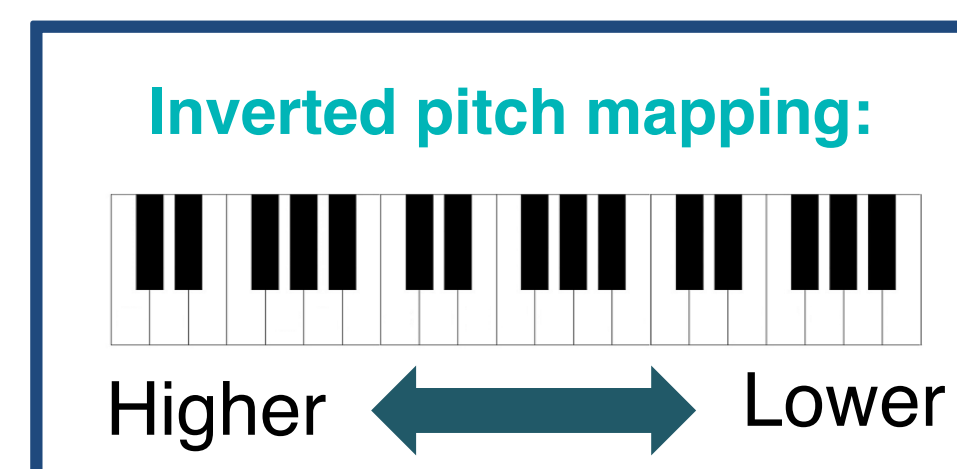


Generalization of Novel Sensorimotor Associations among Pianists and Non-pianists

Introduction

- ❖ Musical training leads to associations between motor planning and pitch content (for review, Pfordresher, 2019), with implications to spatial location and pitch height on piano.
- ❖ Musical training enhances one's ability to generalize learning across sequences (Palmer & Meyer, 2000).
 - **Transfer-of-learning paradigm:** tests how training on one melody is transferred to a new melody.
 - Musicians exhibit **positive transfer**, where prior learning facilitates learning of similar new melody.
 - Transfer of learning occurs when musical structure is conceptually similar, independent from motor movements.
- ❖ However, musical training advantages may be constrained by learned sensorimotor associations (Pfordresher & Chow, 2019).
 - Pianists and non-pianists learned to play melodies on a keyboard while experiencing auditory feedback with either normal or **inverted pitch mapping**.
 - Learning based on inverted pitch mapping was unstable for pianists.
 - Non-pianists showed no difference during later recall based on pitch mapping during learning.



Current Study

Do sensorimotor associations constrain pianists' ability to generalize learning?

- Transfer-of-learning paradigm: pianists and non-pianists learned a melody based on normal or inverted mapping and then performed the same and new melodies.
- How well does this learning transfer to a new melody?

References

- Palmer, C., & Meyer, R. K. (2000). Conceptual and motor learning in music performance. *Psychological Science*, 11, 63-68.
- Pfordresher, P.Q. (2019). *Sound and action in music performance*. San Diego, CA: Academic Press.
- Pfordresher, P. Q., & Chow, K. (2019). A cost of musical training? Sensorimotor flexibility in musical sequence learning. *Psychonomic Bulletin & Review*, 26, 967-973.

