Dear Editors,

First of all, we would like to thank the two referees for the constructive comments and suggestions; these were very helpful and definitely improved our manuscript. The revised manuscript includes all of the revisions requested by the reviewer #1 and the reviewer #2, highlighted in blue and green throughout the text, respectively (entitled “Shaw\_et\_al\_Revised\_Marked”). In the following, we omit positive and summarizing comments by the reviewers, and just respond to suggested revisions. Please note that the page numbers employed below to indicate where the modifications were made in this revised version.

**Reviewer #1**:

Comment #1: It is unclear whether any participants have a history of traumatic brain injury (TBI) and/or mental health conditions such as PTSD. TBI and PTSD are common comorbidities in individuals with limb loss and are known to affect brain activity. The comorbidity of TBI/PTSD may be associated with the injury severity and therefore become confounding factors of this study.

**Response #1: Thank you very much for this insightful comment. While we did not specifically screen for TBI and PTSD, participants were screened to ensure: i) they did not have any cognitive impairments or decreased learning capabilities as assessed via the Mini Mental State Examination (MMSE) and ii) that all participants were free from drug and alcohol use at the time of participation. In addition, all participants reported not being on any medication known to alter the activity of the central nervous system. However, we agree it is not possible to completely rule out differences in the underling brain dynamics between the two groups due to potential differences in prior history and/or presence of TBI/PTSD severity. To help account for this, spectral power for each frequency bandwidth was normalized by the spectral power of the entire spectrum. Information regarding the normalization procedure has been moved from the supplementary material to the methods section under electrophysiological data collection and signal processing in the revised manuscript in the methods section on page 9, sentence: “To account for [...] entire spectrum considered.” Due to word limit constraints, additional participant demographics can be found in the supplementary material under participants on page 1, paragraph: “Twelve individuals with [...] mechanical controlled knees.”**

**Related to this, we did not include a control group of uninjured participants in the current analyses for the reasoning provided in comment #1 by Reviewer #1. In this regard the contrast of TT and TF LL provided control for the possible comorbidities as both groups likely held similar histories while a noninjured control group may have differed significantly. The inclusion of uninjured individuals would not necessarily allow for the control of combat-related mental effects associated with limb loss, which are well-known to influence brain dynamics detected by EEG (e.g., Bhatnagar et al., 2015; Lobo et al., 2015). It is expected that due to the etiology and context of the limb loss (i.e., trauma), there would be some level of combat-related mental effects. Thus, any potential differences in the underlying brain dynamics are expected to be more pronounced when comparing uninjured individuals to injured individuals relative to comparing individuals with varying levels of limb loss. For a review of the rationale provided for the exclusion of a control group, please see the methods section under participants on page 6, second sentence: “The current experimental analyses [...] an uninjured group.”.**

Comment #2: Was there any group difference in the self-selected walking speed? The TF group may choose to walk slower than the TT group due to more severe injury. Would it be a confounding factor?

**Response #2: The self-selected walking speeds (TT LL: 1.16 ± 0.16 m.s-1; TF LL: 1.02 ± 0.20 m.s-1) did not significantly differ between the two groups (*p* > 0.05). Each participant’s walking speed was pre-determined during a 4-minute acclimation period prior to completing the experimental conditions, and these speeds were maintained during the entirety of the experiment. Thus, the possibility of differences in walking speeds as a confounding factor should be minimal. This information has been moved from the supplementary material to the methods section under experimental procedures in the revised manuscript on page 7, sentences: “All walking conditions [...] was detected (*p* > 0.050).” Additionally, we have clarified this point in the discussion section under conclusions and future work. Please see page 20, sentences: “Additionally, self-selected walking [...] varying cognitive-motor demands.”**

Comment #3: The formula of d' needs to be provided. It would help readers to understand the metric.

**Response #3: d' = Z(H) - Z(F) where Z(H) and Z(F) is the Z transform of hit rate and false alarm rate, respectively. This formula has been added to the methods section under experimental procedures. Please see page 7, footnote #3: “d’ = Z(H) [...] false alarm rate, respectively.”**

Comment #4: What was the reference for the EEG recordings? Was there any artifact rejection in data preprocessing? I would expect large movement artifacts in EEG during the walking conditions. Have the authors performed any preprocessing on removing movement artifacts?

