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A comparison of practice on a MIDI wind controller to practice on single-reed instruments

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In the study of piano performance, the use of MIDI keyboards and computer software has improved measurement efficiency and accuracy of data analysis. MIDI wind controllers have existed for over 20 years, but their feasibility as a tool in wind instrument research has received little attention. The purpose of this investigation was to determine the validity and practicality of using a MIDI wind controller in instrumental performance research. Specifically, this study examined performances of the same passages, played by the same performers on a wind controller and played on a saxophone or clarinet, for pitch and rhythmic accuracy. The final phase of the study replicated procedures from previous research comparing the effectiveness of practice strategies on woodwind instruments.

Keywords: MIDI wind controller; practice; cognition; instrument; technology

The advent of the MIDI keyboard in 1983 (MIDI Manufacturer's Association) made available a new tool for studying musical performance. Soon after, researchers began using MIDI keyboards and computers to examine temporal and other aspects of skilled piano performance (Lee 1989, Palmer 1989b, Salmon and Newmark 1989). Since then, it has become common practice to use MIDI keyboards in piano research and music-motor learning research because they facilitate data collection and analysis. Wilson (1992) charged the music research community with using keyboards and MIDI technology to further our understanding of performance movement. While the keyboard community has embraced that charge, the wind community has not. MIDI wind controllers have existed for over 20 years, but their feasibility as a tool in wind performance research has not been studied. The purpose of this study

was to determine if a MIDI wind controller is suitable for performance research.

There are compelling reasons for examining the potential of MIDI wind controllers in research settings. First, computer-monitored musical instruments collect data without the perceptual biases that may unintentionally occur in humans (Large 1993, Lee 1989). Similarly, digital sound analysis is more discriminating than human perception. In addition, the performance specifications of MIDI wind controllers enable data collection for parameters such as air speed that are unavailable through conventional wind performance. Sequencing software used in conjunction with MIDI wind controllers provides a rich array of performance information in both numerical and graphic formats. Individual pitches are indicated by frequency or pitch name, and duration can be indicated in milliseconds. Graphic outputs enable data analysis that is unavailable with conventional methodology (Salmon and Newmark 1989). Palmer (1989a) noted that the advantages of graphic notation include the ability to compare multiple excerpts concurrently, the representation of a temporally evolving performance in its entirety, and the possibility of examining performance details not easily heard. Furthermore, she stated that traditional notation “cannot display the number of dimensions or the precision of each dimension adequately for research on musical performance” (p. 266).

Finally, data generated by MIDI wind controllers can significantly reduce the amount of time required to score acoustic sound files. To score performances in conventional wind research, the performances must be randomized, expert listeners must be trained to use the scoring criteria, experts must listen repeatedly to each performance to achieve the highest level of accuracy possible, and reliability between scorers must be determined. When studies may have thousands of acoustic files (e.g. Stambaugh 2011), this is a very time-consuming process. The numerical data generated by MIDI wind controllers in sequencing software eliminates the need to randomize certain kinds of files (“right or wrong” parameters, including pitch). Software generates lists of pitches and durations. These will still need to be compared to the intended performance scores, but the overall labor time will be considerably reduced.

The study is part of a series of studies examining the feasibility of using MIDI wind controllers in performance research. A pilot study informed the design of this study. The purpose of this repeated-measures design was to compare performance on clarinet or saxophone to performance of the same material on wind controller.

METHOD

Participants

Participants (N=9) were undergraduate (n=7) and graduate (n=2), clarinet (n=3) and saxophone (n=9) majors and one minor. Eight participants were music majors and one participant was a music minor at a large university in the southeast United States.

Materials

The most widely used MIDI wind controllers (MWC) are manufactured by Akai and Yamaha. They use a recorder or saxophone/clarinet style mouthpiece with a manufacturer-designed synthetic reed, are about 600 mm/24 inches long, and weigh about 520 grams/1.2 pounds. The key system is Boehm-style and can be set to saxophone, flute, oboe, recorder, or brass fingerings, depending on the model. True electronic instruments, MWC generate no tone but instead are connected to a sound generating module or computer that enables sound production. For research purposes, the controller and the module need to be connected to computer software which records the digital performance data. When using an MWC in this way, the researcher can collect data about pitch, duration, and breath pressure (volume).

The Yamaha WX5 MIDI Wind Controller was used in this study. It retails for about \$700 US. It has two mouthpiece styles: clarinet/saxophone with a composite reed and recorder. Although it is lightweight, it does come with a neck strap. It can be used with an AC adaptor, batteries, or phantom power. Several performance parameters may be adjusted, including tight or loose lip mode, sensitivity of wind pressure, and fingering mode (three saxophone systems and one flute system). The most significant difference in key set up between the WX5 and a flute, clarinet, or saxophone is that there are four octave keys operated by the left thumb. The wind controller was connected to a Yamaha VL70-m, a virtual acoustic tone generator, which retailed for about \$800 US. The unit is a half-rack mount (220 mm x 212 mm x 46 mm) and weighs almost 3 pounds/1.3 kg. The tone generator was connected to a MacBook Pro laptop using a USB MIDI interface (UM-1G from Cakewalk, retails about \$40 US). This device transmits the MIDI data to notation or sequencing software. In this study, Cubase LE4 was used.

