

# Goldsmith Indices of Body Symmetry



“Physiotherapy” April 1992, vol. 78, no 4, 235 – 242.

“Thus it appears that the measurements were mainly determined by real differences between subjects and that there was negligible systematic disagreement between the testers. It can be concluded that the measurements obtained in this way consistently differentiated among subjects even when made by different testers”

These measures are standardised and relate only to Procedures 1, 2 and 3 for use with Anatomical Measuring Instrument (AMI) with Level Box Angle Sensors as Accessories  
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Simple Stuff Works  
are dedicated to helping  
individuals, their first circle of support and professionals  
to protect body shape, muscle tone and quality of life

Goldsmith Indices of Body Symmetry Procedure: 3<sup>rd</sup> Edition  
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## Introduction



Monitoring body symmetry is essential in the effort to protect body shape. Maintaining symmetry will safeguard internal capacity of the abdomen and thorax and in turn defend function of the internal organs. As such, monitoring body symmetry is indispensable in prevention of premature death. This assessment provides a global measure of body symmetry.

The conventional chest is a vulnerable and mobile structure which distorts immediately and predictably in lying but also features the elasticity to recoil to original proportions on movement. Those who adopt static lying postures acquire progressive fixed distortions as a result of loss of recoil which are predictable according to the following principles. The sterno - spinal line (SSL) is an imaginary line which runs between the sternum and the spine. If the SSL is either vertical or horizontal in the habitual lying posture, over time the chest will compress symmetrically. If the SSL is not vertical or horizontal it will rotate towards the horizontal causing predictable distortion of the chest. To protect and restore chest shape rotational and containment forces are applied in the lying posture.

Reliability and validity of components of the measures have been established in a study published in "Physiotherapy" April 1992, vol. 78, no 4, 235 – 242. The results of these Procedures will only be recognised if carried out by fully trained and qualified measurers using the AMI. To protect integrity of the measures no alterations may be made to the Procedure without permission of the authors. Work to establish construct validity with other variables is ongoing.

The measures will:-

1. Provide the individual with a simple and reliable method of measuring and recording their body symmetry.
2. Provide feedback to those providing postural care for the individual.
3. Increase sensitivity to the early signs of asymmetry, and raise awareness of the processes of its development.
4. Enable the individual and their first circle of support to plan postural care on the basis of objective measurements.
5. Provide data essential for the scientific evaluation of the effects of postural care.

## General Instructions



1. Three people are required to carry out these procedures. An authorised Measurer will take the measurements and instruct two others to assist and support the individual. Informal use of the measures will provide acceptable reliability to identify the degree of symmetry of the body and track changes. Techniques to enhance reliability, for example for use in research are explained within the text.
2. For every procedure the role of each person has been planned carefully to ensure the techniques are carried out accurately. It is recommended that the instructions be adhered to closely.
3. It is important that the individual's feelings are taken into account and that he/she is reassured throughout the Procedure. Time should be taken to ensure he/she is positioned correctly according to the instructions and that he/she is comfortable throughout the Procedure.
4. All procedures should be carried out slowly and gently, never moving into a range of discomfort as this would mean that measurements taken are merely of the individual moving to avoid pain.
5. In order to ensure that measurements are accurate, the person needs to be clothed as lightly as possible. The person may feel more comfortable in clothing as long as the anatomical landmarks can be palpated and range of movement is not restricted. Privacy, dignity, safety and comfort need to be upheld

## Observational Result Sheet

For those who do not have formal measuring equipment, who are supporting those with extensive distortion or completing an evaluation for seating it is possible to obtain useful information by informally observing the structures of the body following the Procedures. An adapted result sheet has been devised to help with this process with additional investigations which are not susceptible to repeatable measures as a consistent starting position is not achievable but references a process traditional within seating assessments. (Minkel, J. Mat Evaluation (RESNA) Online: uploaded 2011 available at: YouTube The PostureWorks)



# The Measurement Procedures

Each of these procedures is carried out in crook lying with the knees flexed to 70 degrees. They are carried out four times and the mean of these four measures is calculated so that both the average result and the range of readings provide information and an indication of intra-rater reliability.