**Response #4: Continuous data collected during the entire experiment were re-referenced to an averaged ears montage offline before further processing. A manual visual inspection known as pruning (Onton, Westerfield, Townsend, & Makeig, 2006) was conducted to manually remove non-stereotypical artifact, which included major motion artifact. In addition, an ICA approach was employed. Although most artifact removed using this approach were ocular related, there were some motion and muscular related artifact removed using ICA. This information was transferred from the supplementary material to the revised manuscript. A detailed account of the signal processing procedures can now be found in the methods section under electrophysiological data collection and signal processing in the revised manuscript. Please see pages 8-9, paragraph: “Continuous EEG data were [...] (Gevins & Smith, 2003; Holm et al., 2009).”. Additionally, we provide several arguments as to why the cortical dynamics observed in the present study were not primarily determined by motion-related artifact, but instead reflect underlying cognitive-motor mechanisms. For a review, please see the discussion section under conclusions and future work on page 22, fourth paragraph: “Additionally, there is some [...] Dyke et al., 2015; Jaquess et al., 2018).”**

Comment #5: What was the method used for computing spectral power? Have the power values been log-transformed before entering ANOVA to meet the assumption of normality?

**Response #5: Spectral power was computed across 1-Hz bins and summed across the frequency bandwidths to estimate theta (4-7 Hz), low- alpha (8-10 Hz), high- alpha (11-13 Hz), and gamma (36-44 Hz) power (please note that the gamma band was added based on comment #5 of Reviewer #2). Additionally, spectral power for each frequency bandwidth was normalized by the spectral power of the entire spectrum considered. This was done to account for possible differences in brain dynamics between both groups (please also see response # 1 to the comment #1 of Reviewer #1). The frontal theta / parietal alpha (FT/PA) and frontal theta / frontal alpha (FT/FA) ratio power were also computed as they provide robust indices of changes in mental workload (Gevins & Smith, 2003; Holm et al., 2009). This information was transferred from the supplementary material to the methods section under electrophysiological data collection and signal processing in the revised manuscript. Please see page 9, sentences: “Spectral power was [...] (Gevins & Smith, 2003; Holm et al., 2009).”. Also, since the Kolmogoroff-Smirnov test and Q-Q plots revealed that the data did not significantly depart from the normality there was no need to apply a log transformation prior to conducting the statistical analyses. This information was also added in the methods section under Statistics in the revised manuscript. Please see page 10, footnote #7: “The Kolmogoroff-Smirnov test […] statistical analyses was considered.”.**

Comment #6: In page 8, the theta and alpha frequency bands need to be defined.

**Response #6:** **Please see response # 5 to the comment #5 of Reviewer #1. This information was transferred from the supplementary material to the methods section under electrophysiological data collection and signal processing in the revised manuscript on page 9, sentence: “Spectral power was [...] power (Pizzagalli, 2007).”**

Comment #7: In page 9, what are the FT/PA and FT/FA?

**Response #7: Please see response #5 to the comment #5 of Reviewer #1. This information was transferred from the supplementary material to the methods section under electrophysiological data collection and signal processing in the revised manuscript on page 9, sentence: “The frontal theta [...] (Gevins & Smith, 2003; Holm et al., 2009).” Additionally, please refer to the introduction section, third paragraph, where FT/PA and FT/FA ratio power is first introduced on pages 4-5, sentence: “Also, the ratio [...] Holm, Lukander, Korpela, Sallinen, & Muller, 2009).”**

Comment #8: In page 9, "between subjects factor" should be "between-subjects factor".