Method

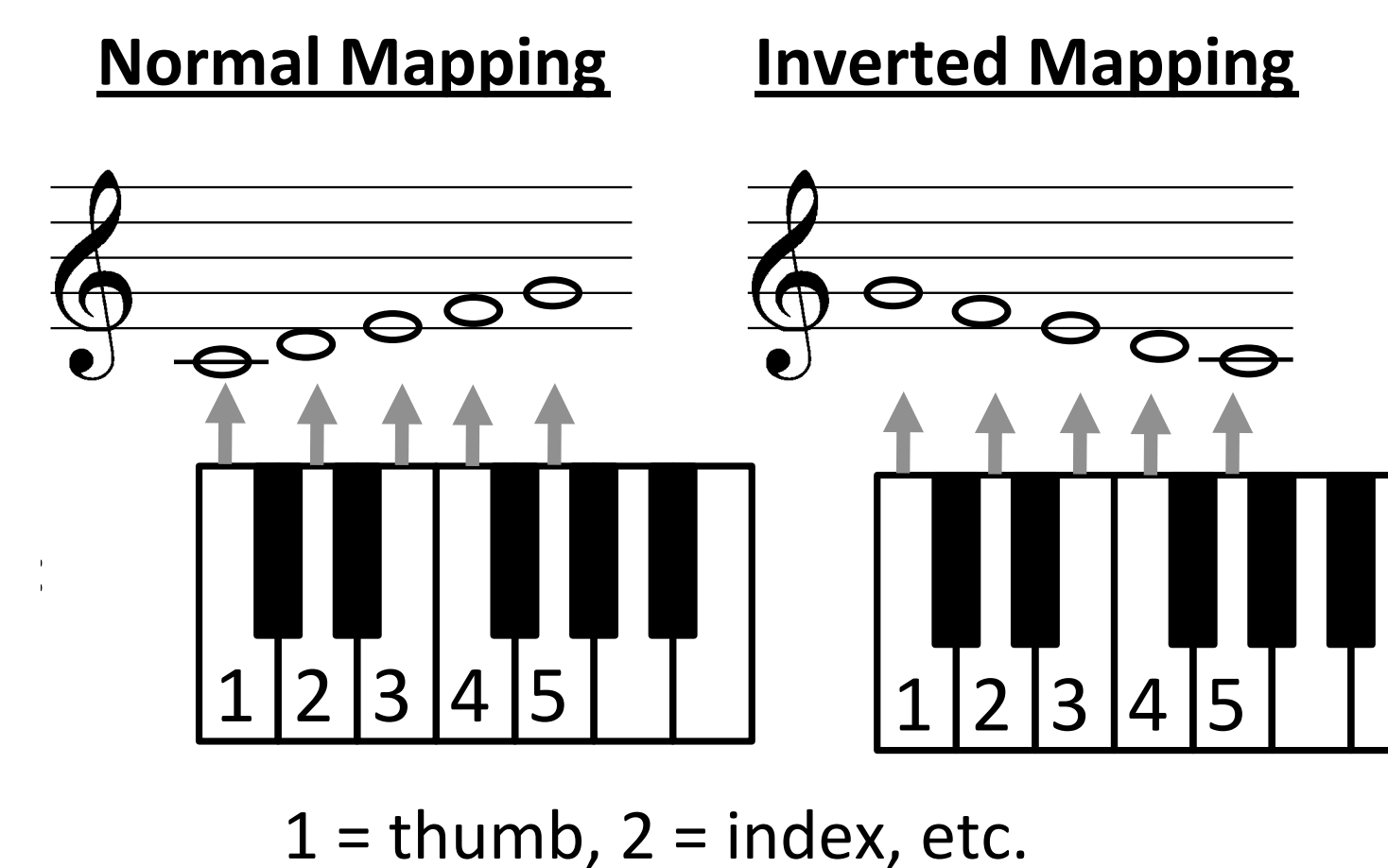
Participants

Trained feedback/ Experience group (n)	Piano experience	Piano lessons	Other instrumental experience	Other instrumental lessons
Normal/Pianists (21)	8.33 (3.65)	6.66 (3.27)	3.90 (5.80)	2.07 (2.99)
Inverted/Pianists (19)	8.05 (3.69)	6.15 (3.55)	6.79 (10.55)	2.92 (5.45)
Normal/Non-pianists (20)	0.45 (0.76)	0.30 (0.57)	4.68 (9.06)	2.53 (3.67)
Inverted/Non-pianists (17)	0.00 (0.00)	0.00 (0.00)	5.35 (5.10)	2.88 (3.12)

Note Mean (standard deviations) of years spent on musical activities for each group

Study Design

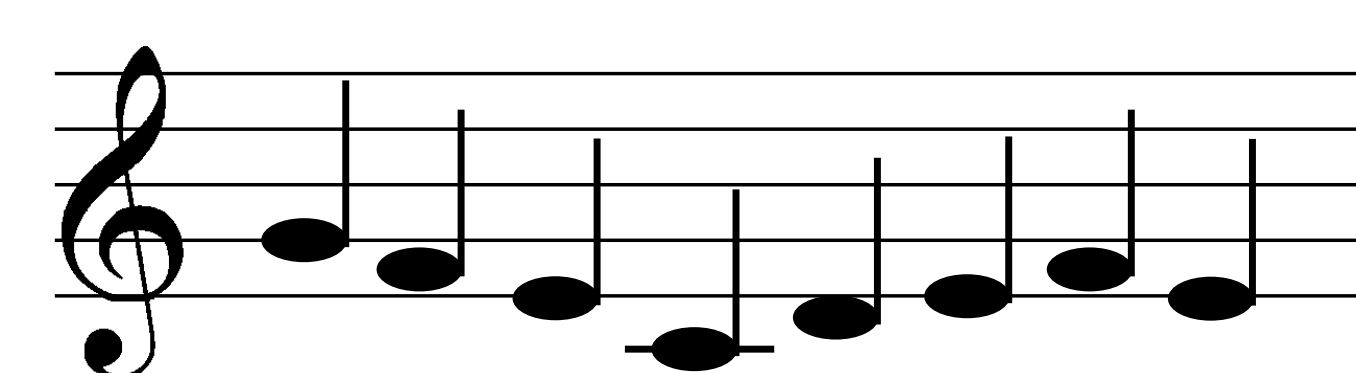
- Transfer-of-learning paradigm
- 2 pitch mapping conditions
 - Normal mapping
 - Inverted mapping



