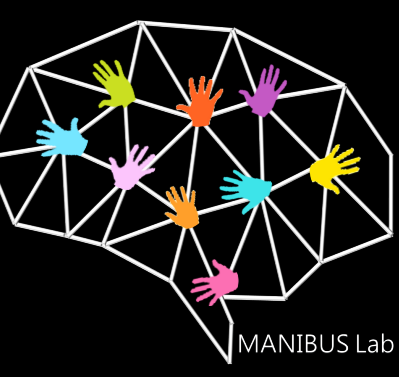


Expertise and injury experience in professional skiers modulate performance in predicting the outcome of observed ski-related actions



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INTRODUCTION

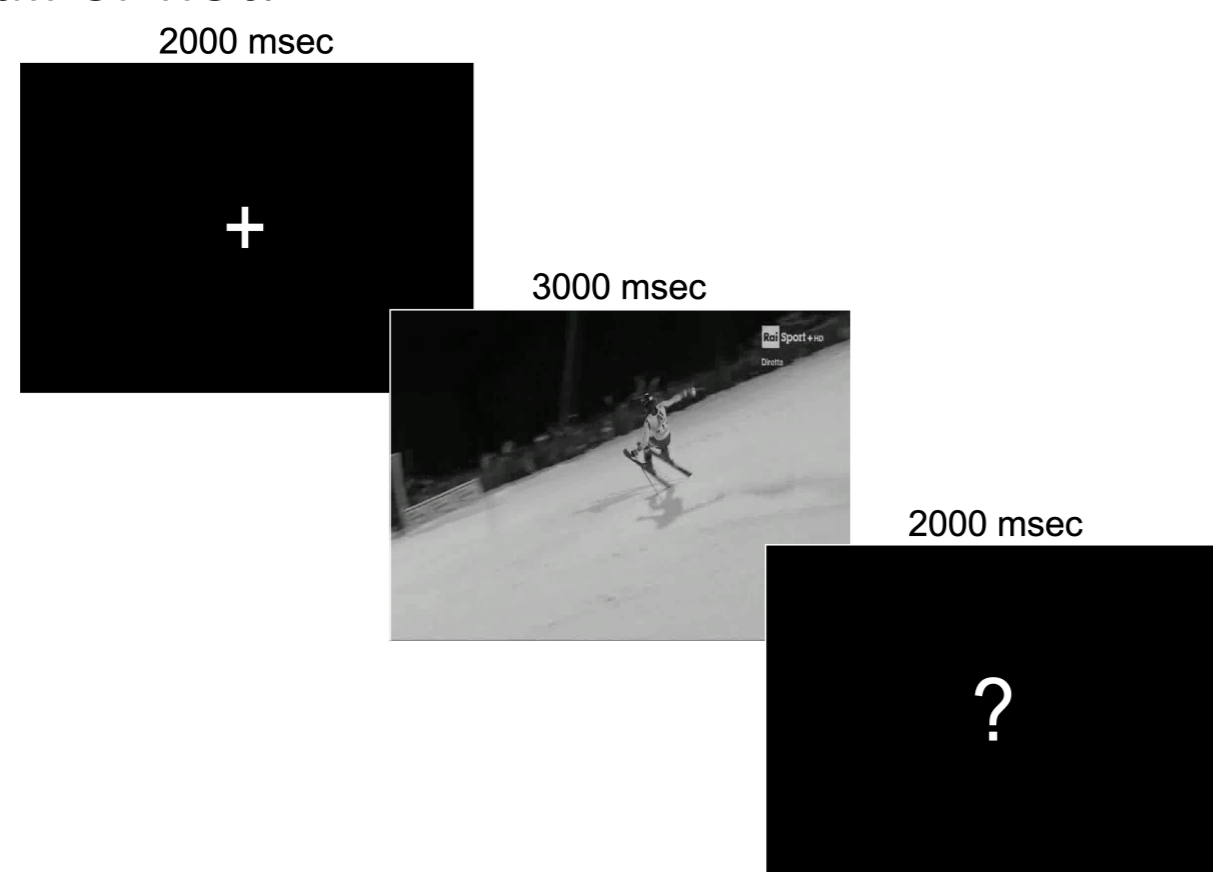
There is compelling evidence that professional athletes, compared to beginners, when asked to predict the outcome of observed sport-related movements, show enhanced performance, mirrored by motor-system modulations¹. Furthermore, motor-system inhibition has been evidenced when participants experience pain² or observe other people experiencing pain (pain resonance)³. Here, we addressed whether observing ski-related actions whose outcome can lead to an injury resulted in differential prediction performances depending on one's own previous experience of injury. Specifically, we investigated **1) the performance (accuracy and RTs) of professional skiers relative to non professional ones in predicting the outcome of another skier's course of action (fall/no-fall), and 2) whether a previous experience of injury in professional skiers affected their performance in estimating whether the fall led to an injury or not.**

Materials and methods

EXPERIMENT 1

Experimental paradigm

Professional (N=22) and **beginner** (N=22) skiers were shown video extracts of ski races representing a skier either about to fall (**fall** condition) or not (**no-fall** condition). Observers had to indicate whether the skier's course of action led to a fall or not.



