

The filming of table tennis

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Abstract It is obvious that TV broadcasting has contributed to the accessibility and growth of modern sports. However, the TV camera can rarely capture the dynamics of the fast-moving sport of table tennis. Camera techniques for capturing the action and skill of table tennis are not good enough to attract the attention of the sports public. Therefore, I studied the best way to film table tennis, in order to make it a true major sport.

Based on properties of table tennis, I propose three important considerations when filming table tennis: filming the motion of the ball clearly, filming the players in full frame, filming the speed and the spin of the ball. I named these the "CFS criteria". Because table tennis is a small-scale sport, advanced camera techniques must be used to zoom in and show the true speed of the ball.

Focusing my attention on these considerations, I analyzed how to address the special camera techniques needed for filming table tennis. First, I simulated TV images by calculating various camera positions in relationship to the field of play and the image to be filmed. Next, I evaluated actual broadcast images. The actual broadcast removed the camera so far from the game that the image appeared to be only two-dimensional. The result is that we do not experience the true speed of the ball. Analyzing these problems, I proposed the best camera position, which can capture the power and movement of the game, and proposed a definite plan for ideal filming.

(Key words: filming, camera position, broadcast, CFS criteria)

1 The problem of table tennis on TV

As you know well, table tennis does not have enough popularity on TV. One of the most important reasons is the quality of filming. The TV camera can rarely capture the dynamics of the fast-moving sport of table tennis. Camera techniques for capturing the action and skill of table tennis are not good enough to attract the attention of the sports public. Therefore, I studied the best way to film table tennis, in order to make it a true major sport.

2 Three considerations of filming table tennis

The special properties of table tennis compared with other sports are the small

ball, the small playing area and the restricted action of the players. These special properties make the filming of table tennis difficult. That is: the ball is too small to see, and the images have no power because player's action is restricted. So we should increase the power of the image by filming players in full frame and by enhancing the energy of the ball (its speed and spin).

Based on these problems, I extracted three important considerations for filming table tennis.

- * Filming The Motion of The Ball Clearly
- * Filming The Players in Full Frame
- * Filming The Speed And The Spin of The Ball

I named those the "CFS criteria". To satisfy the CFS criteria, special techniques are needed when filming table tennis.

3 Calculation

Focusing my attention on the CFS criteria, I began to analyze how to discover the special camera techniques needed for filming table tennis.

3.1 Camera position dependence of images

Figure 1 shows the definitions of parameters that I used for calculations. Figure 2 is the calculated result showing how the image would appear in a TV display with various camera positions. These images the length of the net and the side-angle are constant. Only the distance and the height-angle change.

As you can see, if camera distance is large, sidelines of the table appear parallel and the image appears two-dimensional and it causes the image to be unrelated to the speed of the ball. And if the camera position is high, we have the same two problems. Additionally, if the actual speed of the ball on the TV display increases, it becomes hard to follow the ball, ironically. And the track of the ball appears straight so we cannot deduce the spin of the ball.

Only a short distance and a low-positioned camera can capture both the speed and the spin of the ball completely and it guarantees ease of following the ball.

3.2 Camera position dependence of image size

Image size is a problem not only of zoom-in technique, but also of the filming angle, because zoom-in ratio is limited by the filming angle when the camera covers all of the playing area.

Figure 3 shows how the image size is influenced by height-angle and side-angle. The player's size is shown as two lines, and 20cm ball is shown a square at the center of the table. The image size is adjusted to a 4:3 TV frame.

As you can easily understand, if the height-angle or side-angle becomes large, the camera operator must zoom out until the TV frame covers the whole area. So a small camera angle can make large images. This effect on image size is a larger problem than that of the recent change in ball diameter.

