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# Motor skill transfer: Testing fine motor skills in musicians

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## Introduction

- Most classic research on motor control suggests that motor skills learned are task-specific<sup>1</sup>. However, recent research suggests that extensive motor learning in one domain could lead to an enhancement in an individual's ability to learn a new motor skill.<sup>2</sup>
- According to a previous study, musicians outperform non-musicians in certain perception tasks that require an accurate and immediate motor response to a visual stimulus.<sup>3</sup>
- The objective of this study is to test whether proficiency in playing musical instruments correlates with the rapidity of acquiring new motor skills, investigating the transfer of motor skills from one domain to another through variety of different motor tests.
- This research project comprises a component of the larger study examining motor skill transfer between music and medicine as doctors have observed that medical students with an advanced musical background learn technical skills faster than students with no musical training.

## Methodology

### Participants:

- 28 participants ages 18-28 years
- 14 musicians (minimum grade 8 Royal Conservatory of Music or studying piano performance at university level)
- 14 participants in control group (little or no musical training)

### Procedure:

Two pegboard tests:

- Grooved pegboard (Figure 1) measured, in seconds, the time taken to place and remove pins with each hand.
- Purdue pegboard (Figure 2) tested the number of pins placed with dominant, non-dominant, and both hands in 30 seconds as well as the number of assemblies constructed in 1 minute.

Qigong and hand exercise test:

- Participants watched video clips of 2 qigong movements and were asked to imitate the movements.
- Fist/edge/palm exercise (Figure 5) tested the number of cycles of these three different hand positions performed by each participant in 20 seconds.

### Analysis:

- Qigong performances were evaluated by a qigong master using a marking scheme of 4 points for movement 1 (Figure 3) and 6 points for movement 2 (Figure 4).
- The two groups were compared by testing for statistical differences in test scores via SPSS program.

