Poster: Playing Air Guitar by Electrical Muscle Stimulation

Shan-Yuan Teng
National Taiwan University
No. 1, Sec. 4, Roosevelt Rd.,
Taipei, Taiwan
tanyuan@cmlab.csie.ntu.edu.tw

Jo-Hsi Tang
National Taiwan University
No. 1, Sec. 4, Roosevelt Rd.,
Taipei, Taiwan
jhtang@cmlab.csie.ntu.edu.tw

Yi-Chi Liao
National Taiwan University
No. 1, Sec. 4, Roosevelt Rd.,
Taipei, Taiwan
chichi@cmlab.csie.ntu.edu.tw

Rong-Hao Liang
National Taiwan University
No. 1, Sec. 4, Roosevelt Rd.,
Taipei, Taiwan
rhliang@ntu.edu.tw

Bing-Yu Chen
National Taiwan University
No. 1, Sec. 4, Roosevelt Rd.,
Taipei, Taiwan
robin@ntu.edu.tw

Abstract
Playing air guitar is an enjoyable way to feel the music; however, it takes some skills to be capable of. We propose "EMS Air Guitar," an air guitar assistant using electrical muscle stimulation (EMS), which impulses the user's arm to generate the strumming motion on the right time. We found that EMS can be an effective tool to make the air guitar easier to learn and play.

Author Keywords
EMS, Proprioceptive interaction, Musical performance

ACM Classification Keywords
H.5 Information interfaces and presentation: [HCI]

Introduction
Playing an air guitar is an enjoyable experience, in which performers express the music though their body. Though it seems to be easy at first sight, not everyone can play it well. An air guitarist needs to master several skills, such as body coordination, sense of groove, and imaginations to deliver delightful performances.

Following previous works [1,2], we propose "EMS Air Guitar," an air guitar assistant using EMS to impulse user's arm to generate the strumming motion on the right time. This approach further enhances the immersion of listening to the music. A player first
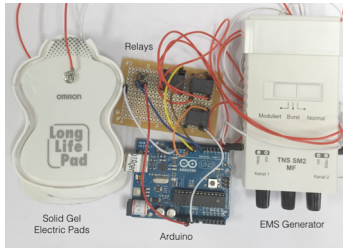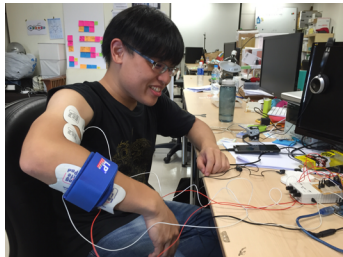
Figure 1: The components of our prototype.

Figure 2: One participant performing air guitar with our EMS prototype.

chooses a piece of music in our system and wear on our prototype. Then, the music will be translated into pulses to the player's arm and wrist automatically.

Implementation

As shown in Figure 1, our prototype includes: 1) a battery-powered (9V) two-channel EMS generator (TNS SM 2 MF) which produces a pulse waveform with a frequency of 25Hz and a pulse width of 290μs, 2) an Arduino Uno used for controlling the EMS generator through two relays, and 3) four solid gel electrical pads that would be attached to the human skin to transmit the pulses. We also translated a selected song with folk-rock strumming patterns into electrical patterns, which could be displayed using our prototypes.

Evaluation and Results

In the evaluation study (Figure 2), enjoyable level and comfortable level of two conditions are examined, where the conditions are "playing air guitar with our EMS support" and "playing air guitar without any support," respectively.

Six participants were recruited (3 females, age 22~23). Two participants have no previous experience on playing guitar, and three participants are beginners while the last one participant is a skillful guitar player. All of them had no prior experience with EMS.

Before study, a calibration is conducted for each participant to produce visible muscle movement yet pain-free. For each condition, we play the same song with speaker, which takes about 40 seconds, while the participants were told to play air guitar. After the study, participants filled in a questionnaire comprised of several 5-level Likert scale questions.

Participants rated the performance as more enjoyable when playing with EMS air guitar (Mdn=4.5 of 5, IQR=1) than doing it freely (Mdn=3 of 5, IQR=1.5). Participants rated the performance as more comfortable when playing with EMS air guitar (Mdn=3.5 of 5, IQR=1), than doing it freely (Mdn=2.5 of 5, IQR=1.75).

Most participants claimed that our prototype significantly enriches the experience of listening to music, and our device is not hard to counter (Mdn=2.5 of 5, IQR=1.75). Also, some participants with guitar-playing experiences suggested that providing more complicated motions could be an excellent experience.

Conclusion

We propose EMS air guitar which is an effective and enjoyable solution for users without instrument-playing experiences to learn and play expressive air guitar. Future work considers enabling more challenging guitar motions.

References

1. Emi Tamaki, Takashi Miyaki, and Jun Rekimoto. 2011. PossessedHand: techniques for controlling human hands using electrical muscles stimuli. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11). ACM, New York, NY, USA, 543-552. DOI=http://dx.doi.org/10.1145/1978942.1979018

2. Pedro Lopes and Patrick Baudisch. 2013. Muscle-propelled force feedback: bringing force feedback to mobile devices. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13). ACM, New York, NY, USA, 2577-2580. DOI=http://dx.doi.org/10.1145/2470654.2481355