A close look at Reese Hoffa’s winning throw at the 2007 World Championships in Athletics

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ABSTRACT
This article focuses on Reese Hoffa’s winning throw in the men’s shot put at the 2007 IAAF World Championships in Athletics in Osaka. Although Hoffa, who uses the rotational technique, has been a solid, top-level performer for some years, he lacks the height of most elite shot putters and thus has a disadvantage with regards to release height. His 22.04m throw in Osaka was analysed in a biomechanical study published in NSA in 2008. Using both the study’s findings and the video material on which the study was based, the author takes a careful look at the throw from a coach’s point of view in order to see what can be learned about how the throw happened and the practical lessons that can be drawn. He details the phases of the throw, emphasising features of Hoffa’s style including his unique footwork, his body positioning and his superior release. Also discussed are some of the original study’s key findings, including release velocity, shot path trajectory and the time course of the shot velocity. The article concludes with confirmation that Hoffa was able to win on the day because of a superior balance of linear and angular momentum and advice for coaches of young throwers.

INTRODUCTION
Reese Hoffa (USA) has been a solid top-level performer in the shot put for some time. In recent years, he has won his event at both the IAAF World Championships in Athletics (2007) and the IAAF World Indoor Championships in Athletics (2006) and his battles with fellow Americans Adam Nelson and Christian Cantwell as well as other top putters from around the world in various national and international events will be talked about for years to come.

At 5’11” (1.80m) and 315 pounds (142kg), Hoffa, who uses the rotational technique, is relatively short for an elite shot putter, but average for weight. Cantwell, for instance, is a few pounds lighter but seven inches (18cm) taller. We could say, therefore, that Hoffa has a slight disadvantage in not being able to attain the release height of most other elite throwers.
So, how did Hoffa, who is coached by Don Babbitt of the University of Georgia in the USA, manage to win at the 2007 world championships in Osaka? His 22.04m winning throw was analysed by BYUN et al. (2008) as a part of a study of the event published in New Studies in Athletics.¹ The results revealed technical aspects of the throw that intrigued me and are, I believe, important for coaches. The authors conclude that Hoffa utilises both linear and angular momentum of body to a great extent. In contrast to Nelson, placed second that day, who seems to emphasise angular momentum.

The purpose of this article is to take a careful look at Hoffa’s winning throw to see if we can all learn HOW it happened and what this might tell coaches of other athletes. Using the SiliconCOACH² software package to analyse athletes at the University of New Hampshire, I had been making videos of shot putters and then matching them frame by frame with Hoffa, which enabled me to see things that otherwise might have eluded me. I also started to see Hoffa’s incredibly consistent approach to this event. This gave me the idea to investigate how Hoffa won in 2007 by first going through the phases of the throw using the video material on which the original study was based and then by revisiting some of the key findings of the study. It was interesting and exciting to have both the video to review and the precise data produced in the study. By providing various shots from the video using SiliconCOACH, I hope that coaches can benefit as I did.

**Description of the Throw**

**Positioning the shot**

The four photos in Figure 1 illustrate Hoffa’s positioning of the shot at the start of the throw. The shot is placed under the ear with the elbow up. As the shot is placed, note there is a slight turn to Hoffa’s right, and that the weight has shifted to the right leg. At this point, inexperienced throwers are normally huffing and puffing, ready to tear the shot in two, but we can see that Hoffa is relaxed. As the throw proceeds, watch how smooth and controlled the action is.

**The wind-up**

In Figure 2, we see that there is a sideways movement of the weight from the right leg to the left and again how relaxed and confident the athlete is. Even though the left arm is extended, there isn’t any tension.

Figure 3 shows the movement right to the end of the wind-up phase. The legs have a slight bend, and in the second picture, there is a hip/shoulder separation, or “torsion”, as BYUN et al. refer to it (see Figure 14). At this point there is very little lean or “tilt”, as the authors say. Here is where the throw really begins, as everything so far has been preparatory.

**First double support phase**

Hoffa initiates his movement to his left, and it is now that we can start to refer to the acceleration curve, along with the trajectory of the shot, as viewed from overhead. In Figure 4, we can see that the left arm is leading the way, while the left leg actively follows.

The arrow in picture two of Figure 4 shows that Hoffa has a unique turning motion with his left foot. We can see that he is on his left heel, resembling what a hammer thrower would be doing. This, I believe, resembles “unseating”, which we know the glide technique shot putters use. It gives Hoffa a slight edge, as he is able to get his centre of mass to move in the direction of the throw. It is interesting to see an elite thrower with a rather advanced technical variation, something perhaps only seen in the discus in recent years. In order to effectively push off, Hoffa will switch back to a conventional, on the ball, turn of the left foot.

**Single support phase**

In Figure 5 we see Hoffa back on the ball of the left foot, with a good bend of the left leg, the left arm extended and the right foot off the
Figure 1: Positioning of the shot

Figure 2: Rocking into the wind-up

Figure 3: The wind-up

Figure 4: Initiation of the turn
ground. Here he is ready to perform a second unique and valuable movement. The second picture in Figure 5 shows the right leg has risen and the feet are quite separated. Then in Figure 6 we see the position of the right foot: it is low to the ground, as low in this part of the throw as perhaps any thrower has achieved.

**Flight phase**

In Figure 7 Hoffa has used a short sprint action, with the left leg remaining bent, to drive low across the circle. At the same time, his left arm is coming in to aid in creating the large torsion angle he will achieve upon right foot touchdown. Many throwers make a mistake at this point by “jumping” too far across the circle. Aided by his efficient movement across the circle, Hoffa will achieve a very effective throwing position. In these photos we can see determination, but not tension.

