CHAPTER FIVE

Development and Application of a Framework for Assessing Movement Quality

Introduction

This chapter takes up the key finding from Chapter 4, namely, that the perspectives used for "assessing" the forward roll, did not consistently describe the case-study data. In addition, it should be noted that what is currently available within the field of gymnastics, e.g., the Australian Gymnastics Federation's scoring system, is not aimed at directly educating the athlete about their performance, and hence does not add to an understanding of the psychomotor domain.

There are two sections in this chapter. In the first section an analysis of the *indicators* for the body configurations for all cohorts is presented. This analysis provides a fine-grained portrayal of the skill under examination. The second section presents an heuristic framework, based upon a detailed analysis of the data. The framework is aimed at providing an instrument capable of discriminating between the movement qualities of individuals, across all three cohorts, children, young adults and older adults.

BODILY CONFIGURATIONS

This section reintroduces the hypothesised sequences of the forward roll, providing details of both the sequences and indicators for all cohorts. Subsequently, a new term, *descriptor* is introduced. The notion of descriptors emerged from the analysis of the indicators of filmed sequences, and refers to the position and/or placement of the performer's joints and limbs during a performance. The findings concerning the justification for the indicators and descriptors are presented in Chapter 7.

There are three subsections within this section, which involve data analysis of all three sequences – the beginning, bridging and end. Each subsection provides an analysis of the one sequence. Each subsection contains a number of pictures that are presented to show the descriptors for each indicator. Each descriptor picture is shown in decreasing order of quality, which is based upon deviations from George's (1980) gymnastics perspective. It is the magnitude of the deviations from the ideal performance that determines the descriptor hierarchy. The pictures for beginning and

end sequence descriptors are shown as single static images. The bridging sequence descriptors are shown as a series of four pictures, which form part of a series.

Beginning Sequence: Indicators and Descriptors

The beginning sequence of the roll commences when the participant stands ready, immediately prior to any initial movement, and finishes when the participant's feet leave the surface. This sequence comprises four indicators that are further subdivided into descriptors. Each descriptor has been allocated an alphabetical code, or in the case of body contact descriptors, a numeral. For example, for the beginning sequence the descriptor for the indicator of hand position "shoulder width apart" is allocated the code "sw", and for the beginning sequence "two contact points" the code is "2". A similar code structure is repeated for all descriptors for each sequence.

Indicator 1 (Beginning Sequence)

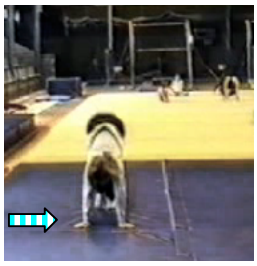
Following analysis, the first indicator was determined to be the *Hand position* on the surface, specifically, the placement and location of the hands relative to the sagittal plane. "The sagittal plane is an imaginary line lengthwise through the body running from front to back. The body is therefore divided into left and right sides" (Tortora & Anagnostakos, 1990, p. 9).

Three descriptors emerged from analysis of the first indicator for this sequence. The descriptors and code, shown in brackets, of the Hand position are:

(i) Shoulder width apart (sw)
(ii) Close to shoulder width apart is judged to be within approximately 10 cm either lateral or medial to shoulders width apart (c)
(iii) Wide of shoulder width is judged to be more than 10cm from shoulder width (w)

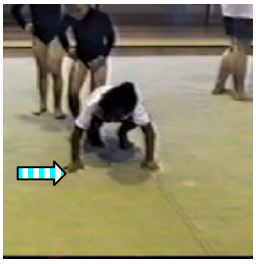
The following Pictures 5.1(i), (ii) and (iii) within Figure 5.1 illustrate the three descriptors for the beginning sequence for indicator 1.

Picture 5.1(i)



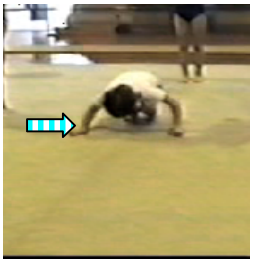
Hands shoulder width (sw)

Picture 5.1(ii)



Hands close to shoulder width (c)

Picture 5.1(iii)



Hands wide of shoulders (w)

Arrow Key: ⇨ Points to hand position

Figure 5.1: Hand position

The ideal form of the roll requires that the hands are placed on the surface shoulder width apart, as shown in Picture 5.1(i). This position affords the greatest anatomical stability.

The distance the hands are placed from the mid line of the body provides the basis for execution of the remainder of the forward roll. The initial hand placement is a critical element for a successful quality performance as it acts as a supporting mechanism and platform for the rotational aspects of the roll that follows.

Indicator 2 (Beginning Sequence)

The second indicator relates to the *Arm/elbow position*. The three descriptors apply to their anatomical positioning, i.e., the angle of the arms at the shoulder and elbow joints.

The three descriptors are:

(i) Arms flexed at shoulder and elbows extended (st)
(ii) Arms flexed at shoulder and elbows flexed (bb)
(iii) Arms abducted and elbows laterally flexed (sb)

Descriptors of Arm/elbow position are illustrated in Figure 5.2(i), (ii) and (iii).

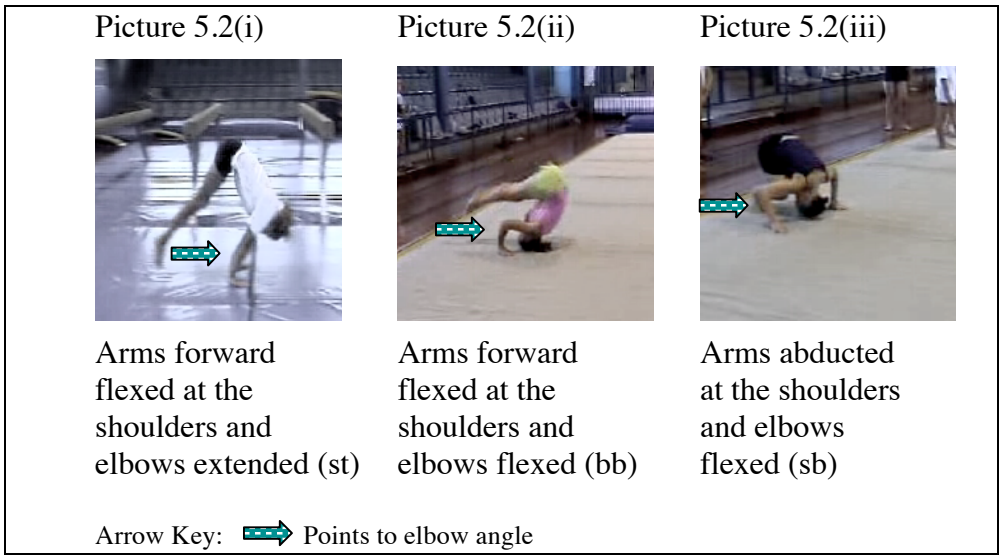


Figure 5.2: Arm/elbow position

In Figure 5.2 the highest quality performance, namely, Picture 5.2(i) shows the elbows straight (extended) with approximately 135° of flexion of the arm at the shoulder through to Picture 5.2(iii) showing the elbows flexed at more than 90° and the arms abducted approximately 90° at the shoulder.

Coupled with the hand position, the amount of flexion of the arms at the shoulder and the elbow is essential for supporting the body at the beginning of rotation. With straight arms there is little reliance on muscular strength to support the weight of the body, as the vertical alignment of the elbow joint performs this function. The greater the flexion of the elbow the more the reliance on muscular strength, especially the biceps brachii and brachii radialis, to prevent the body collapsing down towards the surface.

Indicator 3 (Beginning Sequence)

The third indicator relates to the *Head position* on the surface. Head position is assigned three descriptors, based on the point of contact of the head with the surface. The three descriptors for this indicator are:

(i) Head making "no" contact (nc)
(ii) Back of head contact (ba)
(iii) Top of head contact (cr)

Descriptors of Head position are illustrated in Figure 5.3(i), (ii) and (iii).

