend hundreds of hours putting up thousands of shots without much noticeable improvement in-game shows that there is much room for improvement in the training aspect. An auditory experience that is linked to their shooting form could lead their brains to more easily rewire to a new jump shot. We could turn it into something more similar to playing an instrument. The impact could be similar to that of a person learning to play an instrument with no sound vs with sound. Currently, I feel that programming the audio experience to treat the jump shot like playing an instrument with incorrect movements sounding "worse" vs correct movements making the jump shot sound "better" would be a good approach. The data that would need to be collected is the exact motion of the legs, shoulders, and arms during the jump shot. Currently, most of the time, there is simply a person eyeballing how correct the shooting motion is introducing lots of room for error in high number of reps in a movement that must be very precise. If musicians can reach new levels with their ears and arms working in perfect harmony, why can't basketball players do the same? My system would support basketball players who wish to improve three key movements, post-entry passes, stationary free throws, and quick catch-and-shoot three pointers. In all three scenarios, the system would play frequencies that would allow players to associate a specific rhythm with the correct movements. It will take in the user's arm and leg motion through sensors placed on the athlete's arms and legs. For example, shooting a free throw too fast will result in an auditory rhythm which sounds noticeably sped up. A bounce pass that's not strong enough will result in the system outputting sounds that seem a bit toned down or too quiet. A catch and shoot three where the shooter doesn't utilize their legs properly would result in the beginning of the auditory rhythm being muddied. All of this would turn shooting into something more similar to a rhythm-based video game, allowing athletes to hone their jump shots to be significantly more consistent and accurate. For this specific evaluation, however, we did not have sensors or any way to track body movements to react to the sound, and therefore, simply utilized mid-range jump shots and evaluated how users responded to different types of audio while shooting these jump shots.

2. Methods

An ideal user evaluation procedure here would be having comparable players utilize a fully-functioning and fully-realized version of the simulator for weeks and then assess the results by comparing to comparable players who simply attempted to improve their shooting through more traditional means. An ideal participant would be a college basketball player with a shooting coach showing him proper form for him, but his jump shot is still inconsistent in-game. We would attempt to help him get to the jump shot he wants to get to more frequently will increase his shooting percentages by leaps and bounds, making him go from an athletic big man to a modern floor-spacing do-it-all power forward. However, we simply had to recruit three of my friends, two of which play basketball regularly, and one which is a bit more inexperienced. Sid is an Indian American male who plays basketball regularly weekly. Brandon is an African American male who plays basketball on a weekly basis. Molly is a Chilean female who plays basketball on a monthly basis. I collected five key pieces of data from each participant during the evaluation. These five pieces were how many shots are made with no sound, how many shots are made with the "perfect shot" sound playing, how many of those shots were in rhythm with the sound, how many shots are made with the shooter shooting in rhythm with an "incorrect sound" shot, and the shooter's opinion on how it feels shooting to the sound. The first part was selecting three individuals who have shots that are good when shot with their ideal form but inconsistent due to the player messing up their form during the shot. Sid and Brandon had a good shot, however, Molly needed a bit of work on her shot form still. We would ideally create a sound for each participant based on their jump shot, but given the constraints we had, I simply had one stitched together rhythm which we utilized and slightly altered for each participant. Then, I had the participants shoot 15 jumpers with no sound and recorded the results. After a short rest, I gave the participant Bluetooth earbuds and had them shoot 15 shots with a reinforcing sound playing in their ears. Afterwards, I had them shoot another 15 shots where I altered the sound at different points to make it sound a little "off". Finally, I talked to the participants to get some feedback and qualitative data on how they felt shooting with the sound, and whether they personally felt it benefited or hindered them. All that's left is to analyze the data, and determine, based on the quantitative and qualitative data I collected, whether the sound made a positive, negative, or no impact on the shooter.

3. Results

Each participant shot forty-five total jump shots, 15 with each of the three "types" of audio, from approximately the free throw line (except one who shot from about two feet inside the line). The table below shows how many of the 15 shots the participant made with no sound, with the "reinforcing" sound, and with the slightly altered sound.

