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1 **Comments on "The relationship between T7-Fz alpha coherence and peak**
2 **performance in self-paced sports: a meta-analytical review" (Raman, Filho,**
3 **Exp Brain., 2024): A verbal (analytical) disagreement.**

4 Johnny V. V. Parr¹, Germano Gallicchio², Greg Wood¹.

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- 6 1. Department of Sport and Exercise Sciences, Manchester Metropolitan
7 University Institute of Sport, Manchester, United Kingdom.
 - 8 2. School of Psychology and Sport Science, Bangor University, Bangor, UK.
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15 Corresponding author:

16 Dr Johnny V. V. Parr (johnnyvvparr@gmail.com)

17 Department of Sport and Exercise Sciences, Manchester Metropolitan University
18 Institute of Sport, Manchester, United Kingdom.

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20 ORCID profiles:

21 Johnny V. V. Parr (0000-0002-3096-2601)

22 Germano Gallicchio (0000-0002-2180-8848)

23 Greg Wood (0000-0003-0851-7090)

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35 Dear Editors,

36 We read with interest the recent publication in *Experimental Brain Research* by Raman and
37 Filho, where through their meta-analytical review they concluded that “*independent*
38 *functioning of the motor planning region (Fz) without interference from the verbal-analytical*
39 *region (T7) is linked with superior sport performance*” and proposed that their findings
40 “...*suggest athletes have reduced verbal analytic processing when performing better on*
41 *sports tasks*”. We welcome the authors’ intent, but we disagree with their interpretations and
42 conclusions on multiple levels.

43 Firstly, it should be acknowledged that the evidence of an association between lower T7-Fz
44 connectivity and superior motor performance is mixed. Indeed, in our systematic review
45 (Parr, Gallicchio, and Wood 2023), we found that only 38% of studies found superior motor
46 performance to be associated with decreased left temporal alpha activity and/or decrease
47 left temporal frontal connectivity. Even specifically in the context of sports, there is evidence
48 that T7-Fz connectivity could not discriminate the superior performance of golf putting (Dyke
49 et al. 2014), hockey passing (van Duijn et al. 2017), or pistol shooting (Hunt et al. 2013).
50 There is also evidence of T7-Fz connectivity tending to increase with practice of a golf task
51 along with performance improvements (Gallicchio, Cooke, and Ring 2017), and evidence
52 that left temporal frontal connectivity was not different between expert and novice rifle
53 shooters despite the experts generally showing lower levels of connectivity across the cortex
54 (Deeny et al. 2009). We would also like to clarify that we believe neither our review, nor
55 Raman and Filho’s findings “...*provide evidence that athletes might benefit from*
56 *neurofeedback training specifically aimed at lowering T7-Fz alpha band coherence*”.

57 Second, the interest on the left temporal (T7) and frontal (Fz) locations stems from the
58 cognitive functions that they purport to represent: respectively, language and motor planning.
59 However, it is crucial to acknowledge that there is sparse evidence to support the very notion
60 that changes in T7-Fz connectivity before or during motor execution specifically reflect
61 changes in verbal-analytic processing. In fact, most studies in this area have not assessed,
62 either directly or indirectly, measures of verbal processing or conscious control. Instead, they
63 often rely on the mere assumption that individuals will reduce their reliance on verbal-
64 analytic processing as they become more skilled (e.g., Fitts and Posner’s stages of motor
65 learning; Fitts and Posner 1967)) and increase this reliance when under pressure (Masters
66 and Maxwell 2008). In line with this trend, five of the seven studies analysed by Raman and
67 Filho’s review did not include measures of verbal-analytic processing. Also, Gallicchio et al.
68 (2016) found no change in T7-Fz connectivity under conditions of performance pressure,
69 during which verbal-analytic processing is expected to increase. Furthermore, our review
70 (Parr et al. 2023) indicated that T7-Fz connectivity has been unreliably associated with an
71 individual’s tendency to engage in verbal-analytic processing, and we have previously
72 provided empirical evidence that encouraging verbal (inner speech) and/or conscious motor
73 processing during a motor skill does not drive changes in T7-Fz connectivity (Parr et al.
74 2020). Taking the lack of evidence into account, we urge caution on linking diminished T7-Fz
75 connectivity with “*reduced verbal analytic processing when performing better on sports*
76 *tasks*” as advocated in the meta-analytic review.

77 Finally, we also disagree that Raman and Filho’s findings “...*advance the literature by*
78 *examining a specific brain pathway (as opposed to “whole brain analysis”)*”. Reducing the
79 phenomenon of verbally guided motor control to a single index applicable to a variety of
80 contexts is indeed very appealing. However, that T7-Fz connectivity can be such index is
81 unsubstantiated by evidence. Therefore, limiting research to this index is misguided and
82 might impede rather than promote progress. Our review (Parr et al. 2023) highlighted that

83 approximately half of studies that undertook more extensive EEG analyses found differences
84 in spectral power and connectivity across various sensor locations and/or frequency bands.
85 If the connectivity effect extends beyond the T7-Fz pair, verbally guided motor control is
86 unlikely the interpretation. On the contrary, it cannot be ruled out that the cortical dynamics
87 underpinning superior motor performance and neural/psychomotor efficiency emerge from a
88 diverse and complex network that cannot be explained through a bivariate, “specific brain
89 pathway”, approach. In this manner, we worry that the continued promotion of T7-Fz
90 connectivity as a unique marker of verbal-analytic processing will encourage the continued
91 adoption of low-resolution EEG approaches (e.g., three channels: T7, Fz, T8), which is
92 problematic for numerous methodological reasons that we have covered previously (Parr et
93 al. 2020, 2023).

94 Taking these significant limitations into account, in our view a meta-analysis consisting of
95 seven studies is unsuitable to base such a strong and overly simplistic conclusions
96 presented by Raman and Filho. We have said it before, and we will say it again: “there is a
97 need for stronger evidence before left-temporal- frontal alpha connectivity is accepted to
98 uniquely represent such a marker [of verbal-analytical processing]. To strengthen or confute
99 this conclusion, researchers need to employ a more rigorous methodological approach to the
100 collection, pre-processing, analysis and interpretation of data and more research is needed
101 which experimentally manipulates verbally-guided, conscious motor control” (Parr et al.
102 2023, p.27). Without these stronger methodological and conceptual foundations, we believe
103 it unlikely that that the field will be able to move forward.

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