# THE APPROACH RUN IN THE POLE VAULT

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*This is a follow-up article to Dr. Hays'contribution to* TT # 105 *"The Approach Run in the Long Jump." Despite some filming problems, noted by the author, it appears that vaulters also adopt a visual control strategy in the final stages of their approach. It also appears that elite pole vaulters were more efficient during the initial, programmed approach phase. This is not surprising considering the far more dire consequences the vaulter faces if he is in the wrong position at takeoff.*

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The strategies used by long jumpers during their approach to the board have been the subject of two recent studies. Lee, et al. (1982) studied the approach runs of three female long jumpers and concluded that they maintained consistent striding patterns until they were a few strides from the board and that they then switched to regulating the lengths of their strides according to their visually-perceived relationship to the board. If they saw they were too close to the board, they shortened the remaining strides; and, if they saw they were too far from the board, they lengthened them. (The process of attempting to maintain a consistent, or stereotyped, striding pattern during the first part of the approach, will be referred to here as using a *programming strategy;* that of attempting to correct for errors that have accumulated in the striding pattern will be referred to as using a *visual control strategy*).

Hay (1988) noted that the findings of Lee, et al. could not be considered applicable to long jumpers in general because of the small number of subjects involved, because they were all female, and because they were of a narrow range of ability (PBs of 5.78-6.54m). He therefore conducted two studies to replicate and extend the work of Lee, et al. The first of these revealed that all the subjects of the study (28 elite male and female long jumpers) used a visual control strategy during the final strides of the approach. The second study revealed that, on average, the subjects (19 elite male and female long jumpers, in this case) changed from a programming to a visual control strategy five strides from the board.

Given the obvious similarity in the approach run for the long jump and the pole vault, it seems reasonable to assume that competitors in this latter event might also make use of a visual control strategy to guide them into the desired position for takeoff.

## PURPOSE

The purpose of this study was to determine whether elite pole vaulters use a visual control strategy during the final strides of the approach to the takeoff.

## PROCEDURES

High-speed films of the final of the pole vault at the 1984 Olympic Games were taken as part of a biomechanics filming project sponsored by the International Olympic Committee Medical Commission. These films showed the last 5-7 strides of the approach of each vaulter on each trial.

The films were digitized to obtain the horizontal distance between the toe of the support foot during the support phase preceding each stride and the position of the top of the top hand at the instant of takeoff (*the toe-hand distance*). For this purpose, the instant of takeoff was defined as the instant depicted in the last frame prior to the foot breaking contact with the ground.

For each athlete, the standard deviation of the toe-hand distance for each support phase was computed. (The standard deviation is a measure of how the athlete varied from trial to trial in the placement of his foot.) The standard deviations were then plotted against the support phase, as shown in Figure 1.

## SUPPORT PHASE

The standard deviation of the toe-hand distance plotted against support phase for Thierry Vigneron (France). The support phases are numbered so that 0 represents the

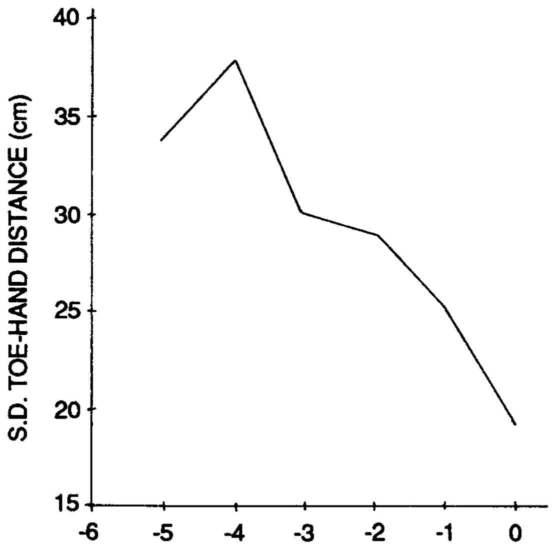


FIGURE 1 VIGNERON (FRANCE)

support phase immediately preceding the takeoff into the vault, -1 represents the support phase preceding takeoff into the last stride, -2 represents the support phase preceding the takeoff into the second-last stride... and so on.