**Response #8: As suggested by Reviewer #1, “between subjects factor” has been changed to “between-subjects factor.” See the methods section under EEG spectral power on page 10, sentence: “FT/PA and [...] between-subjects factor.”**

**All the cited references mentioned above are now included in the revised manuscript.**

**Reviewer #2:**

Comment #1: The authors state a justification for why they did not collect data for a control group of individuals with no loss of lower limbs. I might mention here that while this certainly is of empirical and theoretical interest to assess levels of lower-limb loss, it would still have been preferable to include the third group of control participants with no lower-limb loss.

**Response #1: Thank you very much for the comment. The aim of the current investigation was to examine mental workload as a function of limb loss level (transtibial vs. transfemoral) through the assessment of cortical dynamics under varying cognitive-motor demands. Although a control group of uninjured individuals can provide some context, the inclusion of a control group presents too many confounding factors that could bias our interpretation of the cortical dynamics underlying mental workload in relation to the level of amputation. As mentioned in comment #1 by Reviewer #1, there are a number of common comorbidities (e.g., TBI and PTSD) commonly found in individuals with limb loss, known to affect their underlying brain dynamics. The inclusion of healthy uninjured individuals does not allow for control of combat-related mental effects associated with limb loss. Please see response # 1 to the comment #1 of Reviewer #1. Furthermore, this work is part of a programmatic research approach. As such, a control group was not included in the current investigation to minimize duplication of results for this particular group (please see Shaw et al., 2018; Pruziner et al., 2018). Lastly, prior work conducted by our research group (Pruziner et al., 2018) revealed similar neurocognitive responses to varying levels of cognitive challenge in individuals with and without transtibial limb loss. Such a finding supports a parsimonious comparison between individuals with transtibial and transfemoral limb loss without the inclusion of uninjured individuals as a control.**

Comment #2: With the exception of a 4-way interaction, the high-power alpha data did not show much evidence that group was linked to performance.  For the high-alpha power analyses, there was a Group x Difficulty x Hemisphere interaction, but the authors did not interpret this interaction other than to say that both groups showed a Difficulty x Hemisphere interaction.

**Response #2: The locus of the Group x Difficulty x Hemisphere interaction could not be identified. This has been added to the manuscript in the results section under high-alpha power on pages 12-13, sentence: “While the locus [...] LL was revealed.” It must be noted that there was a small tendency of a Difficulty x Hemisphere interaction for the TF LL group (*p*= 0.097) compared to the TT LL group (*p* = 0.306). This tendency has not been reported in the manuscript since it was not significant, however we are happy to include it if the reviewer and/or editor feel that it is needed.**

Comment #3: It is unclear why the authors did not used an event-related approach (in which they recorded EEG power on each epoch of a cognitive task trial during walking and just seated conditions).

**Response #3: Thank you very much for this comment. We would have been interested to conduct an additional analysis using an event-related approach, however it is not possible at this time since we did not employ any system to event-mark the EEG recording at the beginning of each trial on the cognitive task. Moreover, no predictions were made linking EEG to specific events and thus an event-related approach did not seem warranted. Instead, we segmented the data within a given experimental condition (e.g., seated while performing the low demand cognitive task) and then averaged across the segments as we expected the EEG to be relatively stable from segment-to-segment. This is a well-known approach that has been successfully implemented in prior work conducted by our research group (Pruziner et al., 2018; Shaw et al., 2018) as well as by others (e.g., Borghini et al., 2016; Holm et al., 2009). Furthermore, to ensure the stability of the brain dynamics, we removed the first and last two minutes of EEG data recorded for each experimental condition. This information was moved from the supplementary material to the revised manuscript. It must also be noted that the cognitive task had a random inter-stimulus interval of 100-1000 ms, which is fairly small. Thus taking everything into consideration, we are fairly confident the EEG was relatively stable. In future work, we will be sure to employ additional EEG markers to allow for an event-related approach. Please see the methods section under electrophysiological data collection and signal processing on page 8, sentences: “To minimize any [...] Shaw et al., 2018).” Please see also the discussion section under conclusions and future work, on pages 20-21, sentence: “In addition, the data processing […] information related to specific events.”**

Comment #4: This suggests to me that the authors cannot conclusively link theta- and alpha-wave power data to cognitive and motoric performance. Given that the alpha-wave data showed the most effects, one possibility was that these were “mind-wandering” effects).