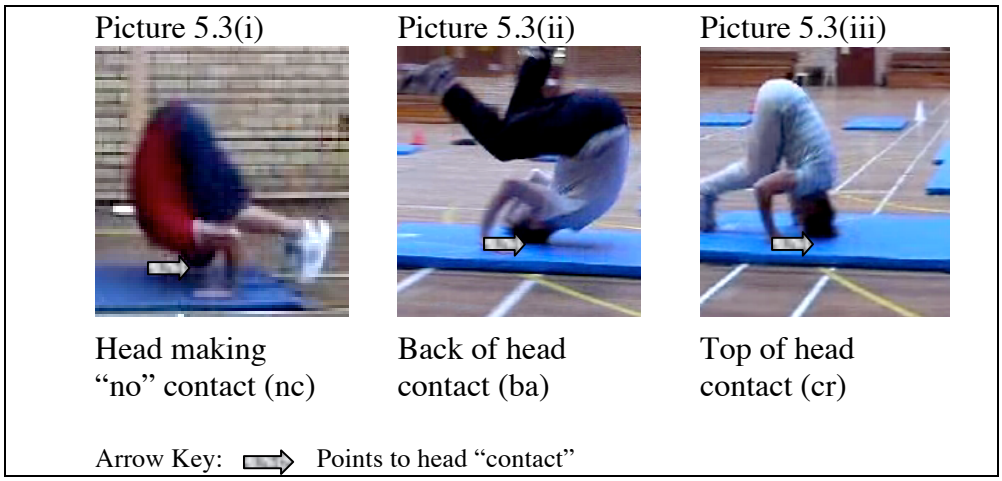


Figure 5.3: Head position

The pictures in Figure 5.3 show the three Head position descriptors. These are Figure 5.3(i) showing the head making no contact the surface, Figure 5.3(ii) shows the back of the head contacting the surface, and Figure 5.3(iii) illustrates the crown or top of the head on the surface, which is sometimes used as a fulcrum that partially (sometimes fully) supports the participant's body weight. The blocked arrows highlight the Head position. The body area across the line of the shoulders and the base of the neck is the preferred point of contact.

The position of the head is essential for a satisfactory completion of the forward roll, and most other bodily movements. With the head "raised off the surface" or with minimal surface contact with the back of the head, the rotation can be carried out smoothly and safely. Placing the body weight on the head is regarded as a potentially dangerous manoeuvre. The ability to keep the head off the surface and control the rate of rotation are indicators of a higher quality performance.

Indicator 4 (Beginning Sequence)

The fourth indicator consists of the number of *Contact points* with the surface at the commencement of the roll.

The five "body" contact point descriptors, in order of quality are:

(i) two contact points, which are the hands (2)
(ii) four contact points, including hands and both feet (4)
(iii) three contact points, both hands and one foot (3)
(iv) five contact points, both hands, feet and the head (5)
(v) six or more contact points, including hands, feet, knees and head) (6 or more)

Descriptors of Contact points are illustrated in Figure 5.4(i) to 5.4(v).

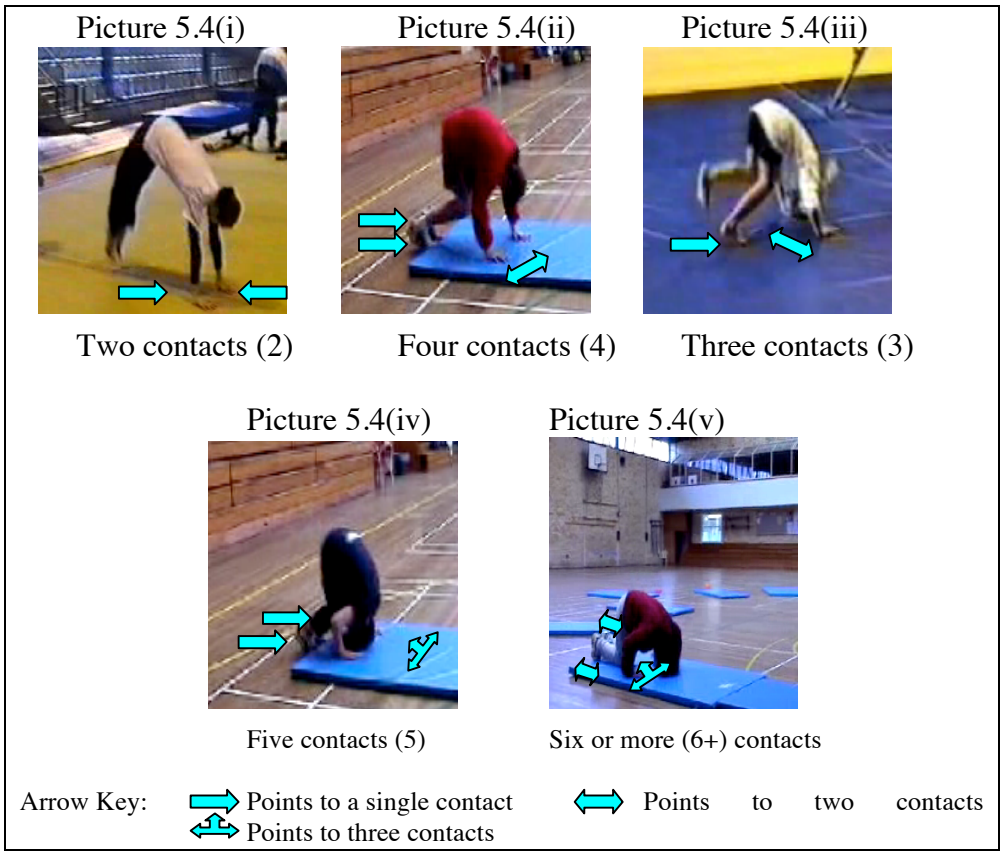


Figure 5.4: Contact Points

Figure 5.4 shows five different participants illustrating the descriptors for contact points. The ideal form of the roll shown in Picture 5.4(i) is two contact points with the surface. Two contact points indicate a "flight phase" before the hands touch the surface. Flight phase is the term used to indicate that neither the feet nor the hands are in contact with the surface and the individual is airborne, albeit momentarily.

Picture 5.4(ii) shows both hands, both feet and the head touching the surface as the roll commences (i.e., four contact points). Picture 5.4(iii) indicates three contact points, a situation which is considered lesser quality than four contacts (Federation Internationale De Gymnastique, 2002; Schembri, 1983). Three contact points indicate that the participant is attempting to initiate movement through the use of one leg to create rotational force. Using this method the participant cannot achieve a flight phase thus impeding progression to gaining higher skill levels. Picture 4(iv) shows both hands and feet on the surface and the head being used as a pivot point. In the final Picture 5.4(v), six or more contact points can be seen, which in the case pictured, there are seven contact points; head, both hands, both knees and both feet touching with the surface.

The most discerning descriptor for this indicator is the inclusion of a flight phase. Its achievement requires a coordinated sequence of bodily movements. A lower incidence of aberrant actions, involved at the commencement of the rotation, points to a lower the probability of a poor quality performance during the remainder of the roll.

Bridging Sequence: Indicators and Descriptors

The following subsection provides a description of the bridging sequence of the forward roll. This sequence commences as the participant's feet leave the surface, and finishes as the rotational aspect of the roll ceases or the feet/legs contact the surface. There are two indicators in this sequence, which emerged from the data analysis, are the position of the (i) *Hip/knee* and (ii) the *Shoulder/arm*.

For each indicator the visual representations of the descriptors, contained within this subsection, are portrayed as part of a series of pictures, whereas the previous subsection showed the images as single and static. As a consequence the descriptions are more extensive. The magnitude of the deviations from George's "ideal" was used to judge the descriptor hierarchy.