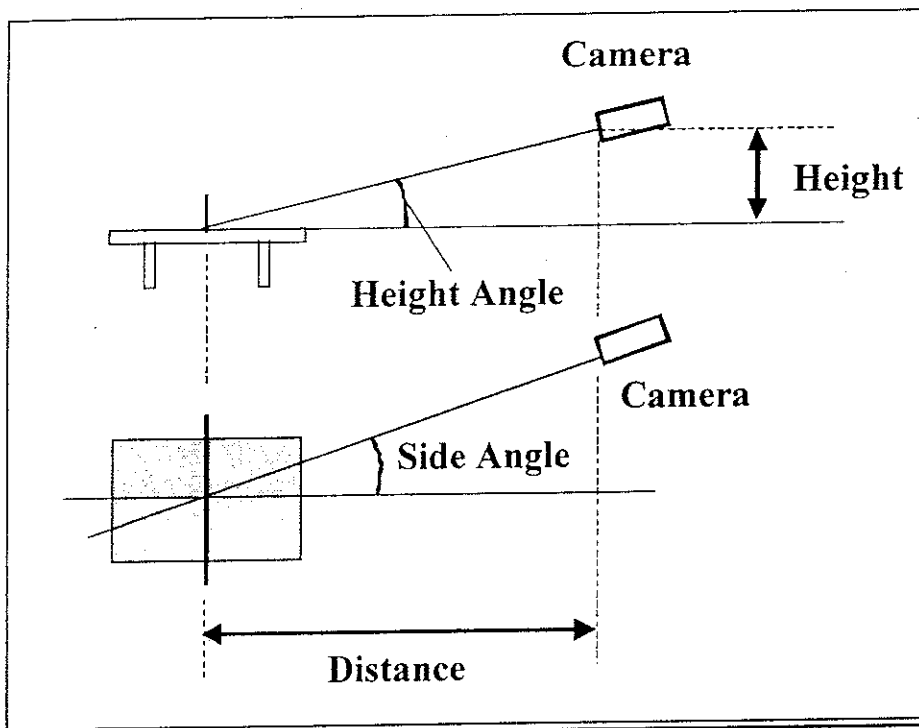


Figure 1. Definition of parameters

Side-angle = 10 degrees constant
 Normalized by net's length

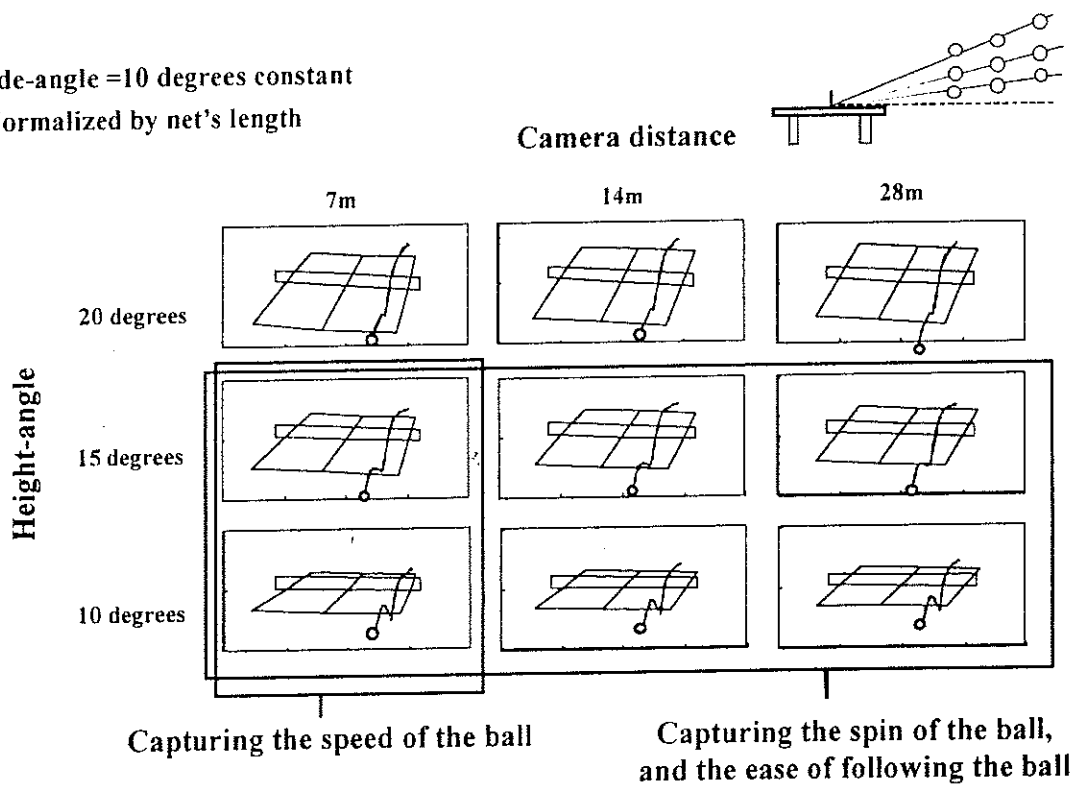


Figure 2. Dependence of image on Camera position

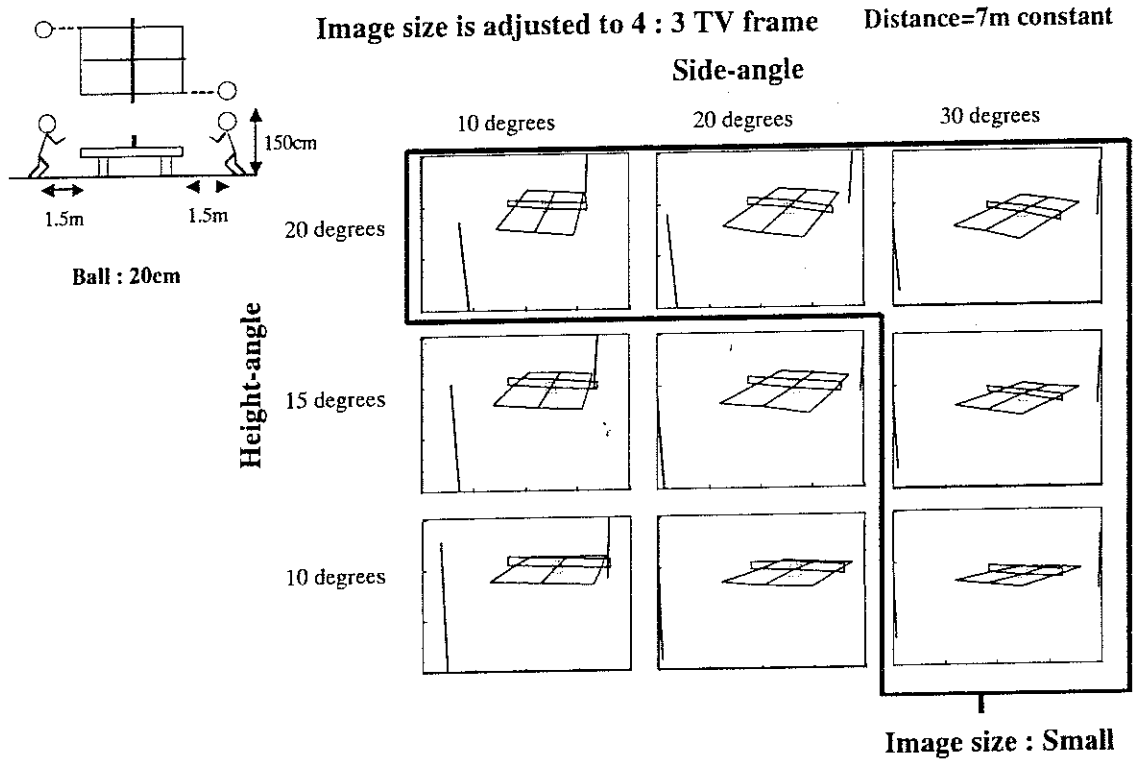


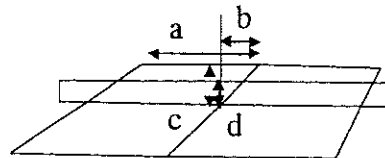
Figure 3. Dependence of image size on Camera position

3.3 Ideal composition and camera position

Figure 4 shows the ideal composition and ideal camera position. A short distance and small camera angle can capture the spin and the speed of the ball and can film the players in full frame. Please check your videotape using this standard.

$$b < \frac{2}{3} a$$

$$d = \frac{1}{2} c \sim \frac{3}{4} c$$



Standard of ideal composition

- Distance : less than 12 m
Capturing the speed of the ball
- Height-angle : 10~15 deg.
Capturing the spin of the ball,
Capturing the player in
full frame
- Side-Angle : less than 20 deg.
Capturing the speed of the ball,
Ease of following the ball
Capturing the player in
full frame

