

**Source Data 1.** Paired foot and track RAV measurements from subjects' unloaded feet and during walking across each of four substrates.

Anatomical RAV measurements were taken from 3-D scans of each subject's unloaded resting foot, and from the midstance pose of their foot as captured and animated during their walking trials on each of four substrates. For trials on deformable substrates, track RAV was measured from the 3-D model of the final track that was left behind. Three models could not be measured due to recording errors, so those cells are blank.

**Source Data 2.** Arch measurements from experimental human tracks.

Tracks from biplanar X-ray experiments are labeled as "HumanExp1". Track RAV and other variables were measured from 3-D models of the tracks produced when subjects walked across wet mud (both "wet 2.5" and "wet 5" variants). RAV, absolute and relative depth, and pitch were measured for each track. Tracks made as part of a previously published experiment<sup>17</sup> are labeled as "HumanExp2".

**Source Data 3.** Arch measurements from experimental chimpanzee tracks.

Track RAV and other variables were measured from 3-D models of the tracks produced when chimpanzees walked bipedally across wet mud<sup>10</sup>. RAV, absolute and relative depth, and pitch were measured for each track.

**Source Data 4.** Arch measurements from fossil hominin tracks.

Track RAV and other variables were measured from 3-D models of tracks from Walvis Bay Namibia, Ileret, Kenya, and Laetoli, Tanzania, as described in the main text. Tracks were

excluded from fossil samples if erosional damage, over-printing, or taphonomic effects were evident in the 3-D model and prevented arch measurement. RAV, absolute and relative depth, and pitch were measured for each track.

**Source Data 5.** Track RAV and navicular heights.

Track RAV and navicular height measurements, collected as part of a previously published experiment<sup>17</sup>. Data set includes measurements of track RAV and depth, and of navicular height and foot length. The latter two measurements were used to calculate relative navicular height (navicular height divided by foot length).

**Source Data 6.** R script used to generate Figure 1H.

Script used to generate Figure 1H. Note that cosmetic adjustments to the output from this code were made using Adobe Illustrator, in order to aid visualization in the Figure displayed in the main text. This script is reliant upon Source Data 1.

**Source Data 7.** R script used to generate Figure 4.

Script used to generate panels of Figure 4. Note that cosmetic adjustments to the output from this code were made using Adobe Illustrator, in order to aid visualization in the Figure displayed in the main text. This script is reliant upon Source Data 2-4.

**Source Data 8.** R script used to generate Extended Data Figure 1.

Script used to generate panels of Extended Data Figure 1. This script is reliant upon Source Data 5.