Indicator 1 (Bridging Sequence)

The first indicator is the Hip/knee position. Both the hips and the knees reflect the amount of flexion (bend) and extension (straightness) the individual exhibits. This indicator has four descriptors. The descriptors for this are shown in the series of pictures. Each one of the four individual pictures represents one part of a total routine involved in forward rolling.

The four Hip/knee descriptors are:

(i) Hip flexion, knee extension followed by flexion of both legs (sbc)
(ii) Hip and knee flexion for the duration of the roll (bt)
(iii) Hip and knee flexion followed by extension of both (bs)
(iv) Hip flexion, knees remain extended then hip extension (ss)

Descriptor 1

The following Figure 5.5 illustrates the sequence of movements required for the first descriptor: Hip flexion, knee extension followed by flexion of both legs (sbc)

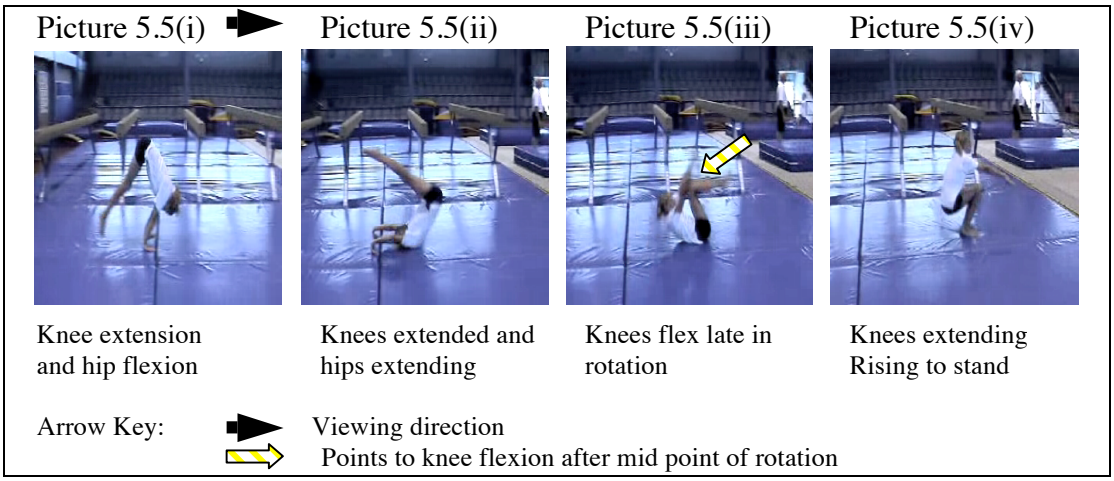


Figure 5.5: Hip flexion, knee extension followed by flexion of both legs (sbc)

The pictures in Figure 5.5 show a participant from the young adult cohort performing the ideal form of the roll, that is, the hips flexing with the legs remaining straight (knees extended) until the knees commence to flex just after the mid point of the rotation. The series, from left to right, shows the maintenance of knee extension after the back passes the vertical plane. The legs commencing to flex at the knees, after the head and upper back have left the surface. The block arrow indicates knee flexion occurring. The final picture depicts the participant rising to stand after the knees are flexed rapidly towards the end of the roll.

Descriptor 2

The series of pictures in the next Figure 5.6 shows descriptor (ii), that is a participant with Hips/Knees remaining flexed for the duration of the bridging sequence (bt).

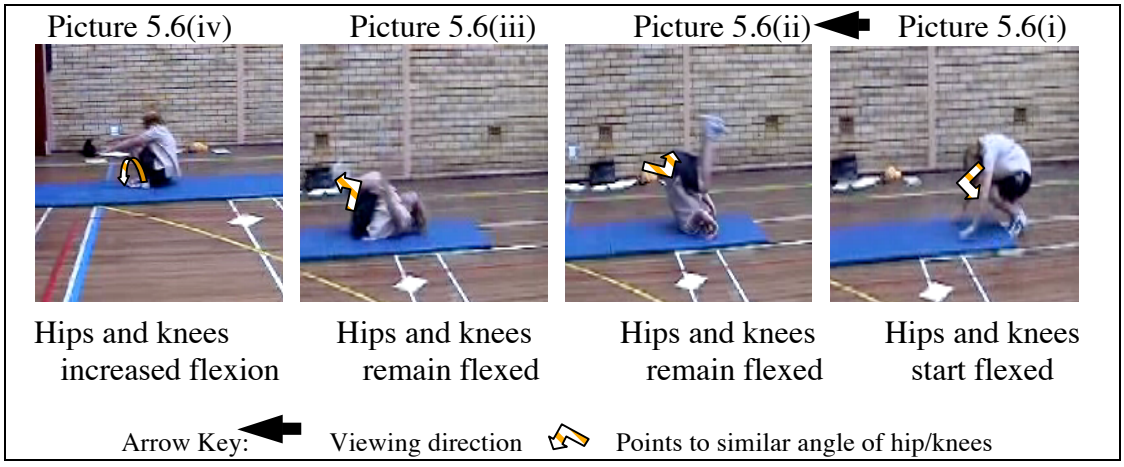


Figure 5.6: Hips/knees remain flexed (bt)

The first Picture 5.6(i) on the right hand side depicts both knee and hip flexion at the commencement of the roll. The remainder of the pictures shows the hip and knee flexion being maintained (see block arrows) after the back has passed the vertical

plane, then remaining flexed after the head and upper back leaves the surface. The final picture shows the participant just prior to rising to a standing position.

Descriptor 3

The two final descriptors for this indicator result in the cessation of rotation, because the legs are extended. As a result of knee extension, various adjustments need to be made by the participant before they can rise to a standing position.

Figure 5.7 shows a participant from the children's cohort, who when viewed from left to right, illustrates hip and knee flexion followed by the extension of both legs (bs).

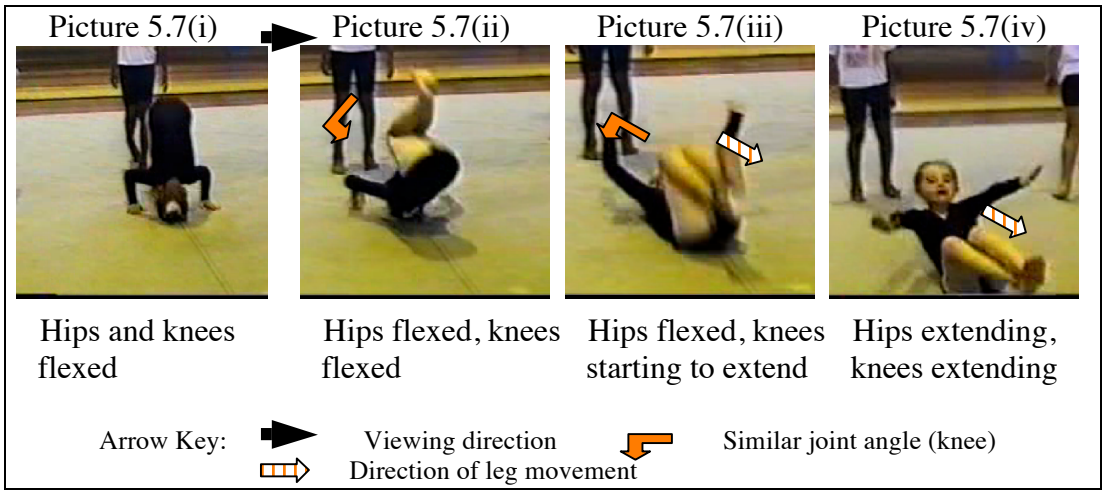


Figure 5.7: Hip and knee flexion followed by extension of both (bs)

Figure 5.7 shows the hip and knees flexed at the commencement of the roll and the maintenance of flexion after the individual's back passes the vertical plane, and the head has left the surface. The final picture shows hip and knee extension at the conclusion of the roll.

Descriptor 4

The following series of four pictures in Figure 5.8 show a participant, from the children's cohort, illustrating the descriptor Hip flexion, knees remain extended then hip extension (ss).