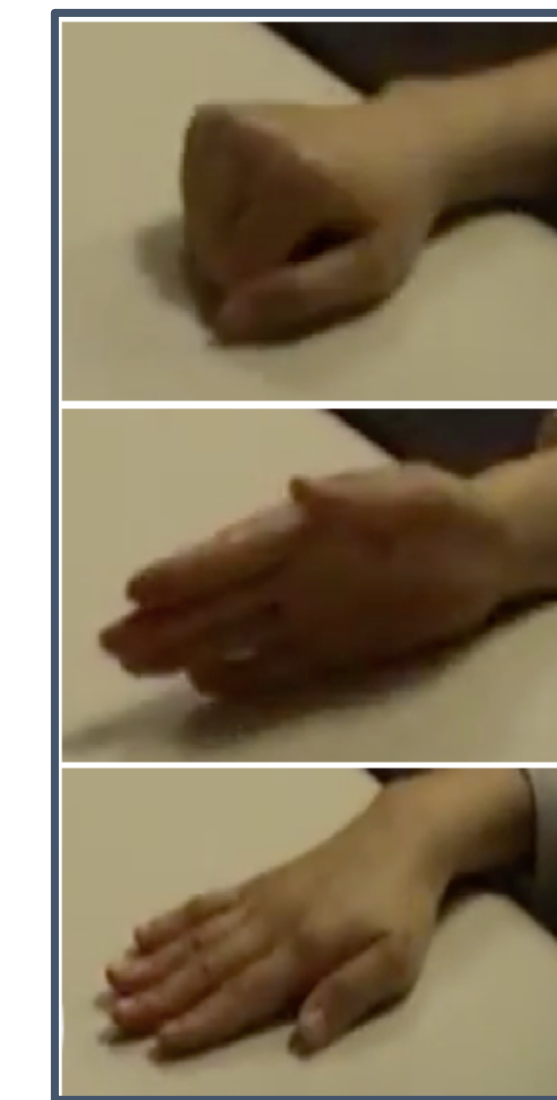


Figure 5: Fist/edge/palm exercise

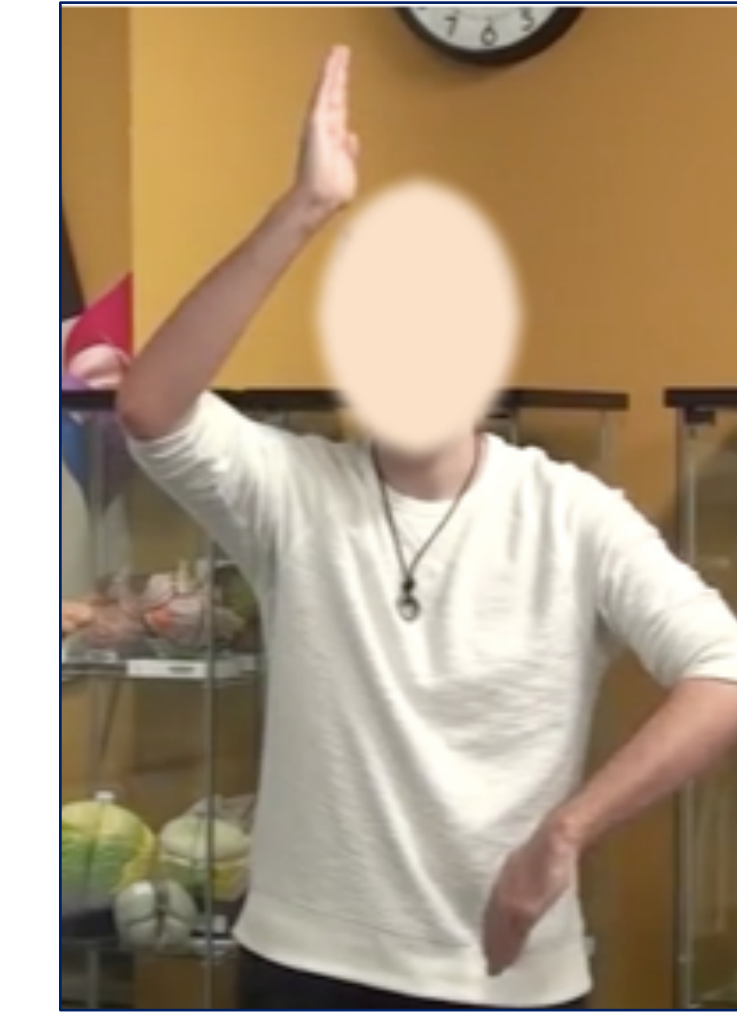


Figure 4: Qigong movement 2

Figure 1: Purdue Pegboard



Figure 2: Grooved Pegboard

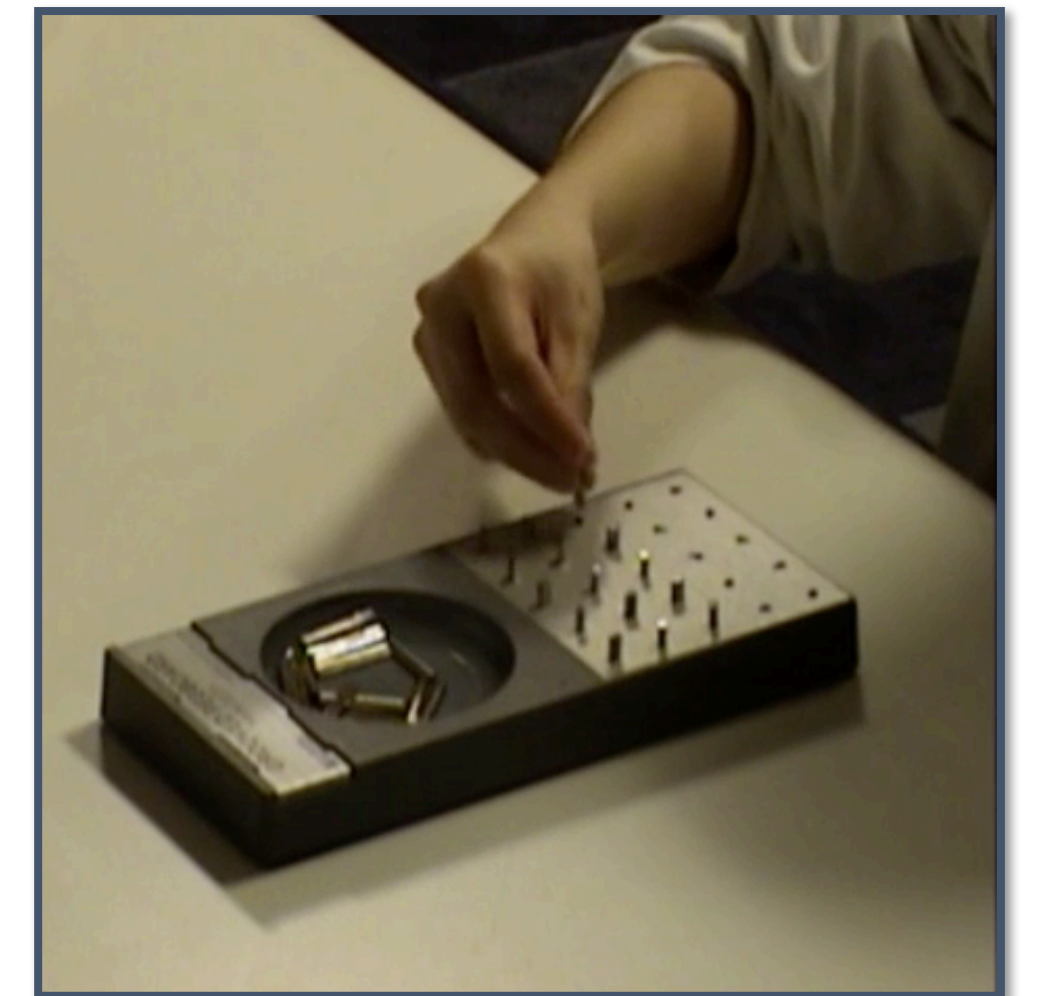


Figure 3: Qigong movement 1



## Results

- The controls did better on the grooved pegboard than musicians with lower average time (seconds); however, this difference was not statistically significant.
- Musicians performed better at purdue pegboard using both hands than the non-musicians, but there was no statistical significance between the means.
- Musicians performed significantly better at the fist/edge/palm exercise using the dominant hand ( $p=0.038$ ) but not significantly better using the non-dominant hand.
- There was no difference in the average scores of qigong movement 1 between musicians and controls.
- Musicians scored slightly higher than the controls in qigong movement 2, but the differences in score were not statistically significant.
- Musicians demonstrated greater differences between their dominant and non-dominant hands in the grooved pegboard and hand exercise tests compared to the non-musicians; however the average differences were not of statistical significance.
- Musicians and controls showed equal differences between dominant and non-dominant hand for the purdue pegboard test.

Table 1: Statistical comparison of motor test results between musicians and controls

Test type	Activity performed	Control		Musician		Statistical results		
		M	SD	M	SD	t	df	p
Grooved Pegboard (measurement units = seconds)	Placing pins using DH	60.79	7.93	61.07	9.78	-0.085	26	0.933
	Removing pins using DH	22.36	3.25	23.36	2.27	-0.944	26	0.354
	Placing pins using NDH	62.79	7.84	64.93	12.22	-0.552	26	0.585
	Removing pins using NDH	22.29	2.49	23.00	3.33	-0.643	26	0.526
Purdue Pegboard (measurement units = number of pins)	Placing pins using DH	14.64	2.17	14.50	2.18	0.174	26	0.863
	Placing pins using NDH	13.50	1.65	13.50	1.23	0.000	26	1.000
	Placing pins using both hands	10.86	0.86	11.36	1.65	-1.006	20	0.326