1 / 1

Measurement in crook lying of the angle of the pelvis when knees are upright

1 / 2

If the angle of the pelvis is not level when the knees are upright - record the angle to which the knees must be taken to bring the pelvis level

1 / 3

Measurement of distance from xyphoid process to lateral border of the chest each side at the level of xyphoid process and calculation of right/left ratio. (r/l)

1 / 4

Measurement of depth and width of the chest at the level of xyphoid process and calculation of depth/width ratio. (d/w)

2

Measurement in crook lying of symmetry of rotation of the pelvis, as influenced by movement of the flexed knees together in an arc right to left, with the shoulders and feet fixed

3

Measurement of the segment of an arc described by flexed knee, indicating a range of external rotation/abduction at the hip, with the pelvis fixed level



## Description of Roles

### The Measurer (A qualified Measurer )

1. Operates the AMI and locates all measurement points accurately and gently, according to the instructions
2. Explains the procedures, gains consent to carry them out and directs the individual to be measured and assistants
3. After the measurements have been taken, wipes off pen marks that have been made on the individual
4. Records the angles and measurements
5. Interprets and reports on the findings and explains implications of the results for postural care
6. Recruits and directs additional assistants if it is necessary to ensure comfort of the individual and accuracy of the measures

### Assistant 1: The Advocate (Someone who is known and trusted by the individual)

1. Advocates for the individual and supports them to ensure they are measured correctly and comfortably.
2. Talks to and reassures the person during the measurement procedures and keeps the measurer and assistant 2 informed about the person's immediate emotional and physical needs
3. Holds the person's limbs when required and makes them comfortable after each procedure

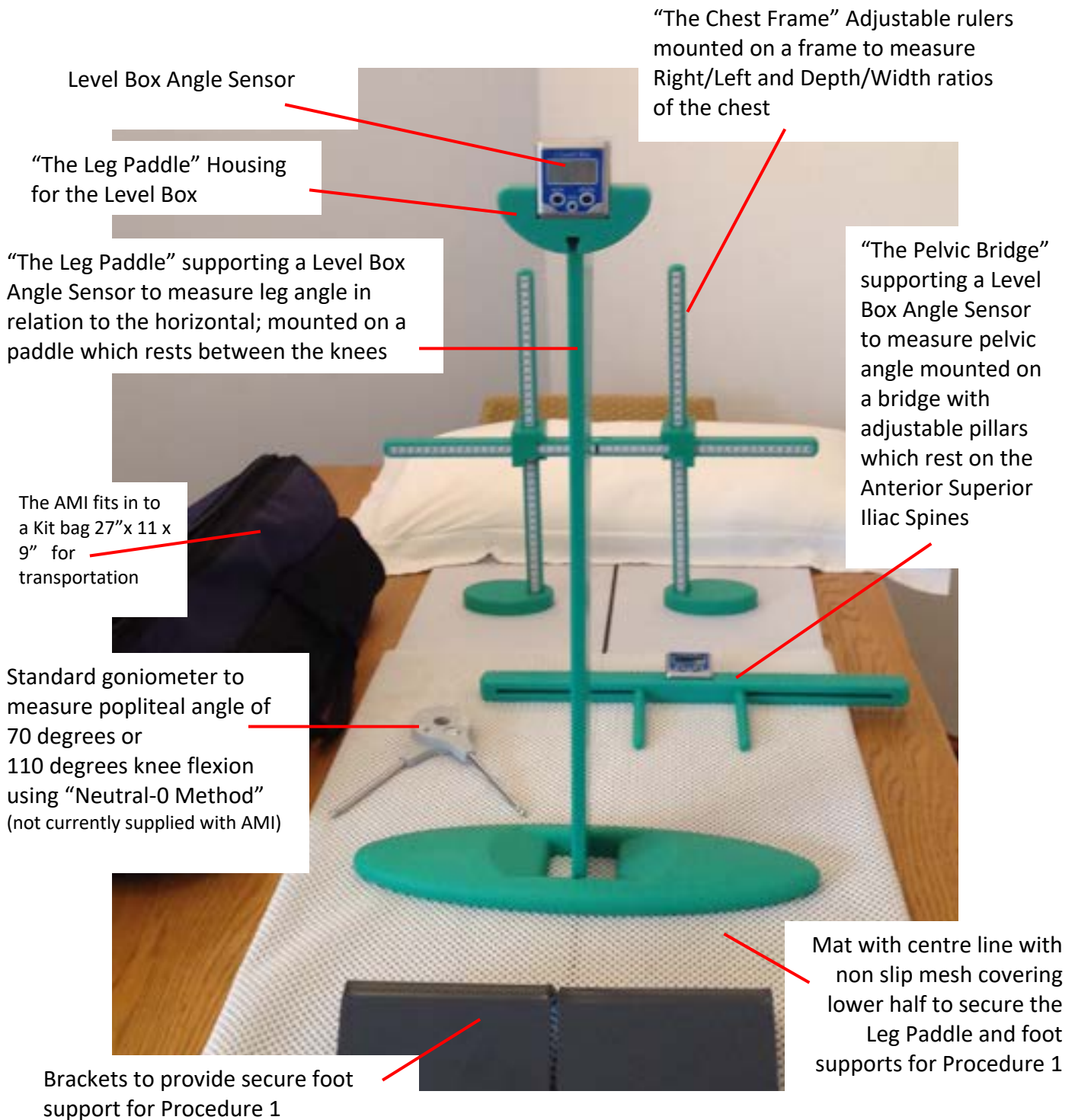
### Assistant 2 (A trained individual with handling skills)

