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# MOTION ANALYSIS OF THE SEATED POSTURE ON AUTOMOTIVE PROTOTYPE SEAT

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## 1. Introduction

In automotive industry, by the past, postural comfort was generally predicted through pressure distribution [Mergl, 2005; Zenk, 2007]. Measuring the joint angles, for the automotive sitting comfort, becomes a new investigation field [Schmidt, 2014]. The aim of this study is to evaluate the reproducibility of sitting movement.

## 2. Methods

Six asymptomatic volunteers (mean: 26yo, 1.74m, 69kg), without back pain, participated in this study. The volunteers sat on a normative prototype seat as Robbins *et al* (1983). The footrest was placed in order to have a thigh angle of 15°. Participants were asked to successively sit 20 times during 3 phases (for a total of 60). The 2 first phases took place in the same day (morning and afternoon) and the third phase took place in the coming month.

Motion capture was made with an opto-electronic system Vicon at 100 Hz. The whole body was equipped with 29 retroreflective markers placed on specific anatomical landmarks and technical plates. Anatomical frames, segmental and articular kinematics of the lower limbs (hip), the pelvis and the trunk were computed according to Pillet *et al* (2010).

Flexion/extension, lateral bending and axial rotation were calculated for trunk and pelvis. Lateral bending and axial rotation were used to confirm that the movement was plane. For the flexion-extension, the variation between the beginning and the end of the movement was measured. The reproducibility was evaluated by Mann-Whitney test.

## 3. Results

Axial rotation and lateral bending can be considered as negligible. Indeed, the standard deviation (SD) is less than 2.5°.

For the flexion/extension, the volunteers are repeatable during a phase (Figure 1). For the trunk,

3 volunteers are reproducible for the 3 phases. One volunteer is reproducible between the 2 first phases. And 2 volunteers are not reproducible. For the pelvis, only 2 volunteers are reproducible between 2 phases: phase 1 and phase 3 or phase 2 and phase 3. The others are not reproducible.

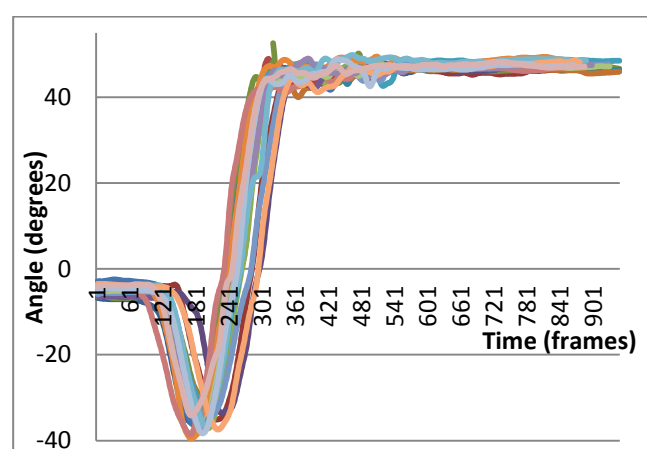


Figure 1: Flexion/extension of the pelvis for a volunteer during a phase

## 4. Discussion

According to the variation of axial rotation and lateral bending, the movement is considered to be plane. As expected, the pelvic anteversion is observed during the movement.

For the reproducibility study, the results show that volunteers do not sit in the same way for the 3 phases. These preliminary results quantified the movement during sitting. More volunteers currently increase the number of experimentations.

## 5. References

- Mergl *et al*, SAE, 2005.
- Pillet *et al*, Gait & Posture, 31:147-152, 2010.
- Robbins *et al*, SAE, 1983.
- Schmidt *et al*, Appl. Ergon., 45:247-260, 2014.
- Zenk *et al*, SAE, 2007.