**Response #4: Thank you very much for this thoughtful comment. While there is always the risk that participants will become disengaged during the completion of the experimental task and “mind-wandering” cannot be fully ruled out, there are several arguments which may weaken this possibility. First, high-alpha modulation was observed as a function of difficulty for both groups (greater cortical activation apparent for the cognitive task of high vs low demand). Based on this result, one may argue participants were more engaged in the cognitive task of high demand and potentially “mind-wandered” during the cognitive task of low demand for various reasons (e.g., too easy, boredom). However, performance on the cognitive task (as indicated by d’) across all experimental conditions did not significantly differ (*p* > 0.107). This finding suggests participants: i) were engaged across all conditions, and ii) could perform the cognitive task equally well under varying cognitive-motor demands, but required the recruitment of additional neural resources in order to do so when the demand increased. If the observed cortical dynamics were reflective of “mind-wandering,” it would have been reasonable to expect d’ (accounts for correct hits and false alarms indicating the capacity to detect information) to mirror the brain dynamics, however this was not the case. Furthermore, although the results for the theta band did not present complex interactions and no effect of group was observed, they were not insignificant. Namely, the increase in theta power for both groups when the cognitive and motor difficulty increased is consistent with prior research and our predictions, suggesting there was an increased recruitment of attentional control and working memory. Additionally, although participants may become fatigued towards the end of data collection, all experimental conditions were counter-balanced across participants to avoid potential order effects. Lastly, as for any dual-task walking study, we recognize that it is difficult to tease apart the cognitive and motor aspect, which likely engaged cognitive-motor processes somewhat differently. However, this study was not intended to disentangle cognitive and motor mechanisms, but instead aimed to assess mental workload under varying cognitive-motor demands. All these points discussed here have been included in the discussion section under conclusions and future work on page 20, paragraph: “As with any dual-task [...] varying cognitive-motor demands.” and on page 21, paragraph: “Furthermore, participants [...] potential order effects.”.**

Comment #5: It is unclear why gamma-wave power was not assessed given the relation of this to attentional processing.

**Response #5: Thank you very much for this comment. Initially only the spectral power in the theta, low-alpha and high-alpha bandwidth were considered since they have been the primary metrics employed to assess mental workload in a large body of previous investigations. As such, for consistency these three frequency bands were employed since they allowed us to: i) define our a priori hypotheses and ii) directly compare our results to those from the many previous mental workload studies (including dual-task walking and some of our prior work). However, we agree with the reviewer #2 that the modulation of spectral power in the gamma bandwidth is also of interest since it has been related to attention and as such has been now added in the revised manuscript. However, to avoid setting a hypothesis a posteriori, here the gamma power has been included as an exploratory analysis.**

**The introduction, methods, results, discussion and reference list have been updated accordingly. Please see:**

**1) The introduction section on page 5, sentence: “Although changes in theta [...] Michels et al., 2010; Pascalis and Ray, 1998).”**

**2) The methods section under electrophysiological data collection and signal processing on page 9, sentence: “Spectral power was computed [...] power (Pizzagalli, 2007).”**

**3) The methods section under statistics and EEG spectral power on page 10, sentence: “Theta, low-alpha, high-alpha and gamma power [...] as a between-subjects factor.”**

**4) The results section under Gamma Power on pages 13-14, paragraph: “A significant Group [...] the walking condition (*p* > 0.050)** **(Figure 6C).”. Also, an additional figure (now Figure 6) along with its caption was added in order to depict the results for the gamma power.**

**5) The discussion section under recruitment of neurocognitive mechanisms irrespective of lower limb loss level on pages 16-17, sentence: “Lastly, both groups exhibited [...] Wagner, Solis-Escalante, Scherer, Neuper, & Muller-Putz, 2014).”**

**6) The discussion section under neurocognitive dynamics as a function of amputation level on page 19, paragraph: “In addition to low- [...] to uninjured individuals.”**

**All the cited references mentioned above are now included in the revised manuscript.**