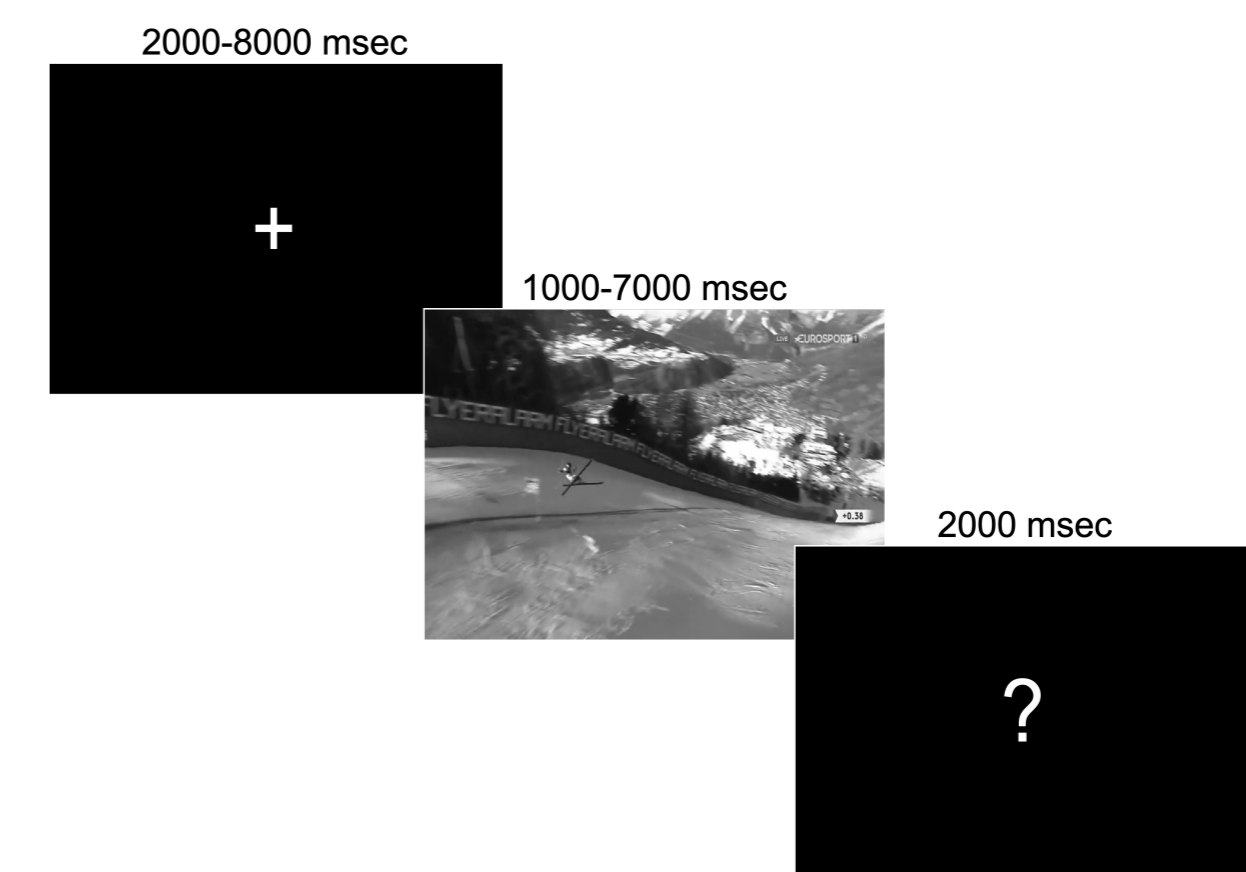
Data analysis

Accuracy and reaction times (RTs) data were collected and entered in two 2*2 ANOVAs with Group (professionals/beginners) as between-subject factor and Condition (fall/no-fall) as within-subject factor.

EXPERIMENT 2

Experimental paradigm

Professional skiers having previously experienced an injury (**injured**; N=19) or not (**not-injured**; N=19) watched videos representing skiers' falls that caused an injury (**injury** condition) or not (**no-injury** condition).



Data analysis

Accuracy and reaction times (RTs) data were collected and entered in two 2*2 ANOVAs with Group (non-injured/injured) as between-subject factor and Condition (no-injury/injury) as within-subject factor.