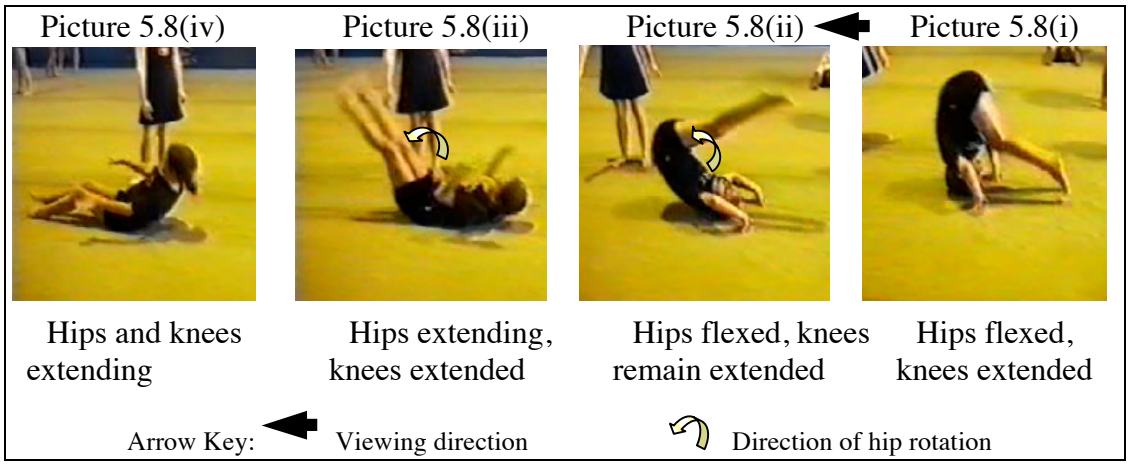


Figure 5.8: Hip flexion, knees remain extended then hip extension (ss)

The series of pictures, from right to left, shows knee extension and hip flexion at the commencement of the rotation. The second picture shows hip flexion increasing (see curved block arrow) whilst knee extension is being maintained after the back has passed the vertical plane. The third picture shows the hips continuing to extend and knees maintaining extension after the head and upper back have left the surface. The final picture depicts the participant in a supine position (on the back with the face up) after the hip/knees continue to extend throughout the roll.

Generally, these descriptors illustrate how the participant attempts to maintain control and rotate around an axis. Knee flexion is important in the process of maintaining angular momentum, with the timing of the action controlling the velocity. Those individuals who elect to remain in the "tucked" position can rotate. However, the dynamics of the rotation is different to the straight-bent-straight configuration of descriptor (i). The tucked position does not permit any change in the angular velocity through the use of the legs. As a consequence, initial rapid rotation in a tucked position cannot be controlled without some other additional action being implemented. There is a certain degree of neuromuscular development required to either flex the knees during rotation or to keep the knees flexed in a tucked position. Hence, younger and less experienced children find the higher quality actions difficult to achieve.

Indicator 2 (Bridging Sequence)

The second indicator of the bridging sequence is the Shoulder/arm position. The feature of importance is the amount of flexion and extension that is evident at both the shoulder and elbow joints.

This indicator has five descriptors, which are shown in the series of Figures 5.9 to 5.13. Each Figure contains four pictures, placed in order from the start to finish.
The five descriptors for this indicator are:

(i) Arms remaining straight, or showing some elbow flexion at the beginning, and moving in an arc with impetus (as)

(ii) Arms flexing (elbow flexion) at the commencement of rotation, and then straightening; the hands may placed lateral to the hips on the surface; some impetus from the arms (af)

(iii) Arms bending or remaining straight (elbow extension) at the commencement of rotation; arms abduct during rotation; little impetus from the arms (av)

(iv) Arms moving with the rotation of the upper body (forward flexion of the shoulders); forearm rotates round the elbow, then arms straighten or push forward past the knees; little impetus from the arms (ar)

(v) Arms rotating with upper body, then contacting the surface with the elbow, then the forearm, followed by the hand(s); no impetus from the arms (ae)

Descriptor 1

Shown in Figure 5.9: is descriptor one, which is "Arms remaining straight, or showing some elbow flexion at the beginning, and moving in an arc with impetus." There may be a slight variation at the commencement of the roll, where the arms either remain extended throughout the roll, or they may be slightly flexed at the start shown in Picture 5.9(ia). In both scenarios the arms swing in a high arc with impetus (as).

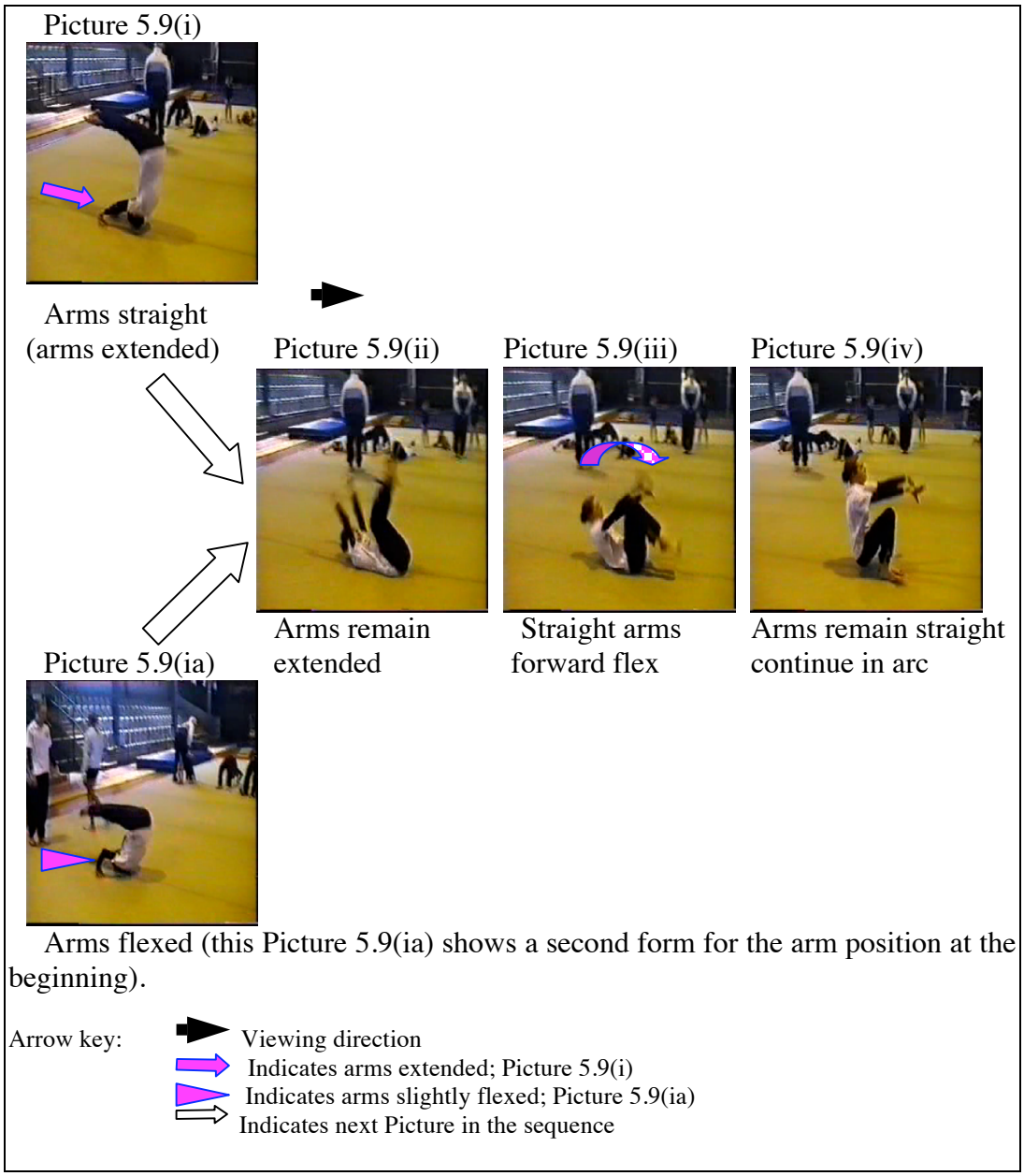


Figure 5.9: Arms remaining straight and moving in an arc with impetus (as)

The pictures in Figure 5.9(i) show the extended-arms moving in an arc during the bridging sequence of the roll, with the maintenance of arms extension throughout the rotation. The picture in Figure 5.9(ia) show the elbows slightly flexed at the commencement of the roll, which is then followed by elbows extending. The movements then become identical to those depicted in the previous sequence.