Results Table

	Sid	Brandon	Molly
No sound	8/15	7/15	3/15
"Reinforcing" sound	9/15	10/15	2/15
Altered sound	6/15	6/15	4/15

Sid stated that although he did like hearing the reinforcing sound while he shot, he didn't feel as though it made a huge difference on his shooting percentages. Having the altered sound play was annoying however according to him. Brandon stated that he liked shooting with the "reinforcing" sound as it allowed him to keep his shot in rhythm and led to his higher shooting percentages with it. Molly stated that she wasn't really sure whether it helped or not as it was difficult for her to shoot in rhythm with the sound in the first place. I observed that Brandon's shot did seem smoother more often with the "reinforcing" sound. Both Sid's and Brandon's rhythm also seemed off in more shots where the altered sound was playing. On average, the "reinforcing" sound did improve shooting percentages.

4. Discussion

The questions we had to answer with this user evaluation study were: "Will the basketball player's shot become more consistent with the correct sound playing?", "Will the incorrect sound mess up the shooter's rhythm?", "Would an actual implementation of this with sensors result in noticeable improvements in shooting percentages?", "Does the player believe that playing his shot as a sound would get annoying and "in the way" if practicing every day?". We found that there is a possibility that the player's shot does become more consistent with the correct sound playing. We were not able to evaluate the results further as the entire study was only done in a day, but if the results held up over a longer time period such as a month, we would be able to determine whether the sound was really what was leading to the more consistent jump

shot. Having an incorrect sound playing, after having the user accustomed to the incorrect sound, does seem to mess with the shooter's shooting rhythm showing that the sound the player is listening to while shooting does indeed have an impact on their shooting. I do believe that an actual implementation of this with sensors, reactive audio alterations, and sounds custom-made to a player's jump shot would result in noticeable improvements in shooting percentages. The players didn't seem to think the sound was annoying and having an actual sound playing to go along with the rhythmic movement of the jump shot did seem to allow them to reach the goal of physically manifesting the sound they here. I feel that this is the next step in basketball training as utilizing multiple senses in tandem results in superior results for humans attempting to get better at any precision work such as shooting a basketball.

5. Conclusion

In the end, we found that there is a very real possibility that auditory "reinforcement" and auditory "punishment" can impact shooting training. The participants generally favored shooting in rhythm with the sound, and the quantitative results somewhat reflected that. The results did vary by individual, and this would probably hold true in a more complete study with a more complete product as different individuals respond differently to auditory rhythm. We cannot determine whether this will have an impact in an actual game where you can't have players wearing earbuds while shooting jump shots. The data we found from the user evaluation study could also have many factors that skewed it, however. The participants shot the fifteen shots with the "reinforcing" sound second once they were already warmed up after shooting fifteen shots with no sound. Also, the fifteen shots shot with the altered sound were taken at after the first thirty, meaning that the participants could've possibly been tired near the end resulting in a breakdown of shooting form in some of the last shots. Due to these factors, it is difficult to draw a definitive conclusion on whether this is a superior alternative for jump shot training. We can, however, see that it does have an impact and that impact varies depending on the person. Similar projects with precision and rhythm based activities have shown promise in improving individuals' skills. This leads to the inference that a fully functioning prototype of this idea could work well for some, and that may make it a worthy pursuit. The major hurdles would be having sensors that could track the exact movements of the body without hindering the athlete and having an algorithm that creates a pleasing sound for each athlete's unique jump shot. If these hurdles could be overcome, I do believe that a long-term user evaluation study with users training with and without this hypothetical tool would show that auditory "reinforcement" and auditory "punishment" has great utility in basketball and possibly many other sports.

REFERENCES

Shooting Revolution - https://shottracker.com/articles/the-3-point revolution

Player Example 1 - https://www.sbnation.com/nba/2018/11/13/18090592/markelle-fultz-jump-shot-history-injury-free-throw

Player Example 2 - https://180coaching.org/shooting/ben-simmons-shooting-mechanics/

Ears and Muscle Memory - https://www.connollymusic.com/stringovation/understanding-connection-between-your-ear-what-you-hear-and-your-muscle-memory-for-playing#:~:text=Of%20course%2C%20your%20muscle%20memory,memory%20to%20improve%20your%20playing.

Current NBA Jump Shot Development - https://bleacherreport.com/articles/2850261-inside-the-development-of-an-nba-jump-shot