1. Supports the individual correctly and comfortably throughout the Procedures
2. Adjusts the Pelvic Bridge to fit the pelvis and uses it to identify angles adopted by the pelvis
3. Holds the individual's limbs and pelvis when required and makes the individual comfortable after each procedure



# Description of the Anatomical Measuring Instrument (AMI)

with Level Box Angle Sensors as Accessories  
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## Setting and Assembling the Level Box Angle Sensors

### Setting the Level Box Angle Sensors

Place the two Level Box Angle Sensors on a level surface and press the zero button. The Level Boxes have a magnetised surface on the base



### Reading the Level Box Angle Sensors

The electronic display provides a reading of whole degrees and also percentage points of a degree. Because the Boxes are being used to measure angles formed by a living, moving body in relation to the horizontal the percentage points will be constantly changing and confuse the readings. The measurement of whole degrees is fit for the purpose of this assessment and therefore it is recommended that the percentage readings are either ignored or the display is blanked off.

### Assembling one of the Level Boxes into the Pelvic Bridge



Fit the magnetised base of one of the Level Boxes onto the metal plate within the slot in the middle of the Pelvic Bridge

## Assembling the second Level Box onto the Leg Paddle

First fit the Level Box Housing onto the Leg Paddle; then fit the magnetised base of the second Level Box onto the metal plate in the Housing.



First fit the Level Box Housing onto the Leg Paddle...

...then fit the magnetised base of the second Level Box onto the metal plate in the Level Box Housing.



## Gaining Immediate Consent

Before carrying out any of the measuring procedures outlined in this manual it is essential to explain to the individual and Assistant 1 what the measures entail and why they are proposed. Immediate wellbeing of the individual must be established and consent for the procedures to be carried out must be gained. The individual's capacity to consent must be considered and in the event that they are unable to provide formal consent it needs to be established that taking the measures would be in the person's best interest. Assistant 1 will act as the advocate in this process.



## The Starting Position

To ensure standardisation of meaningful results an Optimum Starting Position (OSP) is designated.

To attain the OSP the person needs to be able to do all the following:-

- 1) Supine crook lying.
- 2) As straight as possible over a mid line.
- 3) Both knees upright and flexed to a popliteal angle of 70 degrees or 110 degrees knee flexion using "Neutral-0 Method"
- 4) Pelvis level.
- 5) Feet stabilised and together either side of the midline.
- 6) Arms slightly abducted by the sides.