Procedure

1) Training Phase: learned a melody by ear.

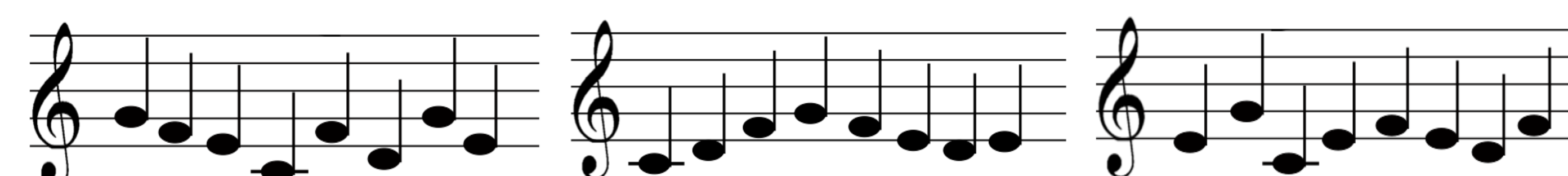
- Participants listened to a sequence and tried to reproduce it.
 - if performed correctly, presented a new sequence.
 - if performed incorrectly, presented the same sequence.



Finger Sequence

Normal: 5 4 3 1 2 3 4 3
Inverted: 1 2 3 5 4 3 2 3

2) Transfer Phase: played the same melody or..