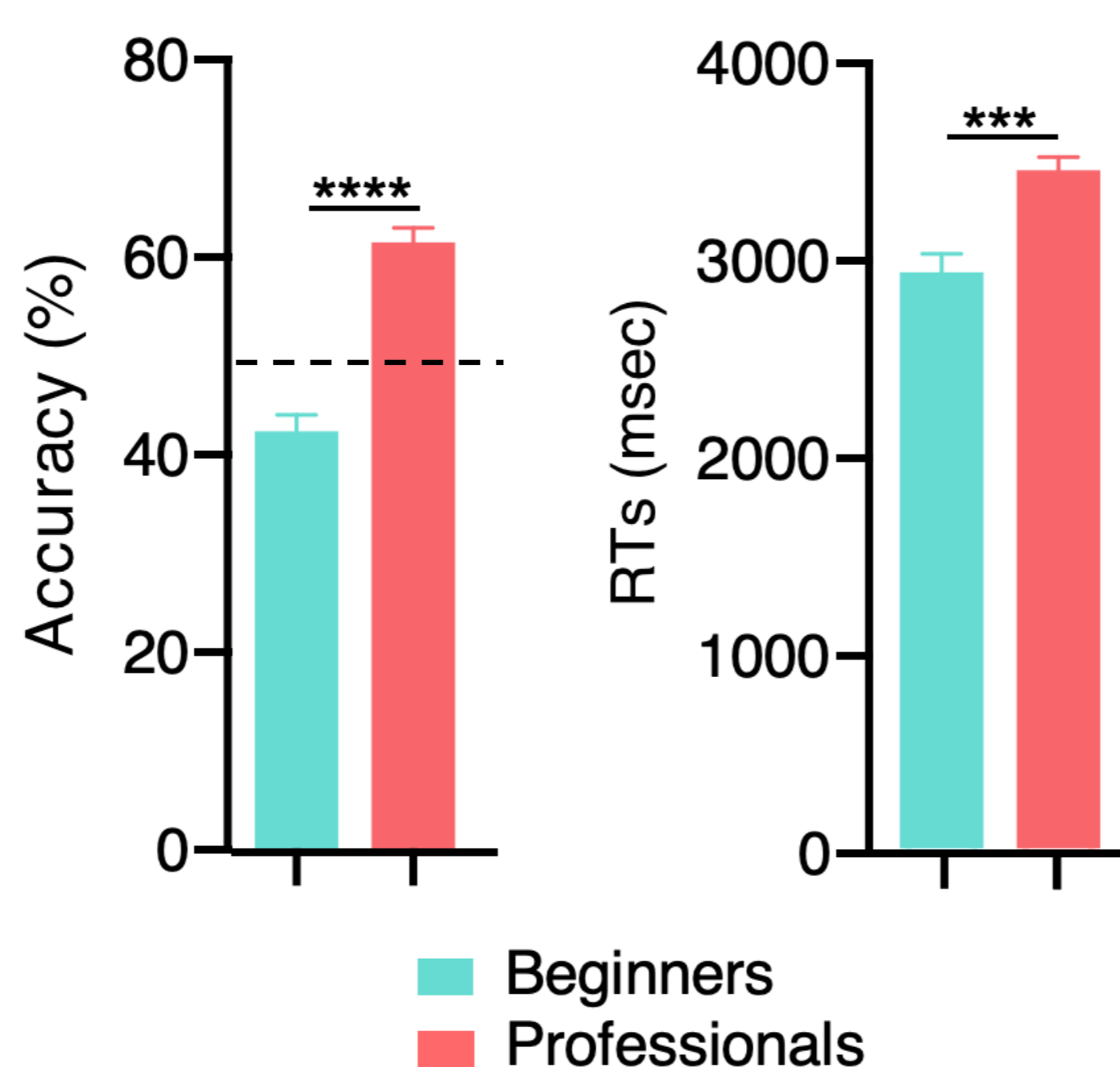
Results

EXPERIMENT 1

Accuracy. Significant main effect of Group ($F_{1,42}=75.56$; $p<0.0001$), with professionals performing significantly better than beginners in predicting action outcome.

RTs. Significant main effect of Group ($F_{1,42}=21.04$; $p=0.0004$), with professionals being slower than beginners.