If existing problems with muscle tone or body shape prevents the OSP from being used, adapted starting positions (ASP1 and ASP2) have been devised, which are described within the text. There may be physical or behavioural factors that will require adaptations to the OSP. Record all such adaptations and be aware of their effect on reliability, which will be compromised if the OSP cannot be attained. Looking at the range of results within the four measures taken can help when assessing reliability. A small range will suggest reliable measures, whereas a large range will reduce confidence in the results.

### Attaining the Starting Position



#### *Assistant 1*

Take up a position at the person's head, talk to and reassure him/her  
Feedback to the measuring team  
about any immediate needs.



*Measurer and Assistant 2:*

Place the person so that the criteria listed for the OSP are met as closely as possible.



Place the non slip mesh over the measuring mat to stabilize the buttocks and feet. Position the leg paddle base so that it is centred over the mid line

Stabilise the feet together and rest them on the brackets. Restricted joint range may require compromise which must be noted on the Comments section of the Result Sheet



In supine crook lying the knees will naturally adopt a popliteal angle close to 70 degrees or 110 degrees knee flexion using "Neutral-0 Method". Bring the knees upright. Check the knee angle with the standard goniometer and adjust the position of the brackets to support the feet in this position.



Wrap the non slip mesh over the brackets to secure the foot support

Reposition the body and ensure that the buttocks are on the edge of the non slip mat, the feet are on the secured brackets and the popliteal angle of 70 degrees or 110 degrees knee flexion using "Neutral-0 Method" is maintained

If joint restriction, spasm or any other reason prevents one or both knees being placed at 70 degrees or 110 degrees knee flexion using "Neutral-0 Method" record the angle formed by each knee on the record sheet in the space reserved for ASP1. This position becomes ASP1.

*Measurer:*

Surface mark the xiphoid process. It is possible to achieve consistent measures by palpating the xiphoid process through a vest top if preferred



## Carrying out Procedure 1

*Assistant 1:*

Support the person's head in mid line with the shoulders flat throughout the Procedure. Inform the Measurer of any concerns or if the Procedure needs to stop.

*Measurer:*

Support the knees upright and the feet together. Bring the knees into an upright position so that the Leg Paddle Level Box reads zero.

*Assistant 2:*

Adjust the pillars on the Pelvic Bridge so that they can be gently rested on the Anterior Superior Iliac Spines. Read the angle displayed on the Level Box which will read zero if the pelvis is level. Record this on the Results Sheet in the space 1 / 1.





Assistant 2:

If the pelvis is not level, record the angle of the pelvis on the appropriate column in the space 1 / 1.

If the right side of the pelvis is raised a small upward arrow on the display will indicate.  
In this example 16 degrees



If the left side of the pelvis is raised a small downward arrow on the display will indicate.  
In this example 16 degrees



If the pelvis is not level request that Assistant 2 moves knees gently towards the side that pelvis is raised until pelvis is level. Read the angle on the Leg Paddle Level Box to discover the angle to which the legs must be taken to bring the pelvis level.



When the legs are taken to the subject's right read the Level Box angle.  
In this example 24 degrees



When the legs are taken to the subject's left read the Level Box angle.  
In this example 21 degrees

Record the angle in the space 1 / 2.



*Measurer:*

If the pelvis is level when the knees are upright, the knees are flexed to 70 degrees and all the other criteria are fulfilled, record that the OSP has been used. If the knees must be taken to one side to bring the pelvis level record that ASP 2 has been used. This position will replace the upright position of the knees in the starting position.

