

# Feedback affects how users improve when training machine learning control

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**Introduction** Machine Learning (ML) control algorithms can lead to more intuitive prosthesis control assuming users can generate consistent/distinct EMG patterns. However, user training is needed to generate such patterns. Proper training feedback might lead to better training outcomes. We study (1) the effect of feedback during training on performance and (2) which feedback leads to the most consistent/distinct EMG patterns in feature space.

**Methods** Able-bodied participants (N=37; mean age 21.6, 18 females) trained using a ML system with 8 electrodes (LDA classifier, Hudgin's feature set). Participants were divided in groups with No Feedback (NF), Visual Feedback (VF) and Visual + Coaching Feedback (VCF) (fig. 1). A pre/post-test design with five training sessions on five consecutive days was used. Outcome measures were online accuracy and number of completed movements measured with the Motion Test and feature space changes (fig. 2).



Figure 1

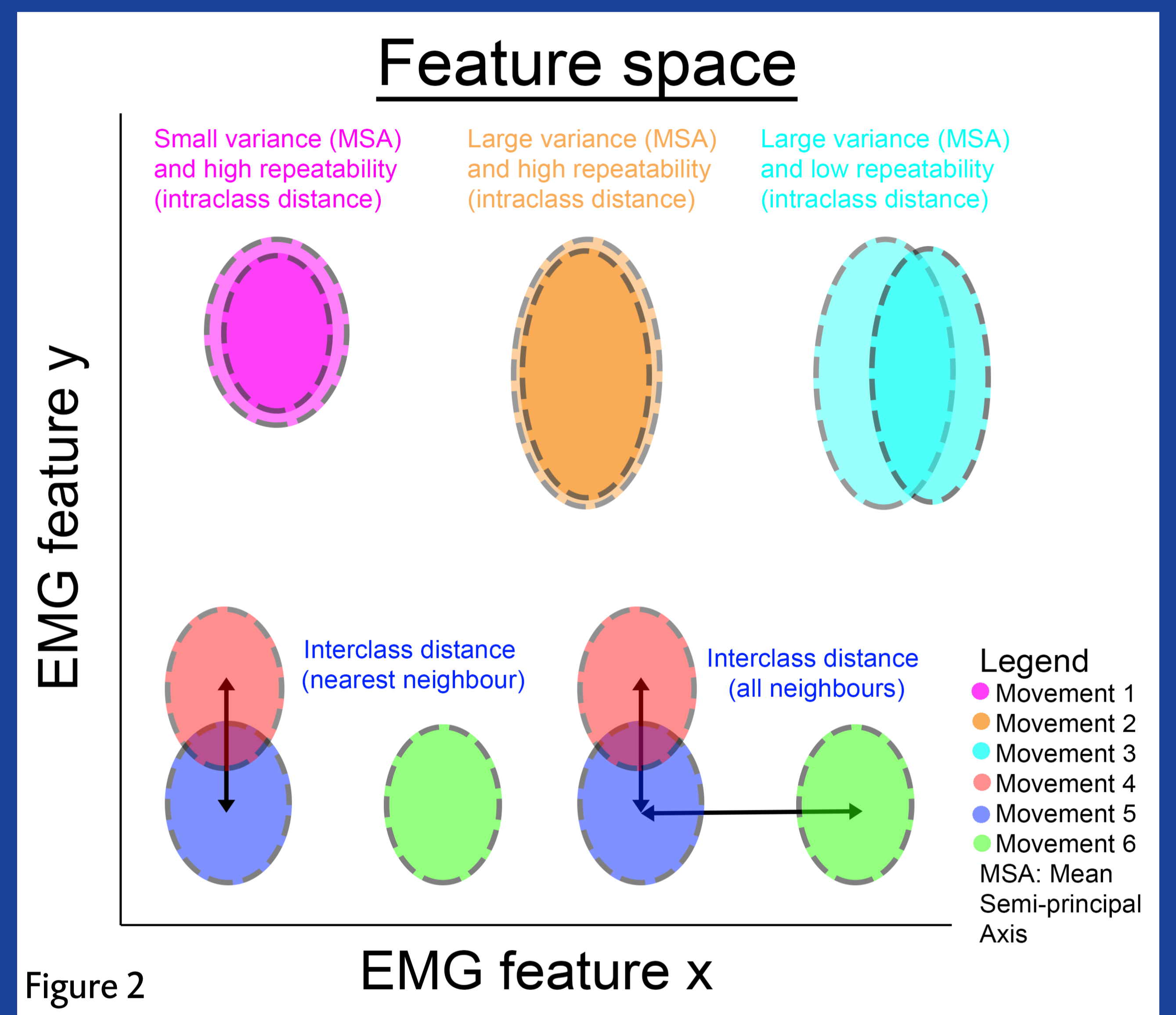


Figure 2

**Results** Both online accuracy and completed movements showed a significant improvement from pre- to post-test with no significant group effect. Principal Component Analysis revealed that the feature space evolved in different ways for the different groups (fig 3). Principal component 1 was found to significantly differ for group NF compared with groups VF and VCF (fig 4).

