



A Comparison of Body Scan Measurement Reliability and Repeatability versus Manual Measurement with Tape Measure

Description:

This experiment was designed to compare the accuracy and repeatability of manual measurements versus measurements taken from a 3D body scanner. It was not intended to be comprehensive but rather to factually demonstrate with a small sample of measurement comparisons:

1. The accuracy of the manual and body scan measurements.
2. The repeatability of the manual and body scan measurements.
3. The sources of differences between manual and body scan measurements.

The comparison involved five female subjects of various sizes from petite to plus size and three measurers. The test was limited to two key measurements (bust circumference and hip circumference). The two measurements were defined to be completely clear and unambiguous – both to the manual measurers and to the body scanner software. The measurement definitions were as follows:

Bust Circumference – measure the circumference of the torso at the height of the greatest prominence of the bust, keeping with measurement line parallel to the floor.

Hip Circumference – measure the circumference of the torso at the height at which the maximum circumference occurs between the crotch point and the waist.

The three measurers were instructed that it was a “goal” of the test for the three manual measurements to be taken consistent with the definitions so as to achieve a common measure between the three measurers. In each case the measurer was a person experienced with measuring subjects for apparel and each had a significant apparel design/development background. Each measurer had to measure the subjects in private beyond the sight and hearing of the other measurers. A mirror was provided to allow the measurer to view the tape position on the opposite side of the subject from where they were standing.

For body scanning consistency tests, the subjects were scanned three times with a minimum of one minute between each scan.

Summary:

The test results showed and documented that even with trained measurers, the difference in manual measurements on clearly defined measurements such as bust and hips can approach 2 inches. The variation using a body scanner with automatic measurement extraction was 55% less in the case of bust measurements, and 75% less in the case of hip measurements. The tests also showed even larger differences between the manual measures and the body scan measures. In each case, the cause of the measurement difference was identified as incorrect placement of the manual measuring tape.

First Results:

Manual Measurements

The maximum difference between manual measurers on the bust measure: 1.5 inches

The maximum difference between manual measurers on the hip measure: 1.75 inches

The minimum difference between manual measurers on the bust measure: 0.5 inches

The minimum difference between manual measurers on the hip measure: 0.0 inches

The average difference between manual measurers on the bust measure: 0.9 inches

The average difference between manual measurers on the hip measure: 0.75 inches

Body Scan Measurements

The maximum difference between body scans on the bust measure: 0.8 inches

The maximum difference between body scans on the hip measure: 0.2 inches

The minimum difference between body scans on the bust measure: 0.15 inches

The minimum difference between body scans on the hip measure: 0.14 inches

The average difference between body scans on the bust measure: 0.44 inches

The average difference between body scans on the hip measure: 0.17 inches

Comparison of Body Scan Measurements to Manual Measurements

Max. difference of the hip measure between manual and scan: 1.8 inches (scan larger)

Min. difference of the hip measure between manual and scan: 0.13 inches (scan larger)

Average difference of the hip measure between manual and scan: 1.1 inches (scan larger)

Max. difference of the bust measure between manual and scan: 3.03 inches (scan larger)

Min. difference of the bust measure between manual and scan: 0.58 inches (scan larger)

Average difference of the bust measure between manual and scan: 1.85 inches (scan larger)

Second Results:

After comparing the results, the manual measurers were given the opportunity to view on a monitor a 3D representation of how the scanner measured each subject. At that point, the manual measurers were given the opportunity to re-measure. Through this process several errors were identified in how the manual measurements were taken. The causes of the errors included:

1. The major cause of bust measurement manual error was in the inability of the measurer to keep the tape position parallel to the floor. In a majority of cases (but not all), the tape position was lower on the back than on the front of the body. This error can introduce a dramatic change in measurement with a tape drop of only 1-2 inches.
2. A secondary cause of bust measurement error appeared to be in the compression of the body. In some cases, to keep the tape in position, the measurer applied tension on the tape sufficient to compress slightly the soft tissue on the bust circumference.
3. The major cause of hip measurement error was in the incorrect identification of the point of maximum circumference. The maximum hip circumference can be driven by the abdomen protrusion, the seat protrusion, or the

side profile. In the majority of cases where the hip was measured wrongly, the hip measurement was taken too high (frequently in line with the seat or abdomen protrusion).

After viewing the 3D images of the body, and viewing how the measurements changed with re-positioning, and with the help of a second measurer, **in each case of the bust and hip the second attempt at manual measure found a measurement within 0.5 inches of the body scan measurement.**

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