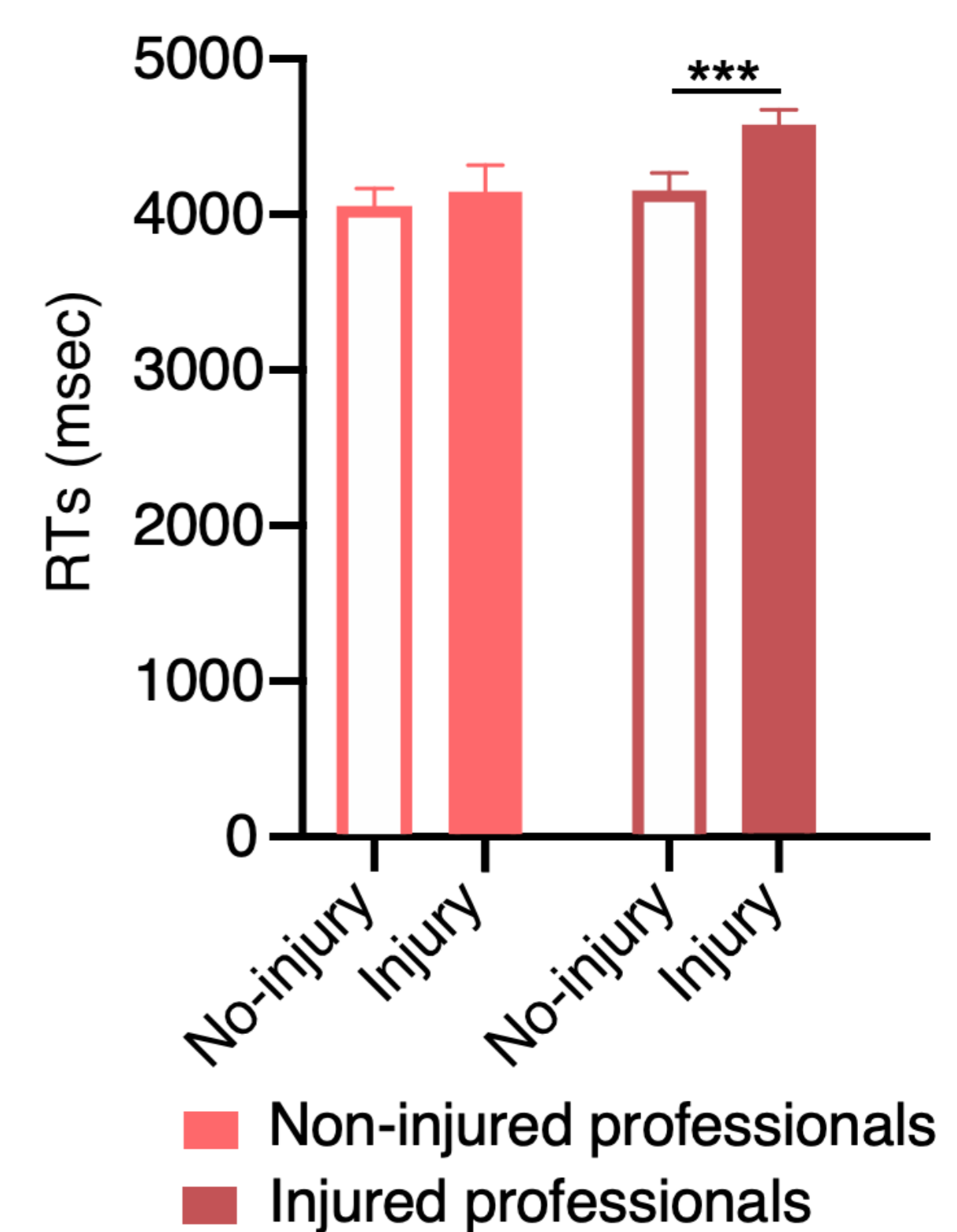
Speed-accuracy trade-off: while beginners' faster RTs were below chance level, professionals' slower RTs were related to higher prediction accuracy (above chance level).



EXPERIMENT 2

Accuracy. No between-groups difference, confirming that both groups of professional athletes were similarly accurate.

RTs. Significant Condition*Group interaction ($F_{1,36}=5.17$; $p=0.02$), with injured athletes being significantly slower in the injury than in the no-injury condition ($p=0.0003$), whereas no such difference emerged in not-injured athletes.



CONCLUSIONS

Our findings reveal that prediction speed and accuracy of observed actions outcome (fall/no fall-injury/no injury) is modulated both by expertise and history of injury experience: 1) professional skiers were more accurate, but slower, in predicting the occurrence of a fall or not, relative to non-professional ones; 2) among professional skiers, those previously injured were slower in predicting the outcome of the observed action when it led to an injury, but were not more accurate, than uninjured skiers.

We propose that a **pain resonance mechanism** could explain such results, inducing a sort of **experience-dependant freezing response** causing a motor-system inhibition during the observation of actions leading to a possible painful experience. Further research is needed to investigate the physiological substrate of this pain-resonance mechanism by measuring the modulation of motor cortex excitability with motor evoked potentials (MEPs).

References

1. Aglioti et al., *Nature Neuroscience* (2008)
2. Hodges et al., *Pain* (2011)
3. Avenanti et al., *NeuroImage* (2006)

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