	Assemblies	9.57	1.02	10.00	1.62	-0.840	26	0.409
Hand Exercises (measurement units = number of cycles)	DH	11.21	2.94	14.43	4.64	-2.191	26	0.038
	NDH	12.93	3.00	15.36	4.80	-1.606	22	0.123
Qigong exercises (measurement units= grading scale)	Movement 1	3.68	0.97	3.68	0.54	0.000	26	1.000
	Movement 2	3.73	0.78	3.86	0.81	-0.416	26	1.000

M=mean, SD= standard deviation DH=dominant hand NDH= non-dominant hand

Table 2: Statistical comparison of differences between dominant and non-dominant hand of musicians and controls in different motor tests.

Test type	Differences between dominant and non-dominant hand						
	Control		Musician		Statistical results		
	M	SD	M	SD	t	df	p
Grooved Pegboard	6.43	3.87	6.64	5.24	-0.123	26	0.903
Purdue Pegboard	1.86	1.75	1.86	1.41	0.652	26	1.000
Hand exercise	2.71	2.13	3.07	2.89	0.088	26	0.713

M=mean, SD= standard deviation

## Conclusions

- Differences between the means for the both hands purdue pegboard, although not significant, was in favour of musicians which was consistent with McCoy's study.<sup>4</sup>
- No indication of increased ambidexterity in musicians compared to the control group contradicted the results involving asymmetry between the hands from Jancke et al.<sup>5</sup>
- Jancke et al. found that musicians outscored non-musicians in dominant hand performance.<sup>5</sup> Our results showed otherwise with the dominant hand exercise being the only exception.

### Future directions:

- The next steps of this research include examining motor skills from surgical suturing and knot tying tests between musicians and non-musicians, determining whether transfer of motor skills from one domain to another exists.
- In the later phase, we will introduce laparoscopic surgery simulation to examine motor learning of bimanual skill between musicians and controls.
- Understanding the fine motor skill acquisition and transfer of those skills from one domain to the other could influence the clinical and surgical practices, allowing the implementation of new training strategies for doctors and surgeons.

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