Music notation was created for two-octave major scales in C, D, and Eb. A short "etude" in the key of C was transposed from a violin piece.

Procedure

All procedures were approved by the Institutional Review Board and participants received \$40 for completing the four-session study. Sessions were conducted individually in a small room with the researcher present. In a repeated measures design, each participant played the same music on his or her clarinet/saxophone and on an MWC. MWC performance was recorded directly into Cubase software. Acoustic performances were recorded using a QC1 microphone and Audacity software. Participants practiced a warm-up sheet for the MWC that included long tones, octave leaps, and two measures of tongued sixteenth notes, for as long as they wanted to. Then they practiced the C, Eb, and D major scales until they could play each scale at metronome marking 88. Next, participants practiced the etude until they decided they were able to play it accurately as written. On their primary instrument, participants warmed up in any manner they chose and then prepared the scale and etude tasks.

Scoring

Timelines were prepared for each participant's performance on the MWC and on their primary instrument. These detailed the start and stop times for each study task, such as practicing the Eb scale. The final trial of each scale and etude on the MWC was located and the MIDI pitch, duration, and volume data exported. The final trials of the acoustic performances were cut and pasted into a new sound file. They were randomized and then scored using procedures established in previous research (Stambaugh 2012). The duration of each trial was measured by highlighting each trial for Audacity to calculate the time. Pitch accuracy was determined by repeatedly listening to each trial and using a point deduction system. Perfect scores were 29 for each scale and 55 for the etude. Incorrect, skipped, repeated, or added pitches incurred a 1-point deduction each.

RESULTS

On Day 1, the amount of time participants warmed up ranged from almost 3 minutes to over 7 minutes ($M=247$ seconds, $SD=82$). On Days 2, 3, and 4, participants played shorter warm-up sessions (Day 2, $M=97$, $SD=81$; Day 3, $M=121$, $SD=92$; Day 4, $M=84$, $SD=66$; see Figure 1). However, the reduced warm-up time was not a good indicator of skill improvement. Pitch accuracy for the etude remained largely unchanged across days (Day 1, $M=38.71$, $SD=4.95$, out of 55; Day 2, $M=41.67$, $SD=4$; Day 3, $M=41$, $SD=6.39$; Day 3,

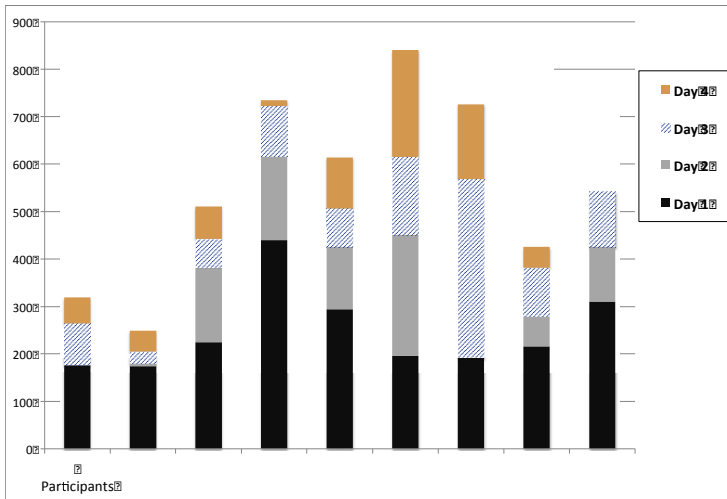


Figure 1. Participant warm-up time in seconds on a MIDI wind controller. (See full color version at www.performancescience.org.)

$M=37.78$, $SD=13.16$). The one area in which participants showed success was speed. Participants were instructed to perform at the same metronome marking each day. The speed scores across days were quite similar (Day 1, $M=17.83$, $SD=10.3$; Day 2, $M=22.33$, $SD=1.68$; Day 3, $M=21.96$, $SD=1.69$; Day 4, $M=22.11$, $SD=1.91$).

DISCUSSION

MIDI wind controllers may be useful for research questions that demand highly precise measurement. However, that same sensitivity leads to brief (and, for some participants, frequent) repeated notes. The mechanical configuration of the octave keys may also lead to octave errors. Therefore, musical tasks should be designed to stay within a 1-octave range. Future research should continue to define parameters that enable MIDI wind controllers to be used validly and reliably.

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