INTRODUCTION
This paper focuses upon the first half of stance phase (0 to 50% of foot contact) in running. Each flight phase ends with touch down (0%) of the foot - generally with the lateral edge of the heel - and is rapidly followed by weight acceptance. During these first 15% of stance phase, the foot comes flat to the ground by a fast initial plantar flexion and subtalar eversion. The accompanying deceleration of the body segments emerges a fast rising vertical ground reaction force: the impact force peak. These initial impact-like phase is followed by midstance (15% to about 50%). The foot remains flat, while the lower leg rotates forward: ankle dorsiflexion. In the subtalar joint, eversion progresses to a maximal value.

Alterations in the foot-to-ground interface (barefoot running or differences in shoe sole hardness) or stiffening of the ankle (ankle brace) clearly influences the movements occurring in the foot-ankle complex, both during weight acceptance and midstance. The purpose of this paper is to demonstrate these passively evoked alterations - by changes in the boundary conditions - and to hypothesise about the underlying mechanisms.

GENERAL METHOD
In the three studies that will be discussed, well trained runners, free of injuries and heel strikers, ran over a built in force plate and different aspects of the movement were filmed with three high speed video-cameras (see also De Wit et al. in this volume).

RESULTS AND DISCUSSION
1. Barefoot versus shod running. Nine runners ran 5 trials barefoot and shod at three submaximal velocities (3.5, 4.5 and 5.5 m-s^-1).

Although the subjects prevailed an heel strike pattern, the initial foot placement was much flatter (more plantar flexion and less inversion) when running barefoot. Nevertheless, the loading rate of the vertical impact force peak was 2 to 4 times higher compared to shod running. At the highest running velocity, although initial foot placement became flatter, several subjects complained about pain in the heel region at touch down. It is clear that in barefoot running, the initial shock reduction is impaired. In previous studies (De Clercq, 1994 and Aerts, 1993) it was demonstrated that, although the fatty heel tissue has distinct shock reducing and damping characteristics and can compensate to a certain extent for different loading regimes, it is mechanically overloaded when running barefoot. Concerning the foot-ankle movements in the frontal plane, in barefoot running touch down is characterised by a more neutral subtalar position, followed by a lower range and rate of subtalar eversion during weight acceptance. This will impose a lower eccentric strain on the inverting muscles, but most probably enhances the vertical impact loading rate (Stacoffe et al., 1988). On the other hand, maximal subtalar eversion, occurring at the end of midstance, is comparable for barefoot and shod running. In conclusion, in barefoot running, passive shock reduction by the heel pad and initial eversion is less compared to shod running and in order to avoid local overloading of the heel, the foot is placed flatter on the ground. Barefoot running at submaximal velocities can form part of a running training, if performed on sand or grass.
2. The purpose of the second study was to investigate the influence of midsole hardness on both impact forces and rearfoot motion (De Wit et al., 1994). Seven trained male long-distance runners ran at 4.5 ± 0.1 m.s\(^{-1}\) with soft and hard shoe soles (EVA; soft shore Asker C40; hard shore Asker C65). The results showed smaller initial vertical impact peaks, occurring with a higher loading rate, and a significantly larger and faster initial eversion when subjects ran with hard shoes. Support is given to the concept that a more pronounced initial eversion offers an additional deceleration mechanism (Stacoff, 1988) also increasing the eccentric loading of the inverting muscles. On the other hand, during midstance soft shoe soles were found to produce a larger maximum eversion, also imposing an increased load on the same muscles. So, as good running shoe should be focused on a balance between reducing impact forces and reducing overpronation.

3. As running forms a basic activity in sports, a third study investigated the influence of wearing a Push® type medium ankle brace upon movements of the foot and ankle during the stance phase in running (De Clercq, 1997). Seven trained male long distance runners ran at 4.5 ± 0.1 m.s\(^{-1}\) 3 trials with and without the tested ankle braces, wearing the same neutral running shoes. The tested brace significantly reduced the range and rate of subtalar eversion. Plantar and dorsiflexion were not affected. It was argued that, although this might not be the prime design feature of the tested ankle brace, this orthotic offers a strategy to influence the range and the rate of subtalar eversion. It may have the potential to prevent runners from overuse injuries associated with overpronation, but interaction between the passive support by the brace and the muscular stabilisation of the ankle joint needs further investigation.

CONCLUSION
It was clearly demonstrated that mechanical changes in the ankle-foot-ground system influence the movements of foot and ankle in the first half of the stance phase in running. Average trends for the tested group of runners were presented. However, rather large inter-individual differences in adaptations appear. This is an additional reason to be very cautious when deducing internal loading from plain kinematic information.

REFERENCES