

Music or Mechanics? Understanding the Role of a Bagpiper's Arm

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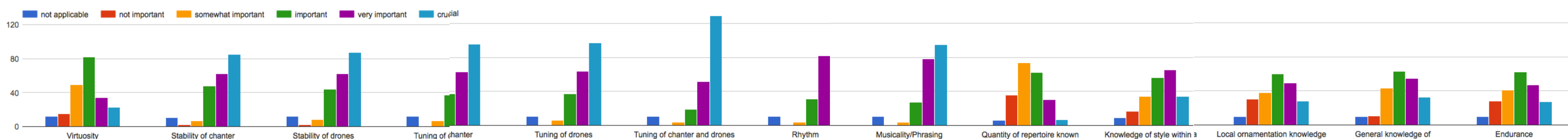
Motivation

The control of a bagpipe is rarely discussed in bagpipe literature: 'blowing is a largely non-verbalized skill, each player learns it individually and develops their own technique' [1]. Despite this lack of verbalization, bagpipe experts agreed that the breathing technique and the bag were essential elements of their playing [1]. A perception study with Bulgarian bagpipes [2] showed that the main criteria for a 'master' piper was the control over the instrument, audible in the first few seconds of the recordings. A survey carried out with 215 pipers within the scope of this research showed that the main criteria for a good piper was the tuning between the drones and the chanter (see below).

- What role does the arm have in the control of the instrument?
- Is the movement of the arm mechanical or musical?

Bidimensional comparative study on cultural and expertise levels

'What, in your opinion, makes a good piper?' (Online survey, 215 participants, December 2016)



Instrument comparison

Western mouth-blown bagpipes with double reed in melodic pipe and single reeds in the three drones.

| Bagpipe | Galician | Majorcan |
|---------------------|------------------------------------|------------------------------|
| Diapason | $A_4 \approx 440 \text{ Hz}$ | $A_4 \approx 472 \text{ Hz}$ |
| Bag Volume | $V \approx 9 \text{ L}$ | $V \approx 15 \text{ L}$ |
| Chanter pitch | $[B_4, E_6]$ | $[B_4, C_6]$ |
| Chanter reeds | double cane reed | |
| Drones pitch | $C_3, C_4, (G_4 \text{ unplayed})$ | |
| Drones reeds | single, cane | single, plastic |
| Chanter onset | $\approx 5 \text{ kPa}$ | |
| Chanter offset | $\approx 4 \text{ kPa}$ | |
| Drone onset | $\approx 4 \text{ kPa}$ | $\approx 1 \text{ kPa}$ |
| Drone offset | $\approx 2 \text{ kPa}$ | $< 1 \text{ kPa}$ |
| Pressure range | $[5, 6.5] \text{ (kPa)}$ | |
| Chanter Sensitivity | $\approx 9 \text{ cts/kPa}$ | $\approx 17 \text{ cts/kPa}$ |
| Drone Sensitivity | $\approx 4 \text{ cts/kPa}$ | $\approx 15 \text{ cts/kPa}$ |
| Air consumption | $\approx 5 \text{ cL/s}$ | $\approx 7.5 \text{ cL/s}$ |

The bag is modelled by a piston to determine the controls parameters of the pressure: arm + insufflation identify the influence of the bag size (a larger bag => lower sensitivity for the arm displacement and insufflation)

Portable experimental setup

Three musicians from each cultural area were chosen, each on a continuum of expertise from beginner to expert. In each culture, all musicians played on the same instrument.

MICROPHONES → Chanter (cents), Drone (cents)

PRESSURE SENSOR → Pressure (kPa)

FLOW SENSOR → Inflow (L/s)

VIDEO (FRONT/ BACK) → Arm (°/s)

Time (s)

Instrument Control Proficiency comparison

Pressure profiles of two Mallorcan pipers with different levels of expertise. Blue: arm moves towards the body, Red: arm moves away from the body.

| Beginner | Experienced | Student | Expert |
|---|--|--|---|
| <ul style="list-style-type: none"> No arm movement One insufflation per note Pressure varies with insufflation Drone tuning varies Sound is not continuous | <ul style="list-style-type: none"> Arm/insufflations are synchronized Regular breathing cycle Pressure variation Tuning (Drone 5 cents, Melodic pipe 10 cents) | <ul style="list-style-type: none"> Arm/Insufflations are synchronized Constant pressure Melodic notes constant but slightly low | <ul style="list-style-type: none"> Arm/Insufflations are synchronized Adaptation of pressure Drone and melodic pipe always tuned to each other |

Fine Control Galicia vs Mallorca

Pressure profile for two musical extracts played by experts. Blue: first iteration of the melody, Red: repetition of the melody.

| Galicia | Mallorca |
|---|---|
| <p>Pressure: -repeated profile -related to the musical phrase</p> <p>Insufflation/arm: -periodical -independent from the musical phrase</p> | <p>Pressure: -repeated profile -related to the musical phrase</p> <p>Insufflation/arm: -irregular -high repeatability of profile -related to the musical phrase</p> |

Bibliography

[1] McKerrell, Simon. 2011. 'Sound performing: sound aesthetics among competitive pipers' in *International Review of the Aesthetics and Sociology of Music*, 42. 165-187.

[2] Rice, Timothy. 2011. 'Evaluating artistry on the Bulgarian bagpipe' in *Ethnomusicological encounters with music and musicians*, ed. Tim Rice, Farnham: Ashgate. 111-128.

Conclusions

Through this study, we can distinguish two levels of control.

The first is technical, as the musician controls the technical aspects of the performance (continuous, steady sound, tuning, relative tuning).

The second is musical, as the musicians adapt their pressure profile to match their musical intention.

On this second level, the insufflations can be independent or matched to the music depending on the technical requirements of the music, the physical requirements of the instrument (such as the bag size) and the local way of playing.

What is next?

- Further statistical data in order to confirm cultural and expertise differences
- Data with other bagpipes, known for their musicality through the bag (Greece, Iran, Turkey...)
- Further acoustic studies of the instrument in order to fully understand the relationship between pressure variations and the material qualities of the instrument(s)