Referee #1 (comments):

I carefully read the letter raising concerns regarding citations. I am very happy to see that you take such concerns seriously and give it due attention.

The main point that the authors of the letter raise is with regard to movement variability as viewed in reinforcement learning literature. Operant conditioning, a form of reinforcement learning, has long relied on variability to guide behavior. Our current understanding is that this form of learning relies on reward prediction error, and is dependent on the basal ganglia.

A novelty of the Wu et al. paper was to demonstrate that in a different form of learning, error-based adaptation that is known to depend on the cerebellum, variability also played a significant role.

In my view, Smith and Ölvezcky have answered the specific concerns of the authors of the letter. Importantly, the specific experimental results that the authors of the letter have suggested are outside the scope of the Wu paper. In my opinion, the authors of the letter have not made their case for a corrigendum.

Referee #2 (comments):

The letter writers' primary charge is that Wu et al do not appropriately acknowledge the sources of key ideas. I disagree. As the authors note, a large fraction of the introduction is allocated to citing previous work on the key ideas.

The article draws a bit more of a false dichotomy (variability as either helpful or harmful) than necessary, and I agree that the article's tone is a little more breathless than strictly required, but this is the style presently in vogue and is not entirely out of keeping with making sure that people understand the hypotheses, novelty, and importance of the study. To my knowledge, Wu et al show the first clear experimental evidence of variability being combined with both reward learning and error-based learning to shape the details of movement. This is the basis on which I recommended publication, and I do not feel it needs a corrigendum.

As a final note, Wu et al ran up against the 50 citation limit of Nature Neuroscience. This is typical; we all cut citations we would like to make because of this limit. In order to encourage scholarship of the ever-growing literature, perhaps this limit should be reconsidered.

Referee #3 (comments):

I have now had a chance to read through the letter, the authors' rebuttal, and several of the previous papers mentioned in the letter. My overall view is that although I agree that the authors could, and probably should, have cited some of the previous work noted in the letter, I do not feel that a corrigendum is required or that the authors need to write a "corrected version" of the paper.

There is no question that a number of previous papers and reviews-including the papers noted in the letter-have recognized various contributions of variability to motor learning and control. These include the role of variability in phase transitions in cyclic motor behaviour, the benefits of variable versus blocked practice in motor learning, the control of variability in optimal feedback control models, the important of variability in operant conditioning, etc. Although the paper by Wu et al. can be criticized for failing to cite some of this previous work, there is no question in my mind that the paper makes a novel contribution in several ways.

First, the paper documents the contribution of variability to both reinforcement learning and error-based learning. Although the important role of variability in reinforcement learning is well established (and perhaps even a little obvious)-as noted in the original reviews of the paper and my original comments on these reviews-the role of variability in error-driven learning is less clear. Second, the Wu et al. paper shows that training can reshape the temporal structure of motor variability and align it with the trained task so as to improve learning. I think this novel observation is the most important contribution of the paper. Third, the paper combines novel experiments with computational modeling, allowing the authors to draw specific conclusions about the precise, computational role of variability in reinforcement and error-based learning.

The letter complains about "over-hyping" about certain claims made in the paper related to previous work. I have some sympathy with the letter writers on this front. However, I also have some sympathy for the authors, who understandably were trying to emphasize the novelty of their work.