

# THE IMPORTANCE OF ARM-SWING DURING FORWARD DIVE AND REVERSE DIVE ON SPRINGBOARD

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## *Introduction*

In the performance of springboard dives from either the forward or reverse group, the competitor begins with an approach consisting of a minimum of 3 steps followed by a hurdle and take-off. To date, little, if any information of the approach, hurdle step, and take-off has been published in Japan (Miller, 1974, 1981, 1984). This study focuses on the performance of a top Japanese woman diver. Analysis of films provided a unique opportunity to study springboard diving performances and to develop a data base on selected continuous temporal form and angles of the hurdle step and take-off of an elite female springboard diver. The

purpose of this study is to identify the segmental significance of arm-swing during diving performance, especially with regard to both the forward dive and reverse dive on the springboard.

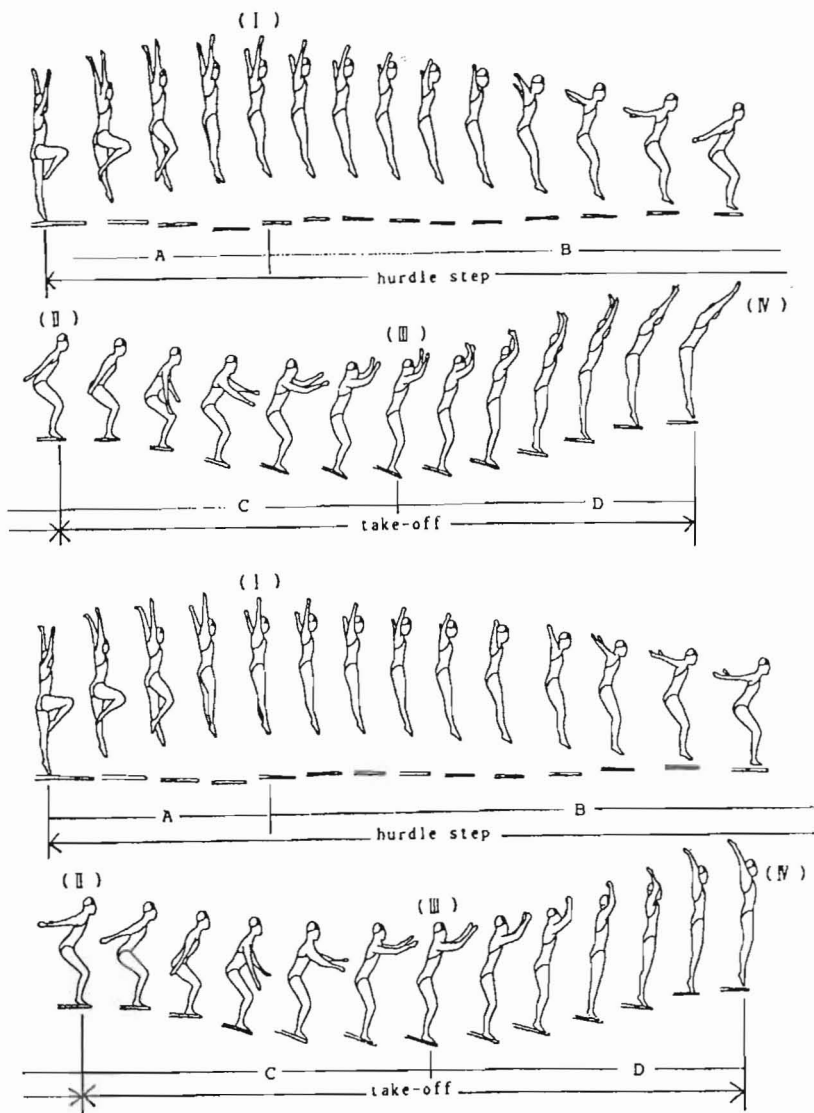
### *Method*

One Japanese elite female diver from Tenri University Diving Team, Japan, subject Y.M., height 157 cm, weight 50.0 kg, age 18 with nine years of experience was the subject of the study. She performed forward and reverse dive exercises on a 1 meter springboard. She won successive all Japan women's springboard diving championships from 1985 to 1987. Films were taken by a Photo-sonics 16 mm camera. The camera loaded with Fujicolor Reversal Film (ASA 500), was positioned in the pool area 20 m from the far board. The shutter factor was 1/800 and the Angenieux zoom lens was set at its maximum aperture of  $f/3$ . The camera operated at 100 fps during the exercise. The film was analyzed with NAC microcomputer and digitizer for kinematic data from which to generate the diagram of continuous form, orbit, graph of angle changes and diagram of hurdle step and take-off patterns for each diving performance.

### *Results*

The results fell into 4 major phases for the forward dive and reverse dive, respectively. They were as follows:

- (a) From last contact with the hurdle support foot to peak of flight.
- (b) From peak of flight to initial contact with both feet at take-off.
- (c) From maximum depression of board to final contact with both feet at take-off.
- (d) From maximum depression of board to final contact with both feet at take-off. (Figure 1).



As for phase A, there was little difference between the forward dive and the reverse dive.

