# Does motion capture cause psychological stress and can we see it in the person's gait?

**Sophie Fleischmann**[1], Miriam Kurz[2], Robert Richer[1], Markus Gambietz[3], Luca Abel[1], Brittany Sommers[1], Björn M Eskofier[1], Nicolas Rohleder[2], Anne D Koelewijn[3]
[1]Machine Learning and Data Analytics Lab, FAU Erlangen-Nürnberg, Germany [2]Chair of Health Psychology, FAU Erlangen-Nürnberg, Germany [3]Chair of Autonomous Systems and Mechatronics, FAU Erlangen-Nürnberg, Germany
Email: sophie.fl.fleischmann@fau.de

## Summary

We aim to determine whether the requirement to attach markers and wear little clothing in optical motion capture (OMC) experiments induces psychological stress and changes gait. We compared gait features and self-reported stress between people experiencing an OMC experiment and a control group. While marker placement led to self-reported stress, it did not lead to significant gait changes at group level. We will further analyze cortisol to objectively confirm the experienced stress and investigate additional gait features.

## Introduction

Human movement measurements with OMC require participants to wear little clothing to minimize the difference between skeleton and marker movement and involve physical touch by the examiner during marker application [1]. Our goal is to investigate whether participants experience psychological stress during this standard motion capture procedure, and if this leads to changes in their walking pattern.

## Methods

We are conducting a gait experiment in which participants without motion capture experience are randomly assigned to an OMC or control group. The OMC group wears short, tight shorts and potentially a bra and is equipped with 39 markers. The control group wears their everyday clothing without markers. All participants walk on a treadmill at two speeds, while we record video in the sagittal plane. Six saliva samples are taken during and after the experiment, to extract cortisol as a biomarker for psychological stress [2]. We assess self-reported stress with the Positive and Negative Affect Schedule (PANAS) questionnaire [3] at the start and end, and post marker placement for the OMC group.

As of submission, we have measured 33 participants (15 male, 18 female) out of the target of 40. Cortisol analysis must be done at once for all participants to ensure a valid comparison, which is planned for March. For now, we thus focus on the gait and reported stress of the 33 participants recorded so far.

We used 2D pose estimation [4] to process the gait videos. We identified left heel strikes [5] and computed gait features: stride times, cadence, hip and knee ranges of motion (ROM), and elbow flexion. We took the mean across all strides in a trial, excluding the first 30s, and across speeds, and performed an analysis into gait differences between both groups.

## Results and Discussion

Marker application significantly ($p<0.001$) increased the negative affect in the OMC group, indicating that individuals experienced stress and discomfort during this phase. The OMC group had a slightly higher hip ROM and lower knee ROM and elbow flexion than the controls. Stride times (1.17s vs 1.16s) and cadence (103 steps/min) were similar.

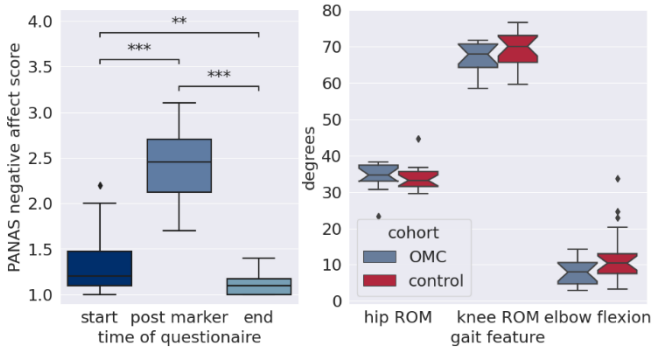


**Figure 1** Self-reported stress of the OMC group before and after marker placement and after walking, and selected gait features

Our results show that marker placement induces subjective stress, which is however not overly reflected in the gait pattern at group level, at least in the features that we computed. Analyzing the cortisol level in the saliva samples will objectively show stress differences between the groups.

## Conclusions

Our study provides initial evidence that OMC induces stress but does not lead to significant changes in participants' gait. At the conference, we will also present cortisol measurements to investigate psychological stress differences between the two groups. Our study indicates that marker-based motion capture can be used without unwanted gait alterations at group level. However, stress might still lead to gait pattern changes at an individual level. Contactless motion capture, or sensor technologies that allow for clothing to be worn, could alleviate the psychological stress experienced by participants.

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