Descriptor 2

The pictures in Figure 5.10 show a participant from the older adult cohort with: Arms flexing (elbow flexion) at the commencement of rotation, and then straightening; the hands may be placed lateral to the hips on the surface; some impetus from the arms (af).

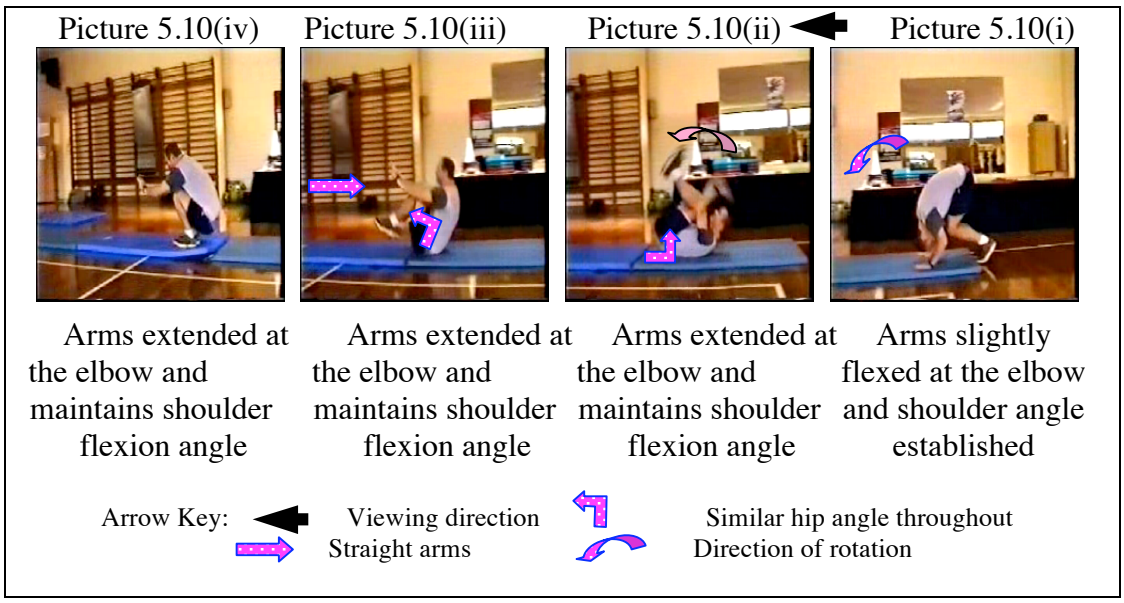


Figure 5.10: Elbows flexing then straightening, with some impetus (af)

Viewed from right to left, the pictures depict a flexed elbow, which then extend as the person's back approaches the vertical plane. The shoulder angle in the first picture is 145° and changes to 90° of flexion by the second picture. This is indicative of a lack of force used in the arm action. The last picture portrays the arms extended at the elbows whilst maintaining a similar degree of shoulder flexion.

Descriptor 3

The series of four pictures contained in Figure 5.11 shows a participant from the children's cohort. These pictures illustrate the descriptor: Arms bending or remaining straight (elbow extension) at the commencement of rotation; arms abduct during rotation; little impetus from the arms (av).

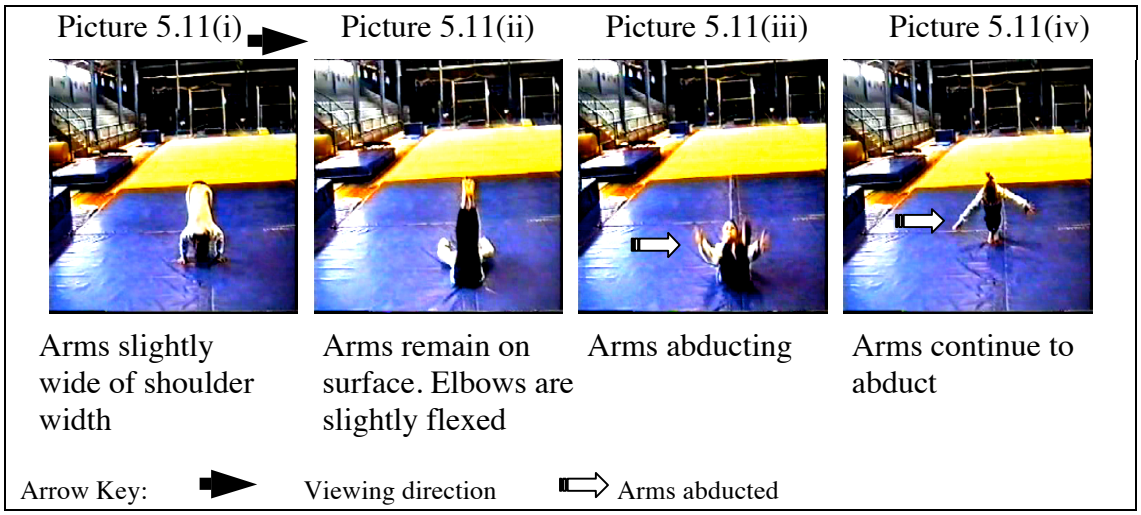


Figure 5.11: Arms bending or remaining straight and abducting, little impetus (av)

The four pictures in Figure 5.11 depict the arms in a position close to shoulder width apart, at the commencement of the roll. The second and third pictures show arm abduction increasing as the back of the body approaches the vertical plane. The final picture depicts the participant continuing to abduct the arms, forming a "V" shape on rising to a standing position.

Descriptor 4

Pictures in Figure 5.12 shows a participant from the older adult cohort displaying the action: Arms moving with the rotation of the upper body (forward flexion of the shoulders); forearm rotates round the elbow, then arms straighten or push forward past the knees; little impetus from the arms. This descriptor may also be evidenced if the participant pushes the arms through between the legs (ar).

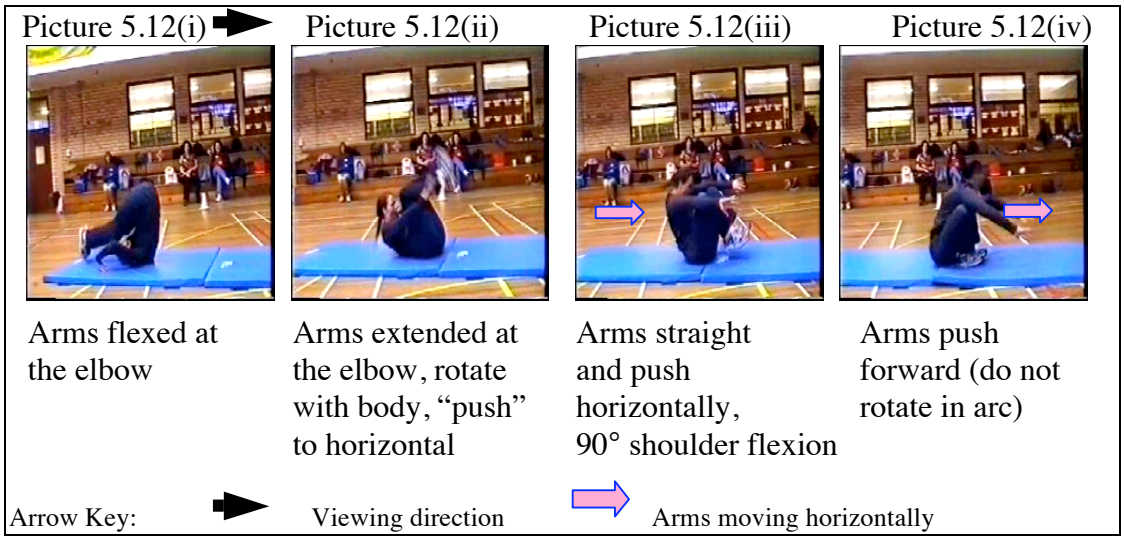


Figure 5.12: Arms and forearms rotate with upper body then arms straighten with little impetus (ar)

The first Picture 5.12(i) depicts the elbows slightly flexed at the commencement of the rotation. The second picture depicts the arm in an extended position. The remainder of the pictures shows the shoulder angle (shoulder flexion of 90°) and elbow extension being maintained after the back has passed the vertical plane. The final picture shows the participant lowering the arms (shoulder flexion of 45°) immediately before the attempt to rise to a standing position.