Similar Melody

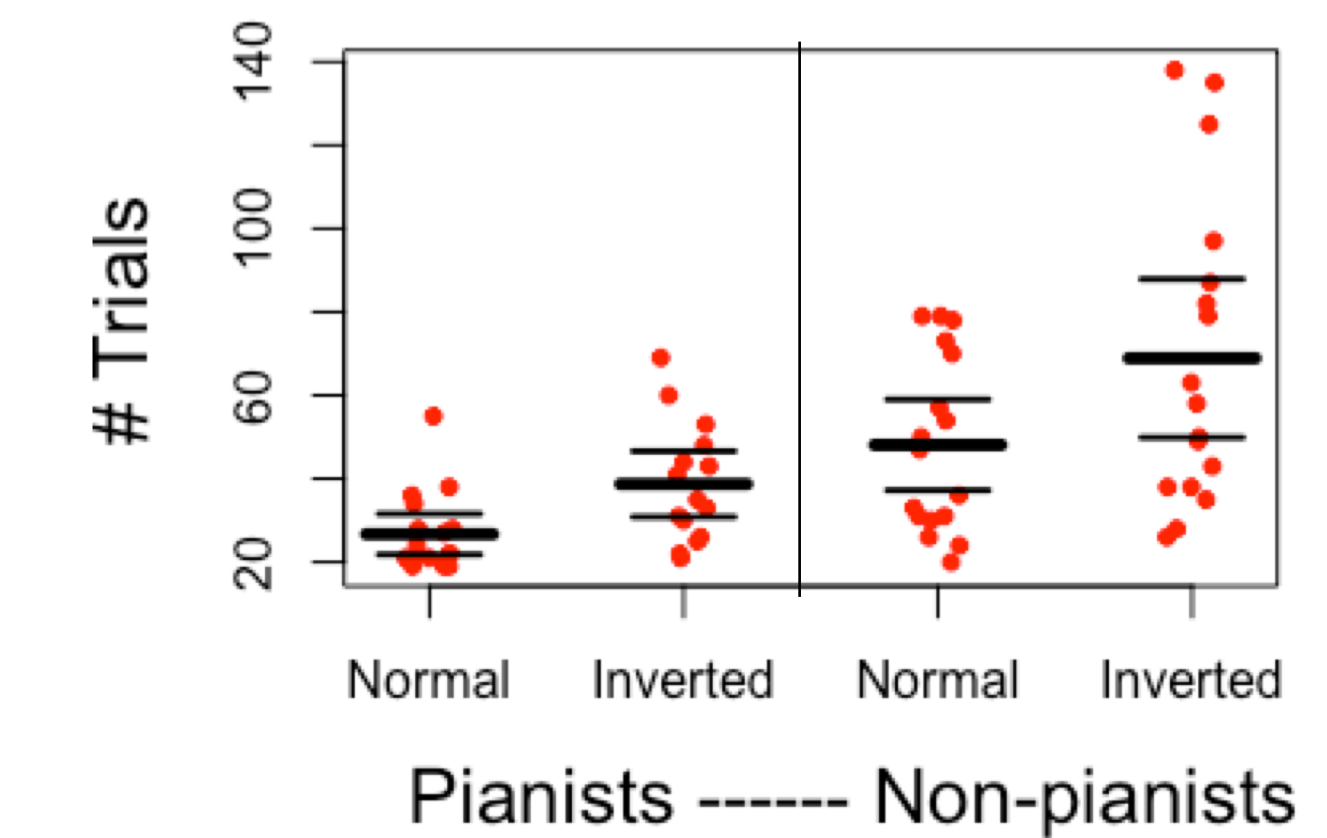
Alternative Melody

Different Melody

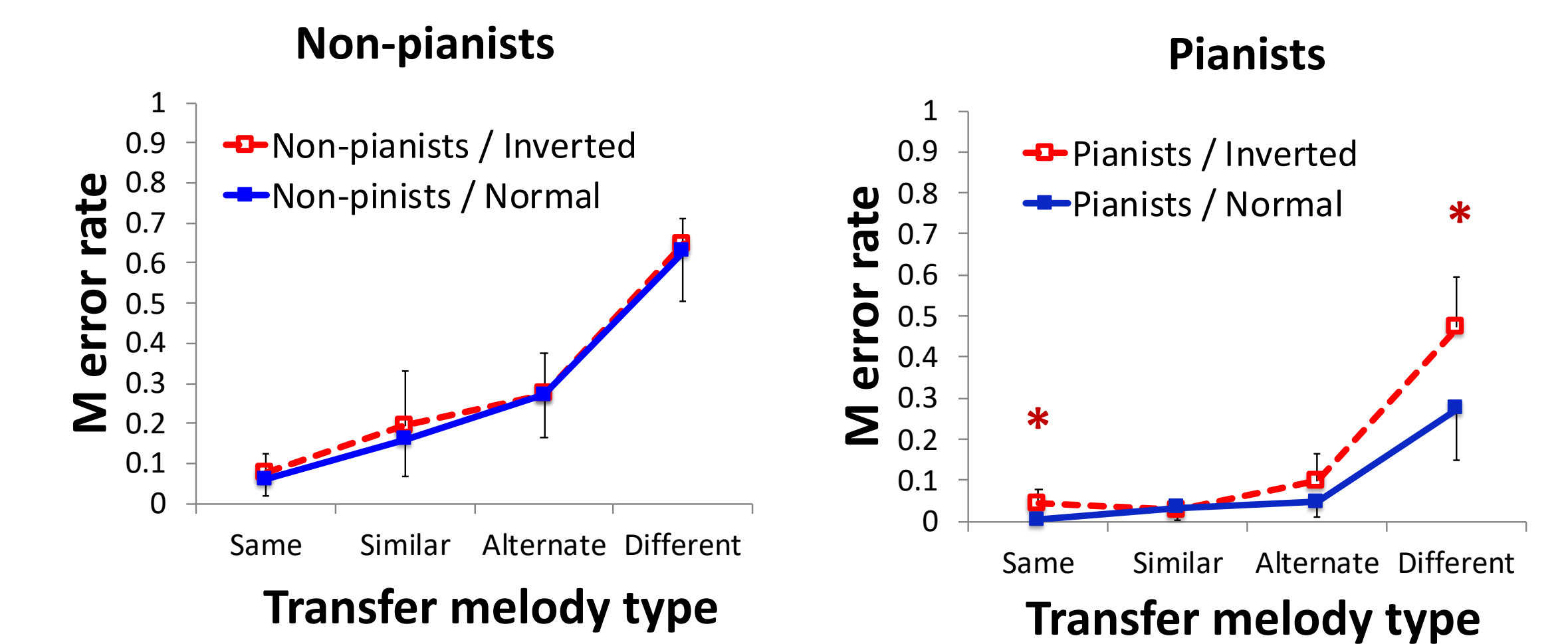
Results

Training:

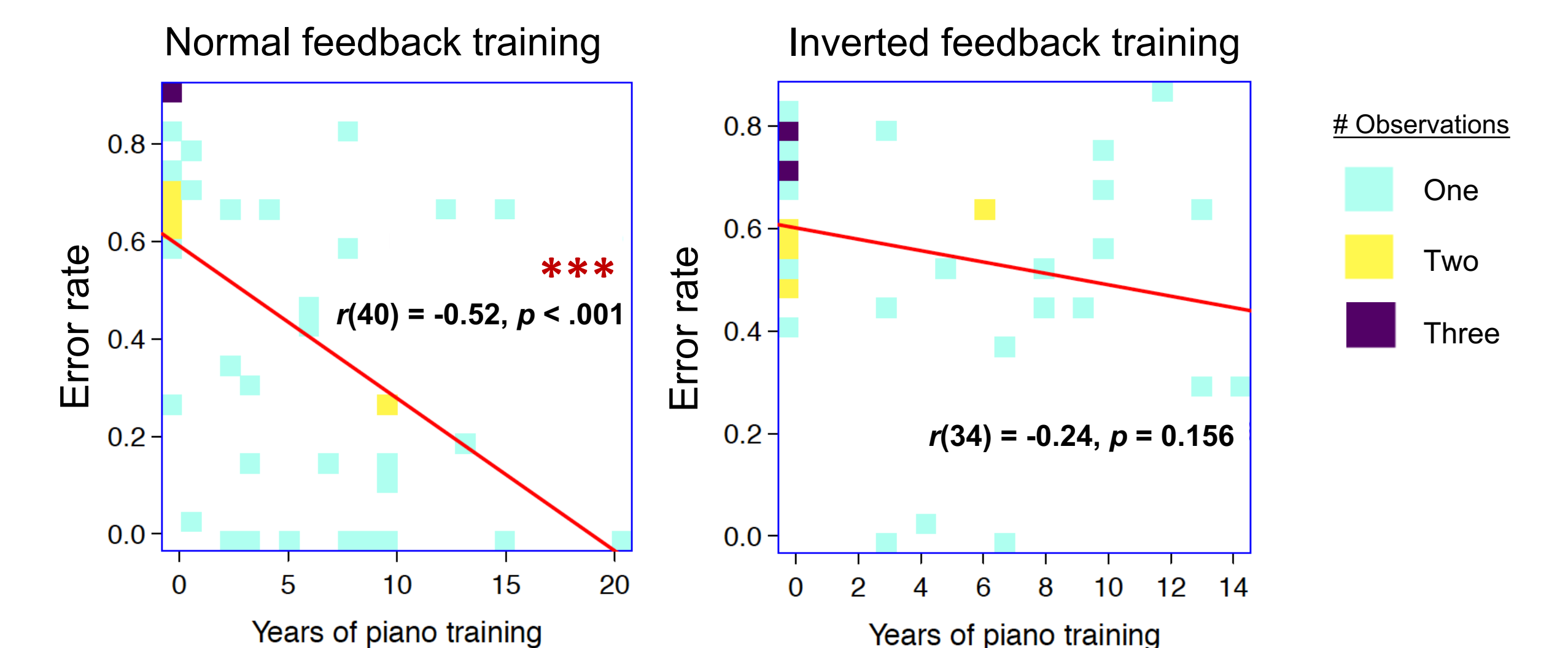
- ❖ Number of trials required to complete training



Transfer of Training:



- ❖ Piano experience and performance accuracy on different melody



Conclusions

- ❖ Participants who trained with **inverted feedback required more training** trials than those who trained with normal feedback in both groups.
- ❖ While pianists who trained with inverted feedback had more errors on the different melody than those who trained with normal feedback, **non-pianists showed no difference of mapping training** (sensorimotor flexibility).
- ❖ Having more piano experience did not significantly reduce the number of errors in performance after learning with inverted pitch mapping.
- ❖ Musical training **crystallizes sensorimotor associations**, making it difficult to learn sequences under a new configuration in a way that can generalize to a wide range of alternate sequences under that new configuration.