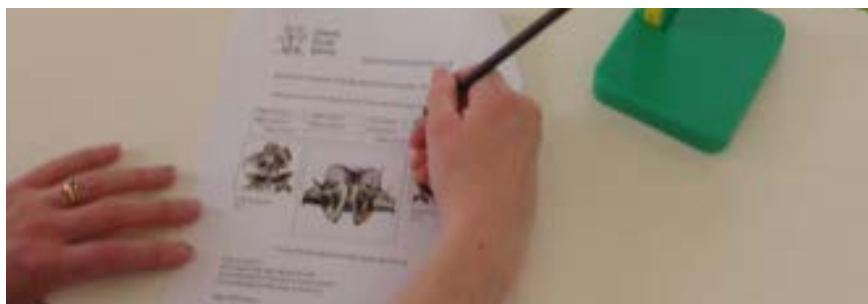
*Measurer / Assistant 2:*

Support the individual with the pelvis level as established in Procedure 1.1 and 1.2. Assemble the Chest Frame in gentle contact with the chest, so that the centre point of the horizontal bar corresponds with the xyphoid process. Check the horizontal bar is level by noting the spirit level and ensuring that the depth measures on the vertical bars are even both sides. The Chest Frame can be assembled with the measuring tapes facing the feet, as illustrated, or the head if this is preferable. Fix the dimensions of the Chest Frame. Assistant 1 can assist in noting measures right and left on the horizontal bar from xyphoid process to lateral borders of the chest.



If asymmetry or a sulcus exists, so that the highest point of the chest is not the xyphoid process, measure from the horizontal bar to the xyphoid process with a soft tape measure and make a note of this distance. Loosen one side to gently and carefully remove the Chest Frame from the person making sure not to rub the skin.

Record the depth of the chest by recording the measure on the fixed vertical bar from supporting surface to horizontal bar. If the xyphoid process is not the highest point on the chest subtract the distance from the horizontal bar to the xyphoid process in order to calculate the chest depth measurement. Calculate chest width from the results of Procedure 1.3.



## Explanation of Procedure 2

Measurement in crook lying of symmetry of rotation of the pelvis, as influenced by movement of the flexed knees together in an arc right to left, with the shoulders and feet fixed.

This measurement indicates symmetry of the trunk, pelvis and legs as the knees are moved from side to side. In a symmetrical individual, as the knees are taken to one side the pelvis rises on the contra-lateral side. The relationship between the angle of the legs and the resultant angle to which the pelvis lifts can be calculated. This angle is known as the *Angle between Legs and Pelvis (ABLAP)*. If an individual is perfectly symmetrical and perfect measurements are taken the *(ABLAP)* when the knees are taken to the right will be exactly the same as when the knees are taken to the left. However, as an individual becomes asymmetric changes occur in this relationship and by measuring and comparing the *ABLAP knees to the right* with the *ABLAP knees to the left* clinician and carers can analyse component parts of the early stages of departure from symmetry.

Two main categories of windswept distortion have been identified by the authors and Kenichi Okuda; the "Classic" type and "Type 1". In the Classic category the pelvis rotates in the opposite direction to the preferred knee posture and in the Type 1 the pelvis rotates in the same direction as the knees.

*Okuda et al, "A classification of the windswept deformities based on analysis of their mechanisms" (1999) 13<sup>th</sup> International Congress of the World Confederation for Physical Therapy. Yokohama, JAPAN. May 23-28, 1999. Hosted by the Science Council of Japan.*



## Carrying out Procedure 2

### 2.1

#### Pelvic Rotation with Knees to the Right

##### *Assistants 1, 2 and Measurer*



Remove the foot brackets, check the popliteal angle of 70 degrees or 110 degrees knee flexion using “Neutral-0 Method” and support the feet with the non slip mesh making sure not to apply pressure on the toes.

##### *Measurer*

Gently bring the knees together in contact with the Leg Paddle.

##### *Assistant 1*

Support the head in midline and the shoulders firm and flat to prevent lifting during the measuring procedure. Inform the measurer if the shoulder lifts.

##### *Measurer and Assistant 2*

Explain to the person that their knees are going to be moved to the right and gently take the knees as far as possible, within the pain free range, towards the floor, allowing the pelvis to rotate and allowing the feet to rotate within the confines of their stabilised position. When the limit of comfortable movement is reached, apply gentle pressure to the lateral border of the left knee to ensure that the left leg is in contact with the Leg Paddle.