Descriptor 5

Figure 5.13 provides information relating to the descriptor: Arms rotating with upper body, then contacting the surface with the elbow, then the forearm, followed by the hand(s); no impetus from the arms (ae). The pictures are of a participant from the older adult cohort.

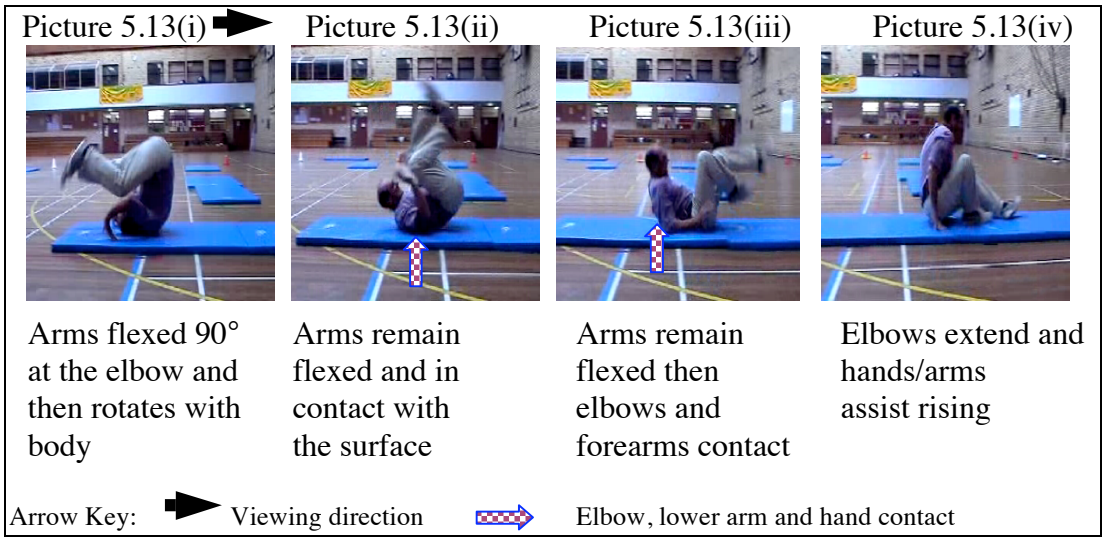


Figure 5.13: Arms rotate with upper body, then elbow, forearm, and hand(s) contact the surface. No impetus from the arms (ae)

Picture 5.13(i) illustrates the arms flexed at the elbows at the start of the rotation and the maintenance of elbow flexion during initial rotation. This is followed in Picture 5.13(ii) wherein the elbows remain flexed after the head leaves the surface, with the elbows contacting the surface as the participant's back approaches the vertical plane. The next picture shows the forearm contacting the surface. The final picture shows the participant placing their hands on the surface.

Generally, an additional mechanism to aid rotation can be provided through the use of the arms, through flexion at the shoulder joints. If the arms remain straight, and are moved in a forceful manner, making a 180° arc from the head towards the feet then, in a similar way to the flexing of the knees, the rate of rotation can be controlled. An absence of arm action means little ability to either control rotation or achieve an end position that permits the participant to rise to a standing position in a single motion.

End Sequence: Indicators and Descriptors

The end sequence of the forward roll is deemed to commence after the rotation concludes, the feet or legs contact the floor and when the participant rises to, or is attempting to rise to, a standing position. This sequence comprises three indicators, which are the (i) *Feet position*, (ii) *Final leg movements* and (iii) *Final rotational movements*. The pictures used to illustrate the descriptors, associated with each indicator are presented in a similar way to those for the beginning sequence (that is as

static single pictures). The descriptors differentiate between the quality of the performances.

Indicator 1 (End Sequence)

The first indicator of the end movements is concerned with the Feet position. This refers specifically to their distance from the buttocks.

The three descriptors of the feet position are:

(i) close to the buttocks (cb)
(ii) placed further away from the buttocks (ab)
(iii) inconsistent placement (in)

The Pictures 5.14(i) to 5.14(iii) in Figure 5.14 illustrate the descriptors for indicator 1 for this sequence.

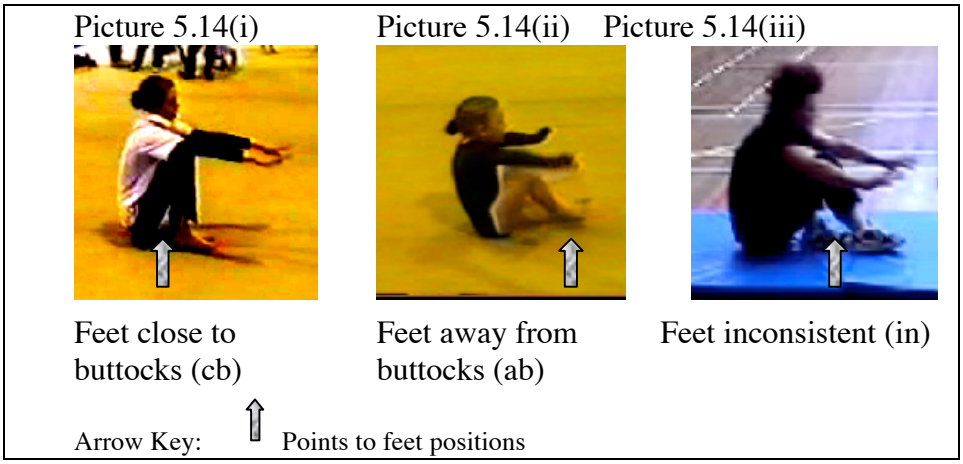


Figure 5.14: Feet Positions

The descriptor in Picture 5.14(i) shows the participant with the feet in the ideal position, with the body's centre of gravity over the buttocks. The middle Picture 5.14(ii), illustrates the feet position further away from the buttocks, making rising to stand more difficult. The result may be movement of the buttocks along the surface towards the feet or the use of the hands to assist rising to stand. Picture 5.14(iii) demonstrates the uneven placement of the feet, in this case one foot in front of the other. An inconsistent placement of the feet is recorded if the participant places the feet in different descriptor positions on different trials.

The position of the feet at the conclusion of rotation is indicative of a number of influences that occurred earlier in the rotation, as well as a number of assisting (affordances) or detrimental factors (perturbances) associated with the physical state

of the individual. Participants are able to rise to a standing position using any one of the various configurations of foot positions, depending on a number of factors, for example, rotation velocity. As an indicator, foot position can discriminate between the "quality" of a movement for each participant.

Indicator 2 (End Sequence)

The second indicator, Final leg movements relates to the alignment of one leg with the other. This indicator is considered within three groupings associated with the leg position.

Sub-descriptors are included as a means of reducing the number of possible Final leg movement combinations to those observed more frequently. The sub-descriptors demonstrate similarities, e.g., sub-descriptor "kfa" demonstrates the concept that the performer is aware that the legs need to be together, yet does not totally achieve the position. Sub-group "ls" shows the participant is unable to control the position of the legs as well as individuals who are classified within the previous sub-group.

