resulting in cardio-vascular adaptations (i.e. increasing heart rate) and an overall physical vitalisation. Today everybody is aware that physical vitalisation is strongly connected to central processes and that physical exercise has a huge impact not only on cardio-vascular, muscle and bone mechanisms but also on mental well being and performance (Dworak et al. 2008; Hollmann and Struder 2000). With this first test run we aimed to demonstrate that artificial gravity, provided by a SAHC, is not limited to peripheral physiological mechanisms. We supposed the resulting physical vitalisation also to interfere with brain cortical activation patterns.

Methods
We recorded EEG activity of one female subject aged 39 years using a 32-channel actiCAP. Data was recorded prior to acceleration and three times during acceleration to 1G (= 25 rpm) measured at feet level as well as during 2G and 3G. EEG data was analysed using BrainVision Analyzer 2 software. After artefact rejection procedures (EOG/EMG) data was segmented into 4 second sections, where a 10% overlap was accepted.

EEG tomography (LORETA)
LORETA enables the spatial identification and analysis of brain cortical activity via traditional EEG recordings (Pascual-Marquès et al. 2002). LORETA software is based on a probabilistic MNI brain volume with 6239 cortical grey matter voxels scanned at 5mm resolution. The LORETA software package is available for academic use by the KEY Institute for Brain-Mind Research (University Hospital of Psychiatry, Zurich, Switzerland; www.uzh.ch/keyinst/New LORETA/LORETA01.htm). For LORETA analysis segmented EEG data was baseline corrected and a remaining minimum of 35 four second epochs of artefact-free resting EEG were averaged to calculate cross spectra in LORETA for alpha-1 (7.5–12.5 Hz), beta-1 (12.5–18 Hz) beta-2 (18–35 Hz) and gamma (35–48 Hz) bands. Using the LORETA transformation matrix, cross spectra for each frequency band were then transformed to LORETA current density files.

Peak alpha frequency
For analysis of peak alpha frequency (PAF) segmented data was baseline corrected and analysed by spectral analysis (FFT) using power output [µV²] and averaged over all remaining segments.

As occipital region show the highest alpha activity we concentrated on alpha activity in a pool of channels O1, O2 and Oz. Peak alpha frequency (PAF) corresponds to the discrete frequency with the highest magnitude within the alpha range,
and is known to be related to specific cognitive functions as for example memory encoding (Klimesch 1996) and performance (Richard et al. 2004).

Results
Localisation of activity using LORETA showed no major differences between the gravity conditions 1G and 2G. As expected, due to the eyes-closed condition, highest values of alpha activity were observed in occipital regions. Major changes could be observed at 3G. Whereas beta-2 activity from 1G to 3G was found to get more pronounced (Figure 2), there seemed to be a shift of gamma activity to frontal brain areas (Figure 3), which are well known to be involved in emotional processing (Faw 2003; Coan and Allen 2004). A shift of PAF in magnitude as well as frequency could be noticed at all three gravity stages when compared to a PRE and POST centrifugation measurement (Figure 4).

Conclusion and Outlook
Within this preliminary study we could clearly show an impact of artificial gravity on brain cortical function. Both reported effects, (1) the increase in beta-2 and gamma activity at 3G and (2) the shift of PAF during centrifugation can be assumed to reflect cortical arousal during centrifugation. The dramatic increase in frontal brain areas at 3G could be connected to an increase in emotional processing (e.g. indisposition, q.v. (Schneider et al. 2008a). The activation in PAF even at 1G points to an increase in cortical excitability, which might result in enhanced cognitive and/or sensorimotor performance (Angelakis et al. 2004). This would put new emphasis on the usage of the SAHC not only in terms of peripheral counter measures but also as a promoter for increased performance due to the overall physical activation. There is a big enthusiasm in space researchers as well as space agencies that SAHCs will help improve fitness and quality of life of our astronauts. We hope, that the very first results of this study will provide researchers with further information and ideas of central changes due to artificial gravity and make aware of the fact that a simple model, counteracting on peripheral changes only, is limited. Possibly there is more power in the SAHC.

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A more detailed version of this manuscript is available upon request.