Matthias Bertsch
University of Music and performing Arts, Vienna

TataTataTakaTaka

Tonguing performance on wind instruments
Visualization and benchmarks
The Tongue

Crucial factor for brass playing

Deficit of research!
- No reference values of tempi for Rehab student

Fast movements
Restrictions of MRI studies

Complex Neuroplasticity of Motor Control

Artificial Split Tongue
Benchmarks of Tonguing Tempi

How fast can one play?
Participants ( N = 206 )

**Participants**

Single Tonguing | Double Tonguing
---|---
*n = 206* | *n = 172*

THANKS to participants: Mnozil Brass, Bozen Brass, students at the Samedan summer workshop Switzerland, the Music University Vienna Austria, the Central Conservatory of Music, Beijing, China and the Ghent University, Belgium
Tonguing – Performance Study

• Play 30 seconds staccato (middle range, mf)

Single Tonguing = TataTata TataTata

Double Tonguing = TakaTaka TakaTaka
Results Tatata – SINGLE Tonguing

- Maximal average tempo for 2 seconds semiquavers (median BPM)
  - **AMATEUR:** 109 BPM 436 NpM
  - **PRO:** 124 BPM 496 NpM
  - **STUD:** 120 BPM 480 NpM

167 BPM Fastest Player

~ 668 NpM
Results Takataka – DOUBLE Tonguing

- Maximal average tempo for 2 seconds semiquavers (median BPM)
  - AMATEUR: 149 BPM 596 NpM
  - PRO: 172 BPM 688 NpM
  - STUD: 171 BPM 688 NpM

238 BPM Fastest Player
~ 952 NpM
Results: by Instrument

Can you play as fast on tuba and trombones, as on trumpets?

**SINGLE**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>BPM Range</th>
<th>NpM Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trumpet n=106</td>
<td>110-120</td>
<td>~440-480</td>
</tr>
<tr>
<td>Trombone n=44</td>
<td>110-120</td>
<td>~440-480</td>
</tr>
<tr>
<td>Horn n=24</td>
<td>110-120</td>
<td>~440-480</td>
</tr>
<tr>
<td>Other n=14</td>
<td>110-120</td>
<td>~440-480</td>
</tr>
<tr>
<td>Tuba n=18</td>
<td>110-120</td>
<td>~440-480</td>
</tr>
</tbody>
</table>

**DOUBLE**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>BPM Range</th>
<th>NpM Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trumpet n=91</td>
<td>150-170</td>
<td>~600-680</td>
</tr>
<tr>
<td>Trombone n=40</td>
<td>150-170</td>
<td>~600-680</td>
</tr>
<tr>
<td>Horn n=16</td>
<td>150-170</td>
<td>~600-680</td>
</tr>
<tr>
<td>Other n=11</td>
<td>150-170</td>
<td>~600-680</td>
</tr>
<tr>
<td>Tuba n=14</td>
<td>150-170</td>
<td>~600-680</td>
</tr>
</tbody>
</table>

Part 2
Endurance over 30 seconds – Example TRP

PRO male, age 33, ID: 0213

Double Tonguing:
Very fast start (231 BPM) slowing down

Single tonguing:
Fast start (130 BPM) and good endurance of (120 BPM)

TRP_20120705_0213_Herbert-Zimmermann_DOUBLE.wav
TRP_20120705_0213_Herbert-Zimmermann_SINGLE.wav
TRP_PRO_M_33y_ID_0213_DOUBLE.wav
TRP_PRO_M_33y_ID_0213_SINGLE.wav
Endurance over 30 seconds – Example TUB

PRO male, age 57, ID: 0230

Double Tonguing:
Very Fast start and slowing down

Single tonguing:
Medium Tempo with great endurance
Single—versus—Double

Only 50% can play TataTata faster than 120 BPM
Matthias Bertsch (Univ. of Music and performing Arts, Vienna) in cooperation with Phil Hoole (Ludwig-Maximilian University Munich)

Visualization of Tongue Motions
High-Resolution 3D-Trajectory
EMA Setup

Electromagnetic Articulograph (Carstens AG501)

- High temporal (250 Hz) and spatial resolution
- Synchronized sound recording
- 4 Head Sensors for head movement corrections
  - 4 Tongue Sensors

scale in mm
SINGLE TONGUING
SINGLE TONGUING – Slow Motion
DOUBLE TONGUING
TRIPLE TONGUING

“Tataka Tataka”
TRIPLE TONGUING – SLOW MOTION

TONGUE SLOW MOTION ANALYSIS (250 fps) 167

FORWARD <----- | ------> BACKWARD> (mm)

DOWN <--- | UP ---> (mm)

EMA-trp-triple-tonguing-slow
EMA Setup clarinet

Electromagnetic Articulograph
(Carstens AG501)

7 Sensors

Tongue:
- back
- mid-R
- mid-L
- tip
- lip
- jaw
- clar

[Image of sensor placements on a clarinet player's mouth and jaw]
EMA (clarinet) – spoken vowels: i,e,a,o,u
EMA clarinet – Staccati upward – Slow Motion

time = 2.641 sec.
Sagittal plane (YZ), i = 660

- right Lower LIP
- tip of tongue position
  x = 0.5 mm, y = -7 mm
- tongue back position
  x = 0.8 mm, y = 0.3 mm
Thank you

www.DrTrumpet.eu