The three sub-descriptors for Final leg movements are:

(i) Legs together (lt) (one sub-descriptor)
(ii) Knees apart and feet together or feet apart and knees together (kfa) (two sub-descriptors)
(iii) Legs crossed or legs apart laterally or longitudinally (ls) (three sub-descriptors

The Pictures in Figure 5.15 illustrate the descriptors for indicator 1; end sequence.

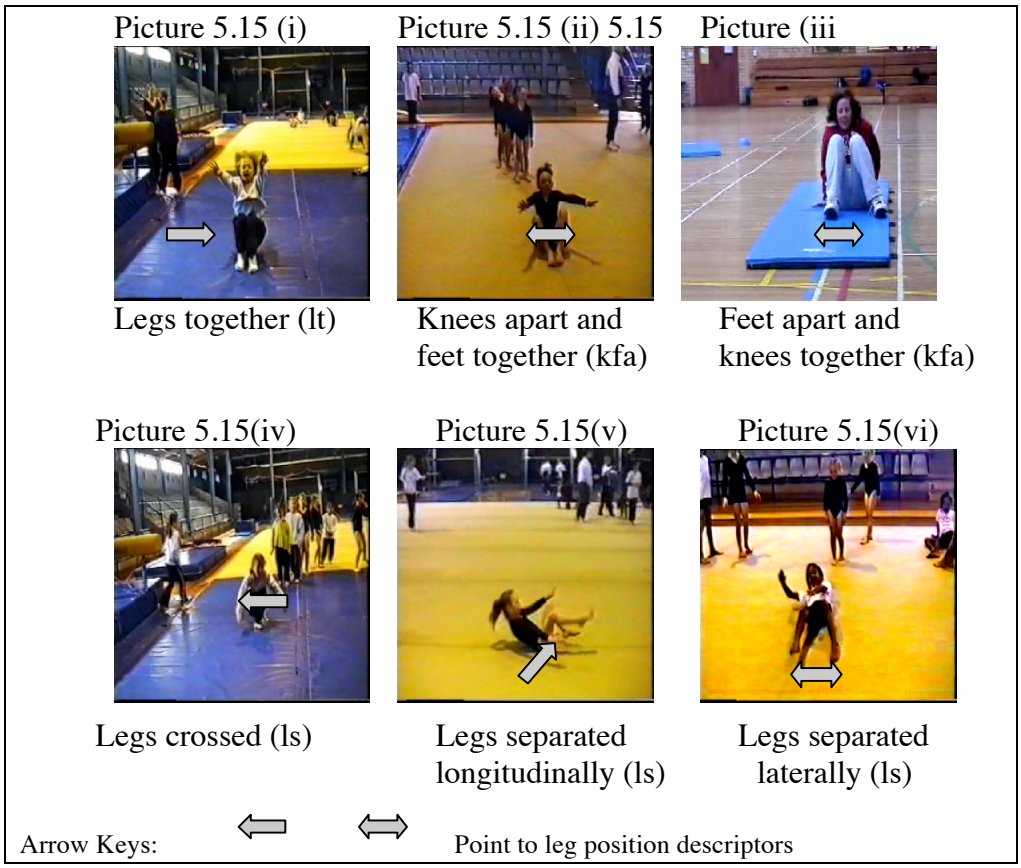


Figure 5.15: Final Leg Movements

Picture 5.15(i) illustrates the "ideal" with the knees and feet together. Pictures 5.15(ii) and 5.15(iii) illustrate the two leg positions of either feet together and knees apart or knees together and feet apart. Pictures 5.15(iv) to 5.15(vi) shows three "inappropriate" leg positions, including, legs crossed, legs separated either longitudinally or laterally.

Indicator 3 (End Sequence)

The third indicator consists of the elements involved with dynamic balance and conservation of momentum and is termed, Final rotational movements. The range of static pictures illustrated in Figure 5.16 provides examples of five movements used for categorization purposes.

The five descriptors for Final rotational movements are:

(i) rising to standing unaided (ru)
(ii) balance lost upon standing (lb)
(iii) roll stoping momentarily (sm)
(iv) hands used to assist rising (u)
(v) roll stoping completely (rs)

The Pictures 5.16(i) to 5.16(v) in Figure 5.16 illustrate the descriptors for indicator 3 for the end sequence.

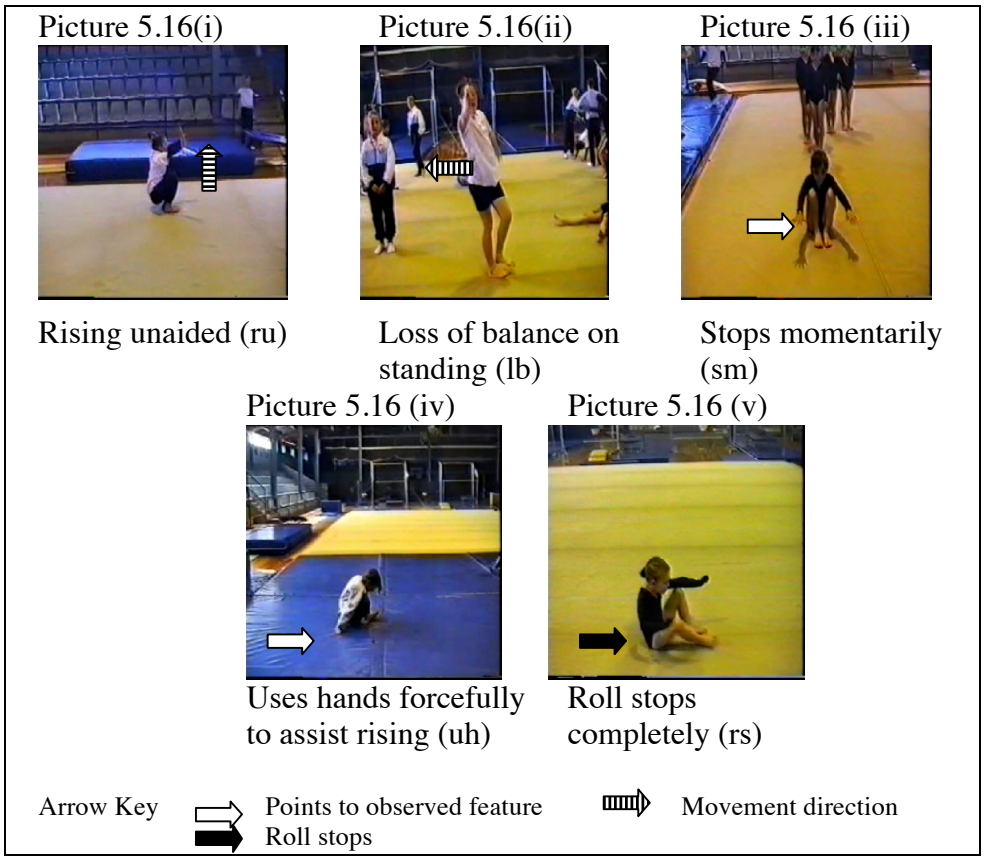


Figure 5.16: Final Rotational Movements

Each picture in the series presents an image of a movement that can occur during the end sequence. Picture 5.16(i) illustrates the highest quality end movement, whereby the performer can rise to a standing position without any extraneous movements; the forward momentum is redirected vertically and balance is achieved. Picture 5.16(ii) shows a performer "overbalancing" a situation that may occur in any direction. Picture 5.16(iii) portrays the performer hesitating or stopping momentarily just prior to attempting to rise to stand. Picture 5.16(iv) shows the performer using thrust from the arms and hands in an attempt to generate sufficient force to permit rising to a standing permission. The final Picture 5.16(v) illustrates the total cessation of the rolling action.