### 2 /2

#### Pelvic Rotation with Knees to the Left

Repeat the Procedure with knees taken to the left

Take the knees from side to side reading and recording the angles of Leg Paddle and Pelvic Bridge



## Calculating the “Windswept Index” and Range of Results

Calculate the average leg angle and pelvic angle from each of the four sets of measurements and enter these angles on the diagram. Work out the ABLAPs by subtracting the pelvic angle from the leg angle for each of the sets of measurements taken and the mean of these. This will give the average ABLAP with knees to the right and the average ABLAP with knees to the left.

In those people who have developed a Type 1 distortion simply interpreting the angles formed by the legs and pelvis will provide useful clinical information. However, many people develop the Classic form of “windswept body shape” in which the legs fall down towards one side and the pelvis rotates backwards towards the supporting surface on the contra-lateral side. In these cases subtracting one ABLAP from another can generate a useful illustrative device. The ABLAP when the subject is taken to the side to which they prefer will be greater than when they are taken to the other side. Thus the figure resulting from subtracting one from another, with the higher number representing the side to which the subject is windswept, can be said to represent the degree of symmetry or otherwise. In this case no difference, or 0, represents symmetry and increasing difference represents increasing asymmetry. This figure can be known as the Windswept Index.

Range of Results: Highest Right/Lowest Left and Highest Left /Lowest right

With four measures being taken to each side a range of results can be studied by comparing the extremes of result. If it is suggested that only one measure was taken and the set of measures consisted of the highest to the right and the lowest to the left the result will illustrate the most to the right that the subject could be said to be windswept. Alternatively if the same calculation was made using the lowest to the right and the highest to the left the result will illustrate the most to the left that the subject could be said to be windswept. This set of calculations can be entered on the Summary Result Sheet and gives a range of possible results, which is useful for two main reasons.

### 1) Identification of intra-rater reliability

Confidence in accuracy of the measures can be extracted from the size of the band of results. A small band illustrates a more reliable measure whereas a large band illustrates either extreme difficulty inherent in the subject’s condition or poor technique on the part of the measurer.

### 2) Strong identification of symmetry.

It can be seen that if an individual is symmetrical the results will span the mid line, with a tendency to become windswept amply signalled by a tendency for the results to drift across to one side.



## Procedure 2

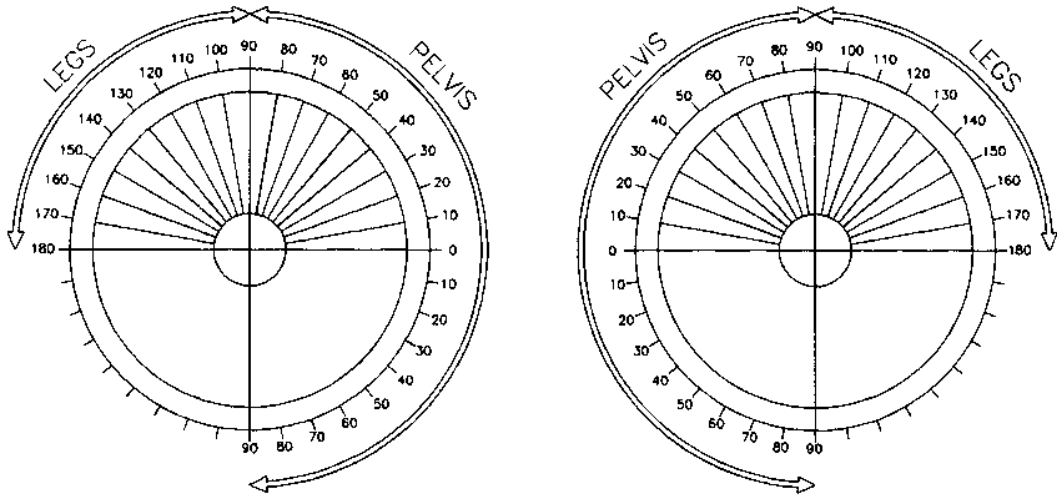
Measurement of rotation of the pelvis as influenced by movement of the flexed knees together in an arc right to left, with the shoulders and feet fixed.