Figure 4. Ideal composition and camera position

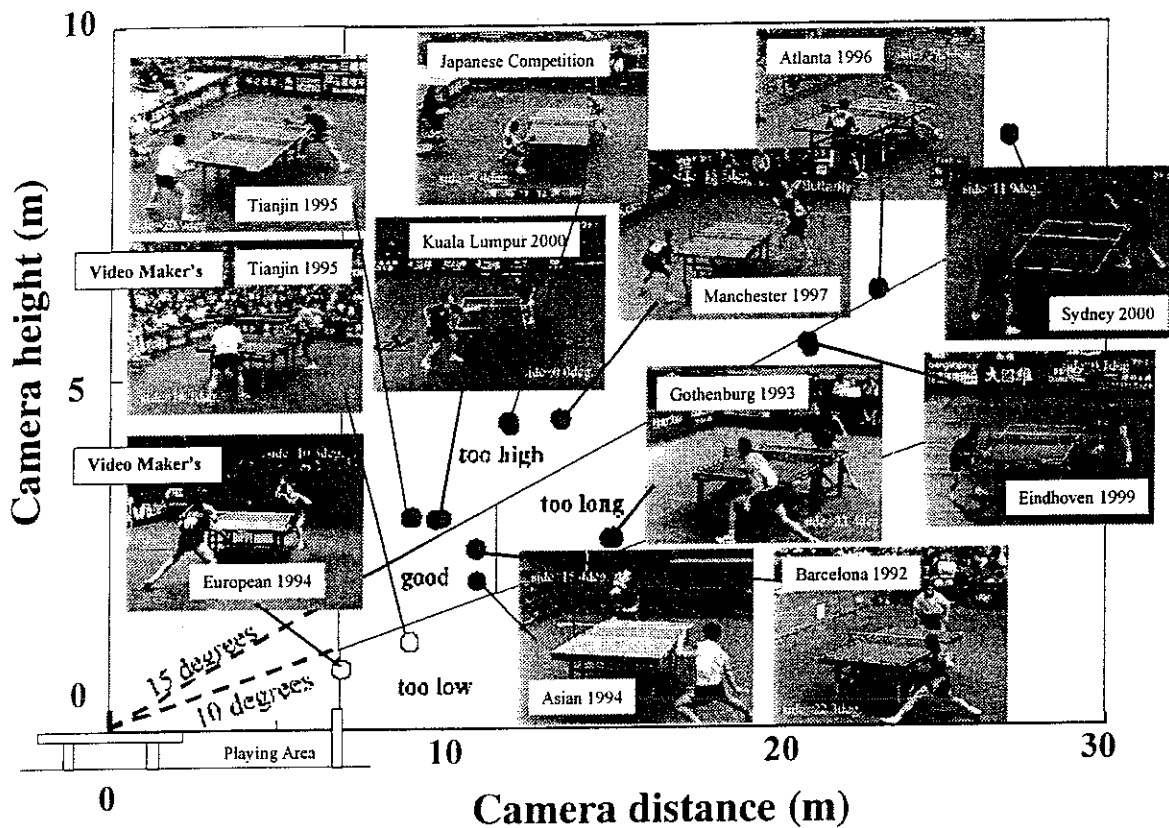


Figure 5. Estimated camera positions of actual TV images

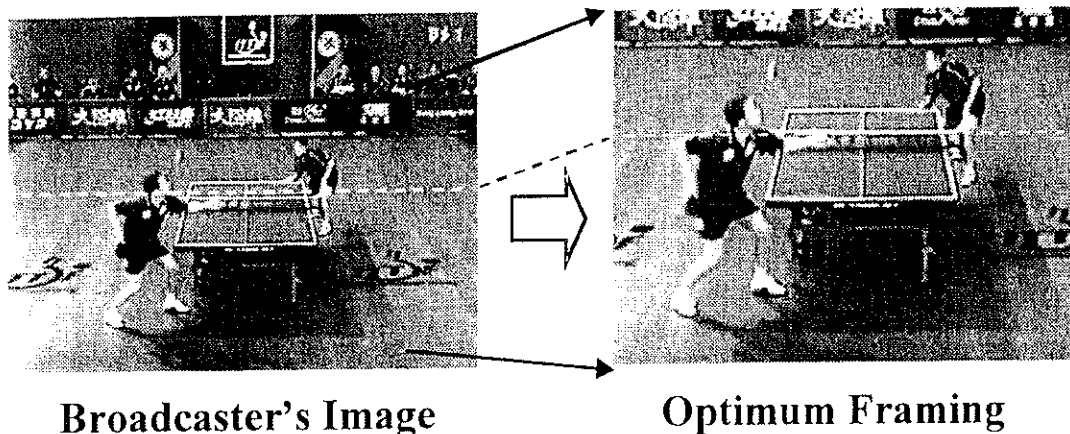
4 Results of analysis of actual TV Images

Figure 5 shows actual main-camera images from world championships and Olympic Games. From these images I estimated the camera positions, which are shown in Figure 5.

As you can see, almost all the broadcasters' camera positions are too long or too high. When the camera distance is too long (examples; Eindhoven 1999, Atlanta 1996, Sydney 2000), the images appear two-dimensional and removed from the speed of the ball. On the other hand, when the camera distance is short enough (example; 1994 Asian), the image can capture the speed of the ball very well.