Conclusion

The descriptions and details outlined in this section of the chapter, emerged using a deductive approach towards data analysis. Three sequences for the forward roll have been established, that is, beginning, bridging and end. From the investigation of movement patterns and positions of all participants (*N*=117), during these sequences

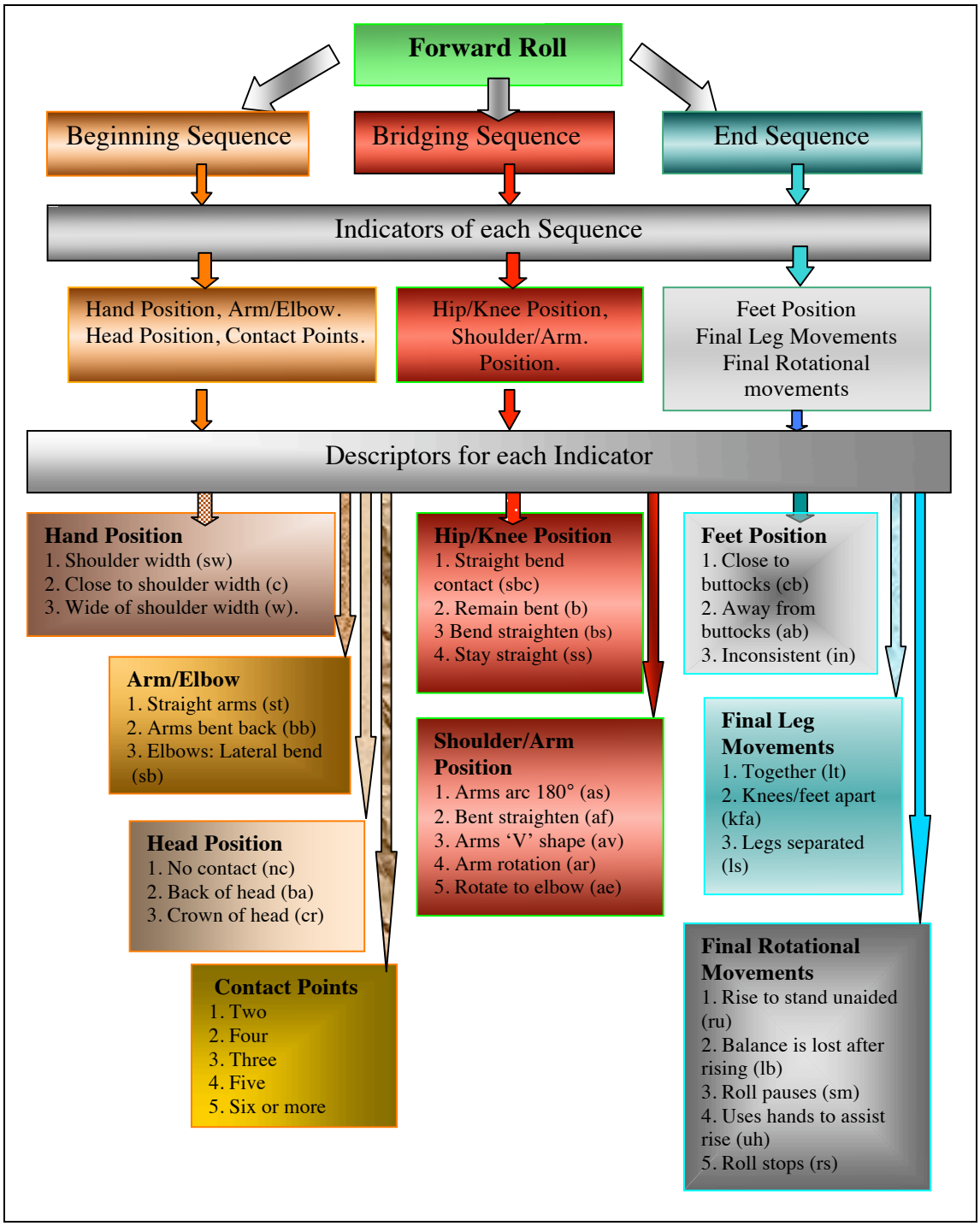
it became apparent that some body configurations were more crucial than others in the execution of the roll.

Each sequence comprises a number of indicators, and the descriptors accompanying them have been devised to permit differentiation between performances of different quality. The use of indicators and their accompanying descriptors assist with deeper analysis of the quality of movements exhibited within and between cohorts.

AN EMERGING FRAMEWORK

The analysis of the indicators and their descriptors led to a conceptual framework that describes how the quality of movement for the forward roll may be ascertained across all cohorts. The framework is termed the Model For Assessing Movement Quality Of The Forward Roll (MAMQ:FR).

The MAMQ:FR illustrated in Figure 5.17 provides a schematic overview of the instrument.



Haynes et al. (2005)

Figure 5.17: A Model For Assessing Movement Quality Of The Forward Roll (MAMQ:FR)

Through the application of the information contained within each "box" a broad template for assessment is offered. Working through the model, commencing with the three sequences of the forward roll, the beginning, bridging or end, by following

the arrows to the indicators and then to the descriptors for each sequence, one can begin to determine the quality of a performance.

The descriptors (presented in abbreviated format) within each descriptor box are arranged in hierarchical order from the most ideal to the least ideal. The first descriptor from each indicator determines a performance of highest quality, whilst the last descriptor from each indicator box delineates the lowest quality. However, for each individual descriptor the degree of quality of performance level can vary.

For example, Figure 5.17 shows that for the beginning sequence for hand position the first descriptor (1) points to a high quality performance, the second to a medium, whereas the third is low quality. Likewise for the arm/elbow the first descriptor relates to high quality, the second and third descriptor medium and the fourth descriptor low quality. The first descriptor of the head position indicates the highest quality, the second descriptor indicates slightly less quality, and the third descriptor indicates low quality.

The descriptors for the number of body contacts with the surface deviate slightly from the pattern, that is, 2, 3, 4, 5, 6+, as three body contact points is not as desirable as four contact points. Three contact points indicate an undesirable asymmetrical configuration of the body.

The first descriptor for the bridging sequence, shown in Figure 5.17, that is, hip/knee position, indicates a performance of high quality. The legs remaining in a "tucked" position (knees flexed) indicates medium quality. The last two descriptors indicate low quality. For shoulder/arm descriptors the first indicates a high quality performance. The second descriptor is a medium quality performance whilst the remainder are arranged hierarchically towards the bottom of the box, to delineate increasingly poor performances.

Observation of the end sequence shows that for indicator 1, the three feet descriptor positions indicate high, medium and low quality, that is, one descriptor for each quality level. However, it should be noted that for second indicator, namely, final leg movements, that with the exception of the first descriptor, a range of movement is included for each of the other descriptors. For this indicator (descriptor 2), that is feet apart with knees together or knees apart with feet together, a single descriptor is formed, indicating a medium performance. Secondly, leg movements are grouped

together, specifically, those related to the legs being crossed, separated laterally or separated longitudinally, which represent lower performance quality. The descriptors for the final movements indicator for the end sequence, in the first instance, persons with high quality performances can rise to a standing position smoothly. The following movement descriptors, namely, if the performer loses balance after attaining a standing position (2) or there is a momentary pause in the roll (3), indicates medium quality. If the hands are used to provide forceful thrust (4) or the roll stops (5) the movements are low quality.

Generally, high quality performances display all the first mentioned descriptors. Medium quality performances may show some descriptors from high quality and some from medium quality. Low quality performances will show mainly descriptors at the end of each list.

The performers may not always exhibit descriptors that place them in discrete high/medium/low categories. For example, the sequences of the roll, that is, beginning, bridging and end, may witness performers exhibiting descriptors that place them on a performance continuum.

In summary, the MAMQ:FR represents an assessment instrument, which is sufficiently fine-grained to be applied across all cohorts, that is, the model has applicability across the "lifespan". It can, therefore, be applied to determine the quality of individuals performing the forward roll.

The next chapter presents an analysis and discussion of both similarities and differences between each cohort. The analysis employs the descriptors as a means of comparison, for the three cohorts.