**Right foot touchdown**

The first picture of Figure 8 illustrates another unique aspect of Hoffa’s technique: the early landing of the right foot. As a coach, may I say WOW! What we see here is a coiled spring, tilting back, with an excellent right foot position, and then a right to left action. Look at the fourth picture, which shows the left arm coming out to delay the shoulder rotation. You can almost feel the power that will come from the right side when that left foot touches down.

**Left foot touchdown**

In Figure 9 we see how Hoffa achieved the 14.07 m/sec release velocity reported by BYUN et al. (see Figure 12 and Figure 13). All the work he has done up until this point has put him into a superb throwing position. His lower body is being driven by the right side while his shoulders are delayed by his left arm. There has been an accumulation of angular momentum and now there will be an application of linear momentum.
The release

Many coaches want to see a big left leg lift at the release, which elevates the thrower. For the inexperienced thrower, this often results in jumping up, and not accomplishing much in delivering the shot. In contrast, Figure 10 shows Hoffa teaching a master class in the release. He is working every single ounce of power out of the ground while at the same time driving the right side into a solid block of the left side. Note that at the moment of release he is barely off the ground.
This photo sequence simply shows a well-coached athlete using the mechanics he was capable of, more efficiently than the others in the competition.

Biomechanical Findings

Shot path trajectory

Let’s now turn to some of the other findings of the study. Figure 11 shows the trajectory of the path followed by the shot (top view and side view) for the best throw of each of the finalists in the 2007 World Championships in Athletics. Remember the mention above of the left leg bend as Hoffa entered the turn?

Look at the dip in his trajectory (side view) compared to that of Nelson, who had a flat line on his 21.61m best throw of the day. In contrast, eighth-placer Yuriy Bialou (BLR) actually raised the trajectory quite a bit on his 20.34m throw, meaning his movement was not as effective as those of Hoffa and Nelson.

Comparison of Hoffa and Nelson

From the top views in Figure 11, we can see that Nelson’s movement was considerably smaller in the turn compared to Hoffa’s. Following the remarks of BYUN et al., this may be the result of Nelson giving up some linear momentum in favour of angular momentum.
With that said, the results for release velocity were nearly the same: 14.07 m/sec compared to 14.06 m/sec, and there was only a small difference in release height: 2.34m compared to 2.38m. However, the angles of release were 32.35º for Hoffa compared to 30.77º for Nelson. Therefore, if there is any aspect here from which to draw a conclusion, it is that Hoffa’s greater angle of release gave him the winning edge. Another of the
study authors’ statements is appropriate here: “It can be proposed that the aim of the preparation for the delivery is to accelerate the whole body and secure a favourable body configuration rather than to accelerate the shot itself.”

With his balance of angular and linear momentum, Hoffa was able to achieve more or less the same release velocity as Nelson with a better body position for an advantageous angle of release and, by that, a victory on this occasion.

The technique and style of Nelson, with his more explosive approach to the shot, and his dynamic left leg action, should be covered in another article and, although not present at this competition, Cantwell too offers another interesting approach to shot put technique.

**Time course of shot velocity**

Figure 12 gives the time course of shot velocity (resultant velocity shown) of each of finalists’ best throw in the competition. Hoffa’s line shows a typical drop in velocity, which began as his right foot landed. But wait, you might well be thinking, didn’t he point out the right foot action as a unique and valuable feature earlier? The answer is yes: it is unique and it is valuable because Hoffa uses it to put his body into a more effective throwing position, thus negating the temporary drop in shot
velocity. Compare this to Nelson, whose line wavers but does not show the same magnitude in drop of velocity as Hoffa's and who achieves effectively the same release velocity as Hoffa, but who is not able to match Hoffa's angle of release.

Linear and angular momentum

The major point I want to note from Figures 13a and 13b is the magnitude of Hoffa's maximum resultant linear momentum, which was 368.9kg/m²/sec. It was achieved after Hoffa had left the rear of the circle and just before the moment of left foot take-off. This figure exceeds that of Nelson and even that of the best glide thrower on the day, Andrei Mikhnevich (BLR), who was third with 21.27m. In other words, Hoffa had the most successful drive in the direction of the throw.

Note the high level of Nelson's angular momentum and particularly the peak of the angular momentum for his left leg compared to the same figures for Hoffa.

Trunk tilt and torsion angle

Figure 14 details the forward-backward trunk inclination, and the angle of torsion in the trunk for the three medallists. There is not much difference between Hoffa and Nelson in the tilt. One item pointed out by the study authors is that "Nelson shows a more rapid recoil than Hoffa." The recoil refers to the tor-
sion, and here it means the decrease in the angle between the hips and shoulders.

Conclusion

Hoffa won the men’s shot put at the 2007 IAAF World Championships in Athletics because on the day he had a superior balance of linear and angular momentum. If there was a small edge, perhaps it was in the release angle. The practical message here is that shot putters with good tilt and torsion are able to achieve throwing positions that make an effective transfer possible.

None of this means that a particular athlete should take these pictures and try to copy Hoffa’s technique. However, the coach can see some really good aspects of this technique, and make corrections. For example:
- If the athlete is “lunging” out of the back, show him/her how Hoffa does it;
- Younger athletes like to crank up in the wind up, but as the photos show Hoffa certainly does not (and neither do many of his peers);
- Many athletes over-rotate out of the back and never achieve the location that Hoffa and others achieve with their feet.

Use the photos wisely!

Acknowledgements

I would like to thank Prof. Kiego Ohyama Byun for his assistance, particularly with obtaining permission from the Science Committee of the JAAF (Japan Association of Athletics Federations) for me to examine and use the videos taken of the throw covered in this article.

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REFERENCES

4. Ibid.