And when the camera is too high (examples; Manchester 1997, Japanese Competition), the images become too small. The Japanese Competition especially is terribly small because of the large height-angle. We should never film like this. Additionally there is another problem at this image: The framing. As I show at left image of Figure 6, the camera operator positioned the net at the center of the frame, losing the chance of filming the player in full frame. If they frame it as the image on the right of Figure 6, the image size would increase. So we should request them to give priority to image size over the symmetry of the image.

On the other hand, the Video maker's camera position is close enough and low enough images of the players are large enough and capture the speed and spin of the ball by its track. But the camera position is too low so we cannot see both sides of the tables. Furthermore this image has the problem of following the ball, because of the brightness of the background. So if we place the camera at lower position, we should take care of the background problem. European 1994 is a good example of background.

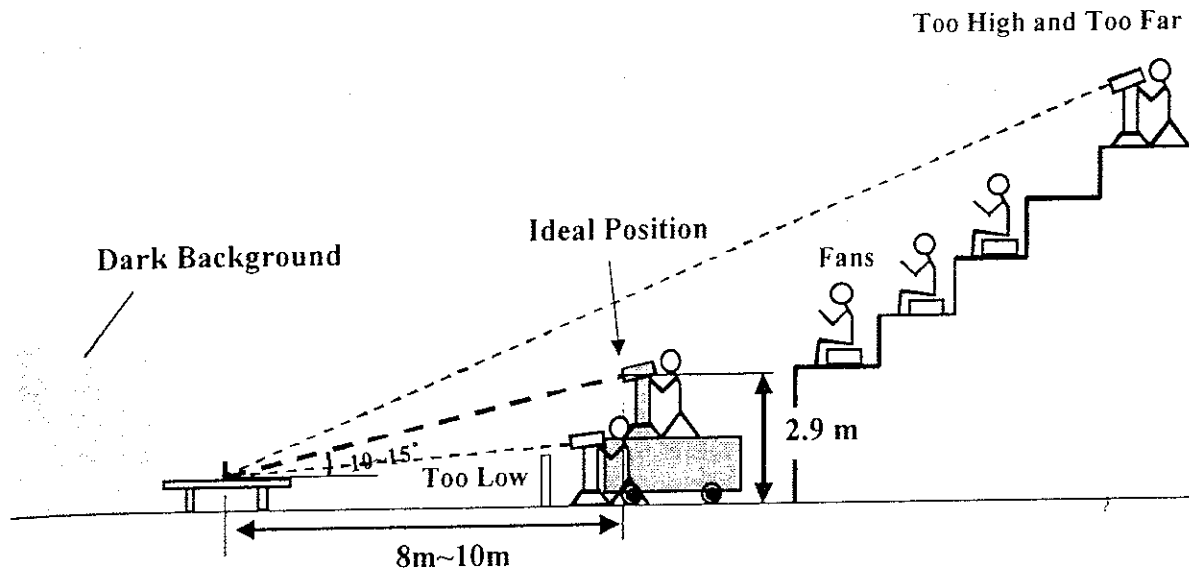


Give priority to image size over vertical symmetry

Figure 6. The problem of framing

5 Definite plan for ideal camera position

Generally, the broadcasters place their cameras at a long distance, so the camera height is limited by the design of the hall. Why do they place their cameras at along distance? Because the image filmed by a long-distance camera is stable and symmetrical and beautiful as a picture. So we should request them to place their cameras at the ideal position by giving priority to power and excitement over the beauty of the image. And if their camera-stand doesn't have enough height for the ideal position, we should prepare a special camera-stand for ideal height as Figure 7 shows. Of course we should give priority to the broadcaster's camera position over the view of the play by fans in the stands, because there are huge numbers of fans in front of the TV display. We should also prepare a dark background for low angle filming.



- Special Camera Stand for Ideal Camera Height
- Dark Background for Low Camera Position

Figure 7. Definite for ideal filming

6 Conclusions

Based on the special properties of table tennis, I proposed the CFS criteria when filming table tennis to attract the attention of the sports public.

First I determined the ideal camera position and composition by calculation.

Next by analyzing actual broadcaster's images, I concluded that most camera positions are too far from playing area and too high, so that images appear two-dimensional and do not capture the speed and spin of the ball. As a result, the images have no power.

Finally I proposed definite plans for the ideal filming for table tennis.

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