**Discussion** Following training all groups had similar performance. Surprisingly, NF achieved as good online performance as VCF. Interestingly groups behaved differently in feature space after training; meaning that different training methods lead to different outcomes in the feature space. It remains to be seen if these results are applicable in individuals with an upper limb defect.

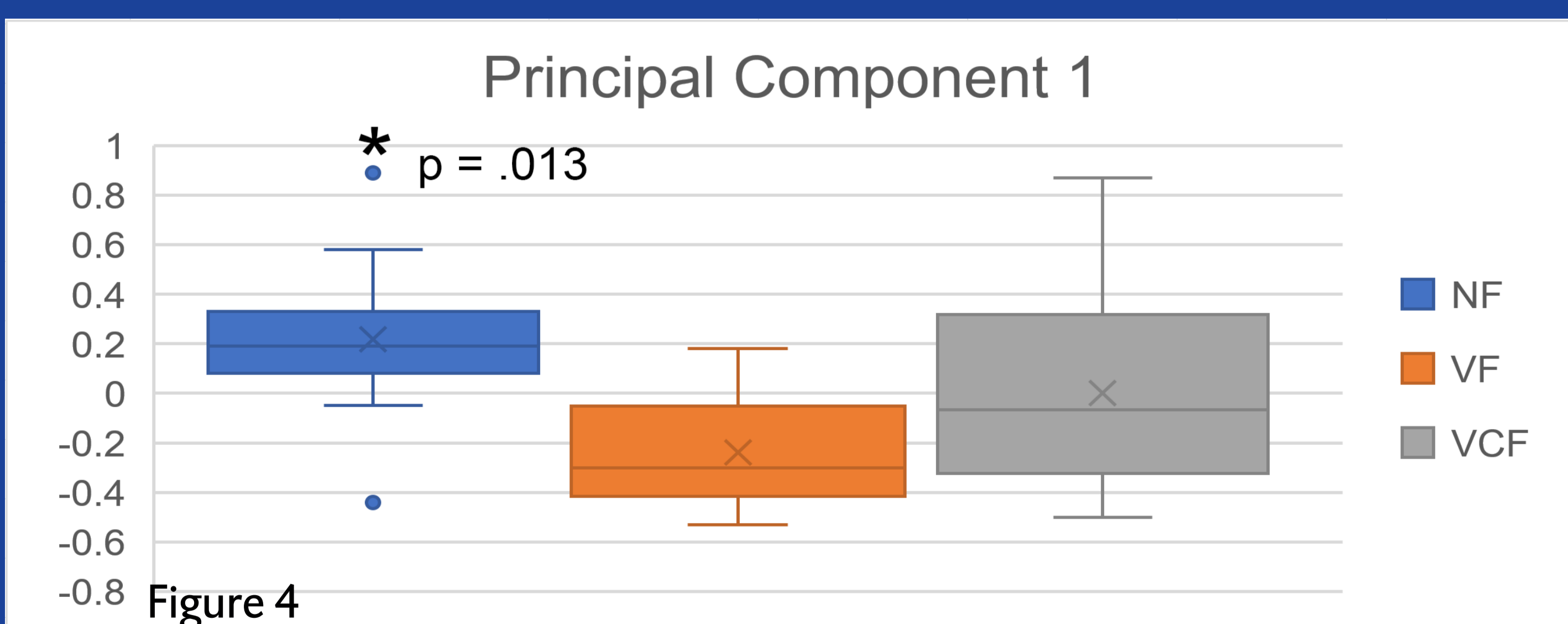