As for phase B, the arms in the forward dive were brought down earlier than those of reverse. The forward dive seems to have started the arm-swing earlier than the reverse dive to set the arm for

forward rotation at take-off. The difference between the arm positions in the forward and reverse dives at initial contact, with both feet positioned for take-off is shown in Figure 2.

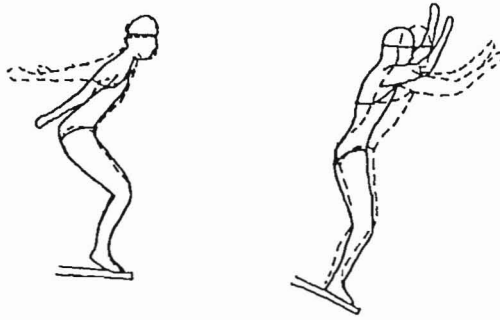


Figure 2: Diagrams of temporal form at initial contact with both feet at take-off (left) and maximum depression of board (right) in forward figure (——), and reverse figure (.....).

On the average, the shoulder angle, as determined by the segmental end points of the right wrist, shoulder and greater trochanter, showed that the reverse had a larger angle than the forward (49.4 vs 25.2 degrees). (Table 1, Figure 3).

During phase C, the phase from board contact to total depression, the forward-arm-swing began earlier and moved higher, for the forward dive when compared to the reverse dive (Figure 2). On the average, the shoulder angle at maximum board depression demonstrated a larger angle for the reverse dive as compared to the forward dive (238.7 vs 227.0 degrees) (Table 1, Figure 3). Elbow angle, as determined by the segmental end points of the right wrist, elbow and shoulder, also determined, that the reverse dive produced a larger angle than the forward dive (144.8 vs 122.7 degrees) Table 1, Figure 3). Since the forward dive always demonstrated a smaller angle during this phase, it is suggested that the range of forward arm-swing should be smaller for this dive than for the reverse dive.

As for phase D, although the reverse dive had a larger elbow angle during phase C, the forward dive produced a larger elbow angle during phase D than did the reverse dive at final contact during take-off (173.8 vs 159.5 degrees) (Table 1, Figure 3). In the forward dive, arm-swing was smaller before the board recoil; after that point, it became greater for forward rotation. On the other hand, for the reverse dive the arm-swing was greater before board recoil and then became smaller after that point for backward rotation.

Table1: Angle of shoulder and elbow during each dive performance,  
 (I) peak of flight at hurdle, (II) initial contact at take-off, (III) maximum depression of board, (IV) final contact at take-off.

position	shoulder (degree)		elbow (degree)	
	forward	reverse	forward	reverse
(I) peak of flight at hurdle	195.1	190.1	172.5	176.5
(II) initial contact at take-off	25.2	49.4	177.8	190.1
(III) maximum depression of board	227.0	238.7	122.7	144.8

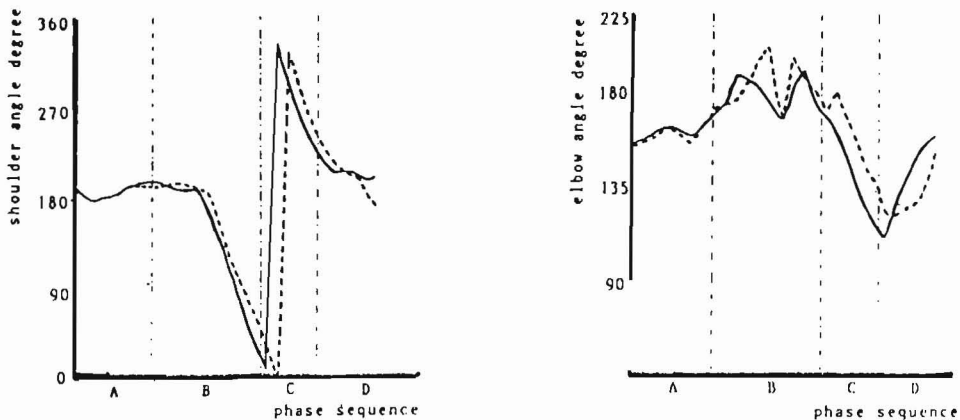


Figure3: Angle changes of shoulder and elbow during forward and reverse dive performance, respectively, in forward figure (——), and reverse figure (-----).

### Conclusion

During the hurdle step of spring board diving, the arm-swing pattern of the forward dive differs from that of the reverse dive. Both of these swing patterns enable the diver to better execute the airborne phases of each dive. Due to this noticeable difference in swing pattern, the hurdle step and take-off may be distinguished in each dive.

In order to create rotation during the forward dive, it is necessary to swing the arms forward as soon as the board begins to recoil. Therefore, the diver must be ready while the board is depressed. For the reverse dive, the arms are swung more quickly during the latter half of the board recoil in order to create a backward rotation so that the diver's body will not strike the board.

As coaches instruct their divers, they may not always understand that the arm swing on approach, hurdle step and take-off is different for the forward and reverse dives. These are not quite distinguishable from the airborne phases. It is suggested that coaches could become better instructors if they understand the specific components of the chain of motion for each dive, including the approach, hurdle step, and the take-off in springboard diving.

## *References*

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