Assuming that the athlete sets out to reproduce the same striding pattern he has practiced over countless training sessions—that is, to use a programming strategy—an overall increase in the standard deviation during the first part of the approach indicates that small errors in striding have gradually accumulated as he proceeded down the runway. A general decrease in the standard deviation during the final strides of the approach indicates that he has taken some corrective action. Or, specifically, that he has used a visual control strategy to modify the lengths of his last few strides before takeoff.

## RESULTS AND DISCUSSION

The filming arrangement (camera positions—etc.) for the pole vault at the 1984 Olympic Games were less than ideal for the purpose of this study. This is exactly as expected given that they were not taken with this purpose in mind. At best, the film records permitted only the last 5-7 strides to be evaluated. Furthermore, many of the support phases were obscured by officials, athletes and others positioned or moving between the camera and the subject at crucial times. Despite these shortcomings, some initial indications could be obtained concerning the strategies used.

All twelve finalists used a visual control strategy over the final strides of the approach. The maximum value of the standard deviation to the toe-hand distance range from 6 cm (Lytle) to 33 cm (Vigneron) with an average of 17 cm. This maximum value was recorded for the seventh-last to the second-last support phase before takeoff. On average, the maximum value—which value was taken to signal the adoption of a visual control strategy—was recorded for the fourth-last support phase of the approach.

These findings are of particular interest when compared with those recorded previously for seven finalists in the men's long jump at the 1986 TAC Championships (Hay, 1988). In this latter case, the maximum value of the standard deviation of the toe-board distance ranged from 15 cm to 44 cm with an average of 24 cm. This maximum value was recorded for the eighth-last to the third-last support phase before takoff. On average, this maximum value was recorded for the fifth-last support phase.

Assuming that changes in the location of the start mark had little influence on the measured standard deviations in the two cases, it thus appears that the elite pole vaulters studied were more effective in performing the initial programmed phase of the approach than a comparable sample of elite male long jumpers. While there may well be other explanations, it seems likely that this difference is due to pole vaulters making more full-length approach runs in training—and, with the great stresses that an incorrect position imposes on the body, to having a much greater incentive to be in the right position at takeoff!—than do long jumpers.

The pole vaulters also adopted a visual control strategy one stride later, on average, than did the long jumpers. It is tempting to suggest that, with less accumulated error in their striding, the pole vaulters did not have to start making corrections as early as did the long jumpers. There is, however, little support in the previous research (Hay, 1988) to suggest that the point at which a visual control strategy is adopted is related to the amount of error accumulated up to that point.

Finally, it was evident that the corresponding toe-hand and toe-board distances differed considerably between the two groups of subjects. For example, the average toe-hand distance for the support phase preceding takeoff into the seventh-last stride was 13.67 m for the pole vaulters, and the corresponding toe-board distance was 17.11 m for the long jumpers. Thus, the average length of the last seven strides was 1.95 m for the pole vaulters compared with 2.44 m for the long jumpers. This pronounced difference was no doubt due to differences in the approach velocity-differences that were in turn due to the vaulters having to carry a pole and, in all probability, to their having less sprinting ability than the long jumpers.

## CONCLUSION

While limitations in the data require that the findings of this study be considered indicative rather than conclusive, they are sufficiently consistent with what has been found previously for long jumpers (Lee, et al. 1982; Hay, 1988) and triple jumpers (Hay and Koh, in press) to encourage the view that a more comprehensive study now in progress (McGinnis, personal communication) will confirm that pole vaulters make use of programming and visual control strategies in much the same way as do their counterparts in the horizontal jumps.

## REFERENCES

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