Figure 4

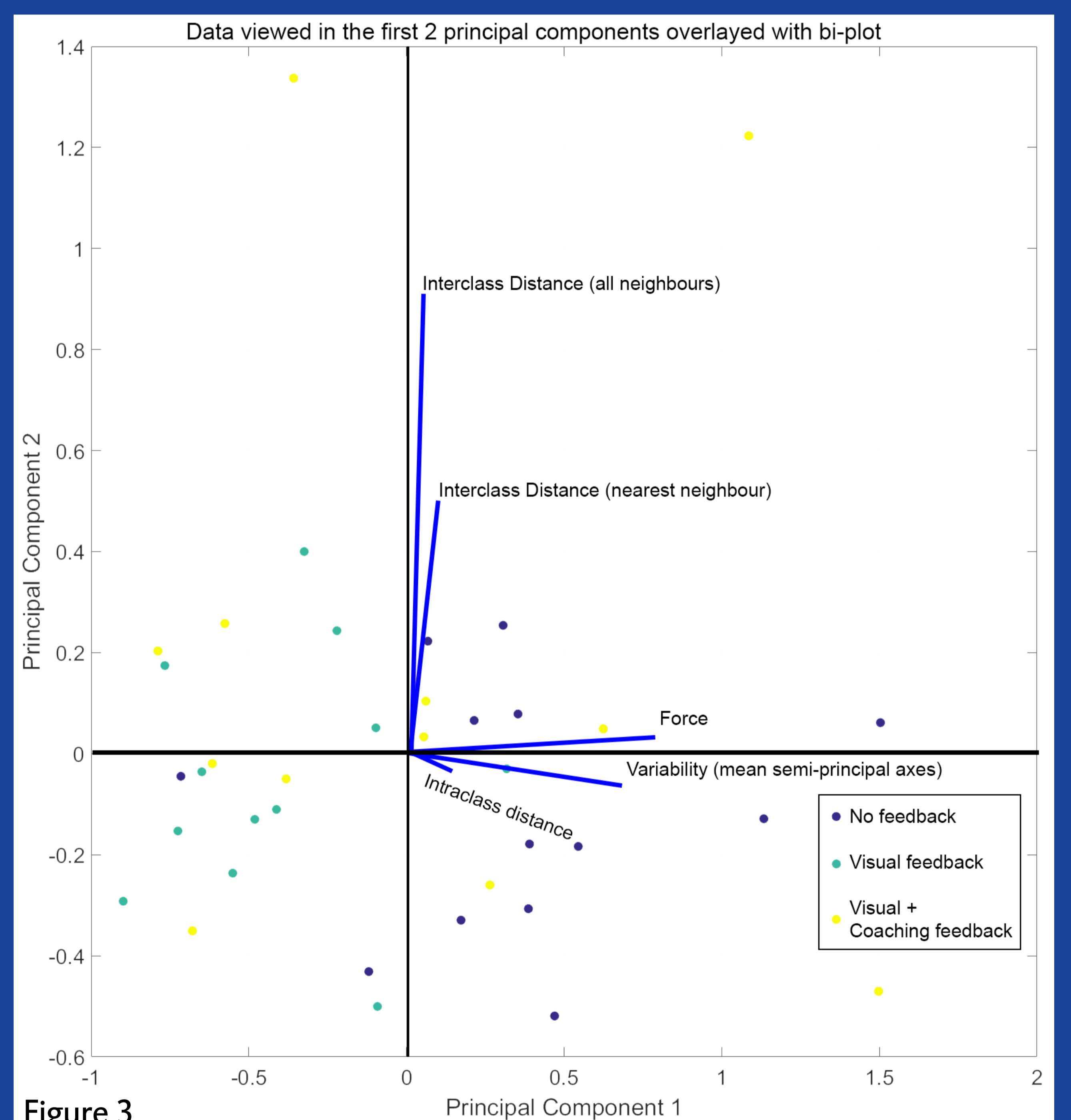


Figure 3

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 687795, project Acronym INPUT. The content of this poster does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the poster lies entirely with the authors.

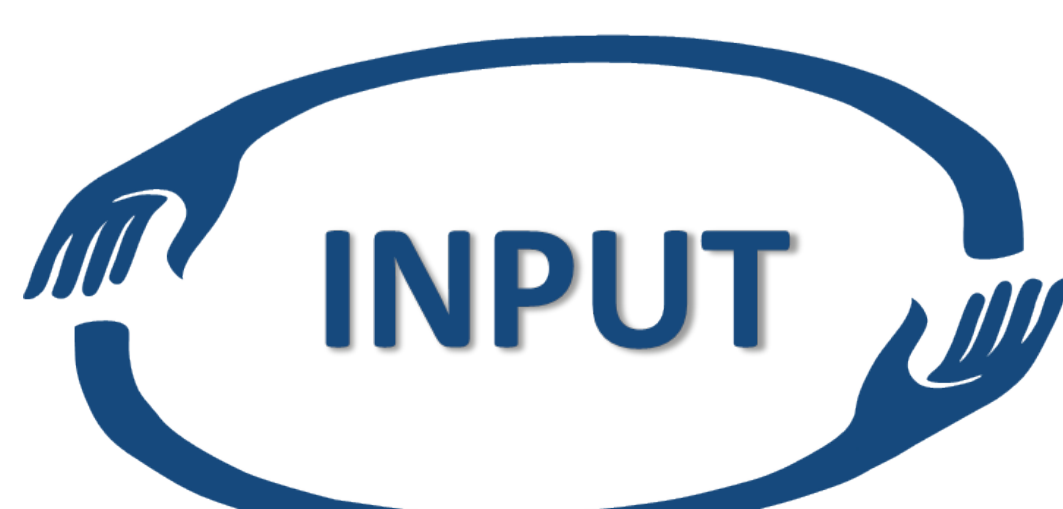
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