2 / 1 knees to the right

$A+B = C \text{ minus } D = \text{ABLAP}$

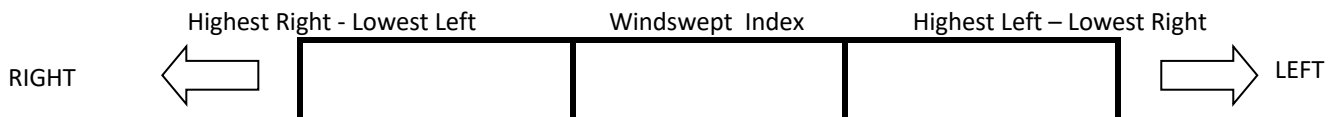
2 / 2 knees to the left

A	90 degrees	90	90	90	90	90	90 degrees	90	90	90	90	90
B	Level Box						Level Box					
C	Leg angle						Leg angle					
D	Pelvic angle						Pelvic angle					
ABLAP	ABLAP Right					Mean	ABLAP Left					Mean



### Windswept Index

(to be completed for those who are symmetrical or have Classic asymmetry)

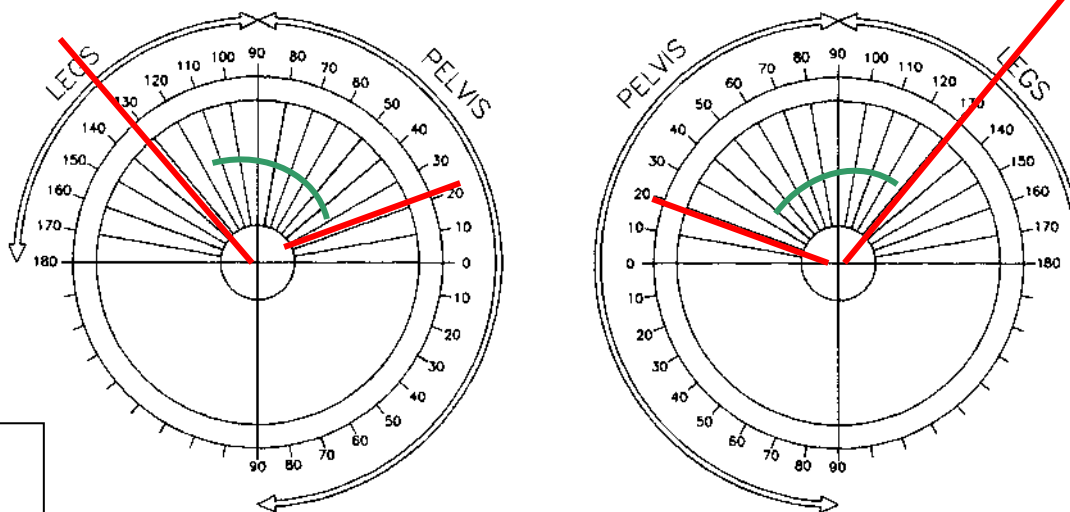


Knees to Right = Leg angle 130 – pelvic angle 20 = ABLAP 110  
 Knees to Left = Leg angle 130 – pelvic angle 20 = ABLAP 110  
 ABLAP to right: 110 minus ABLAP to left: 110 = 0 = Symmetry

Pelvic Angle  
 20 degrees both sides

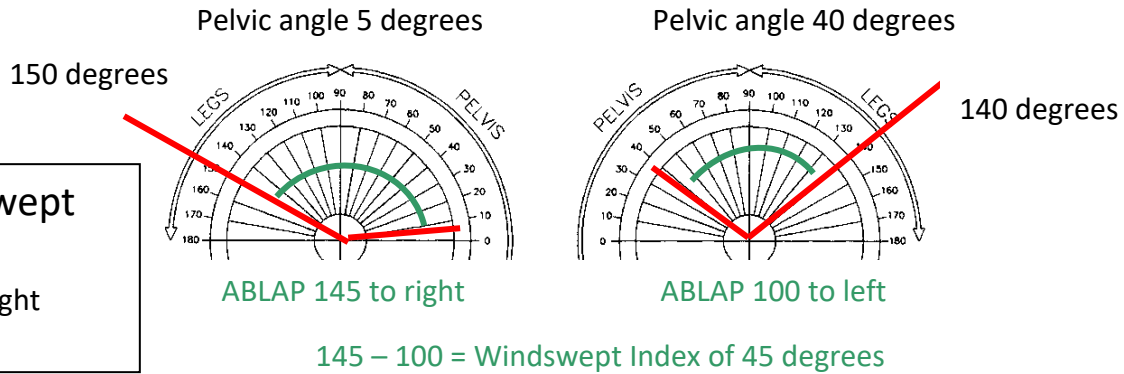
Leg Paddle Angle  
 130 degrees

Leg Paddle Angle  
 130 degrees

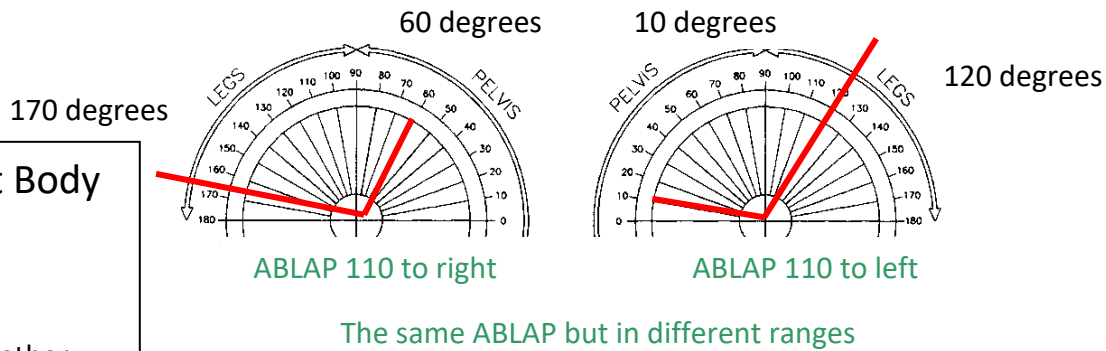


Symmetry

**“Classic” Windswept  
Body Shape**  
45 degrees to the right



**“Type 1” Windswept Body  
Shape**  
Similar ABLAP but in  
asymmetric range  
Legs and Pelvis move together





## Carrying out Procedure 3

Measurement of the segment of an arc described by the flexed knee, indicating a range of external rotation / abduction at the hip

3 / 1

External rotation / abduction at the right hip

### *Assistant 1*

Move to the foot of the measuring mat. Support the left foot and knee to ensure that it remains in the upright position if the OSP is to be used or the angle specified in Measurement Procedure 1 / 2 if the ASP2 is to be used

### *Assistant 2*

Check that the pelvis is level and hold the pelvis flat and firm. Inform the Measurer if the pelvis lifts

### *Measurer*

Gently take the right knee outwards, feeling for the extent of pain free range at the hip. Collaborate to assess joint range by deciding the point at which outward movement of the knee begins to influence the level of the pelvis.



3 / 2

External rotation / abduction at the left hip

Repeat the procedure but with movement of the left knee.



## Making a Plan

Measures obtained by this Procedure will identify the degree of symmetry of the body and indicate the therapeutic positioning needed to protect and restore body shape. This will need to be applied particularly in the lying posture as this is the only position in which the required rotational forces can be activated. Protecting the structure and balance of the body will help to protect it from abnormalities of muscle tone.



Collaborate with all concerned with regards implications for postural care paying particular attention to Safety Planning with the well trained first circle of support.

