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

Cassandre Balosso-Bardin, Augustin Ernoult, Patricio de La Cuadra, Benoît Fabre, Ilya Franciosi

► **To cite this version:**

Cassandre Balosso-Bardin, Augustin Ernoult, Patricio de La Cuadra, Benoît Fabre, Ilya Franciosi. Music or Mechanics? Understanding the Role of a Bagpiper's Arm. International Symposium on Musical Acoustics, Jun 2017, Montréal, Canada. 2017. hal-02432815

HAL Id: hal-02432815

<https://hal.science/hal-02432815v1>

Submitted on 9 Jan 2020

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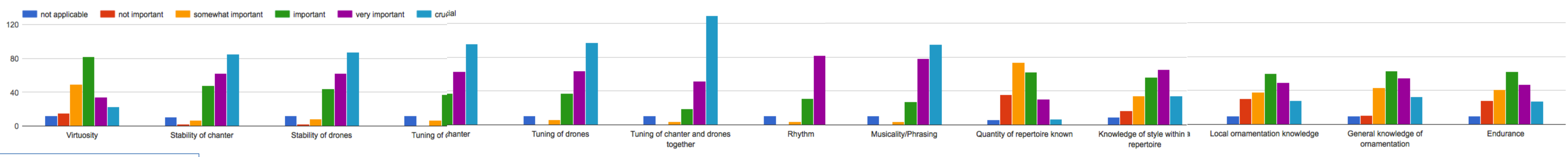
Motivation

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?

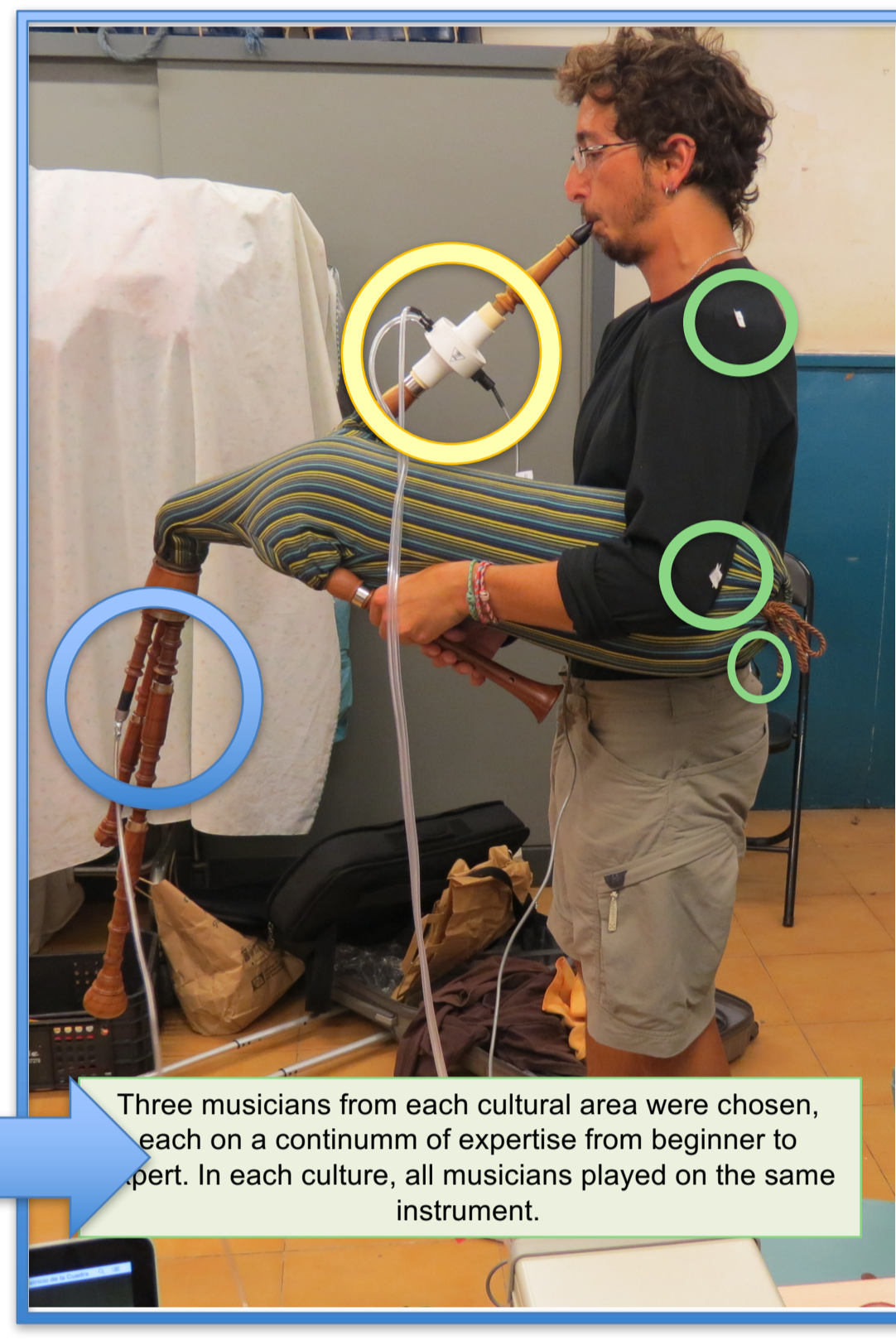
Bidimensional comparative study on cultural and expertise levels

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

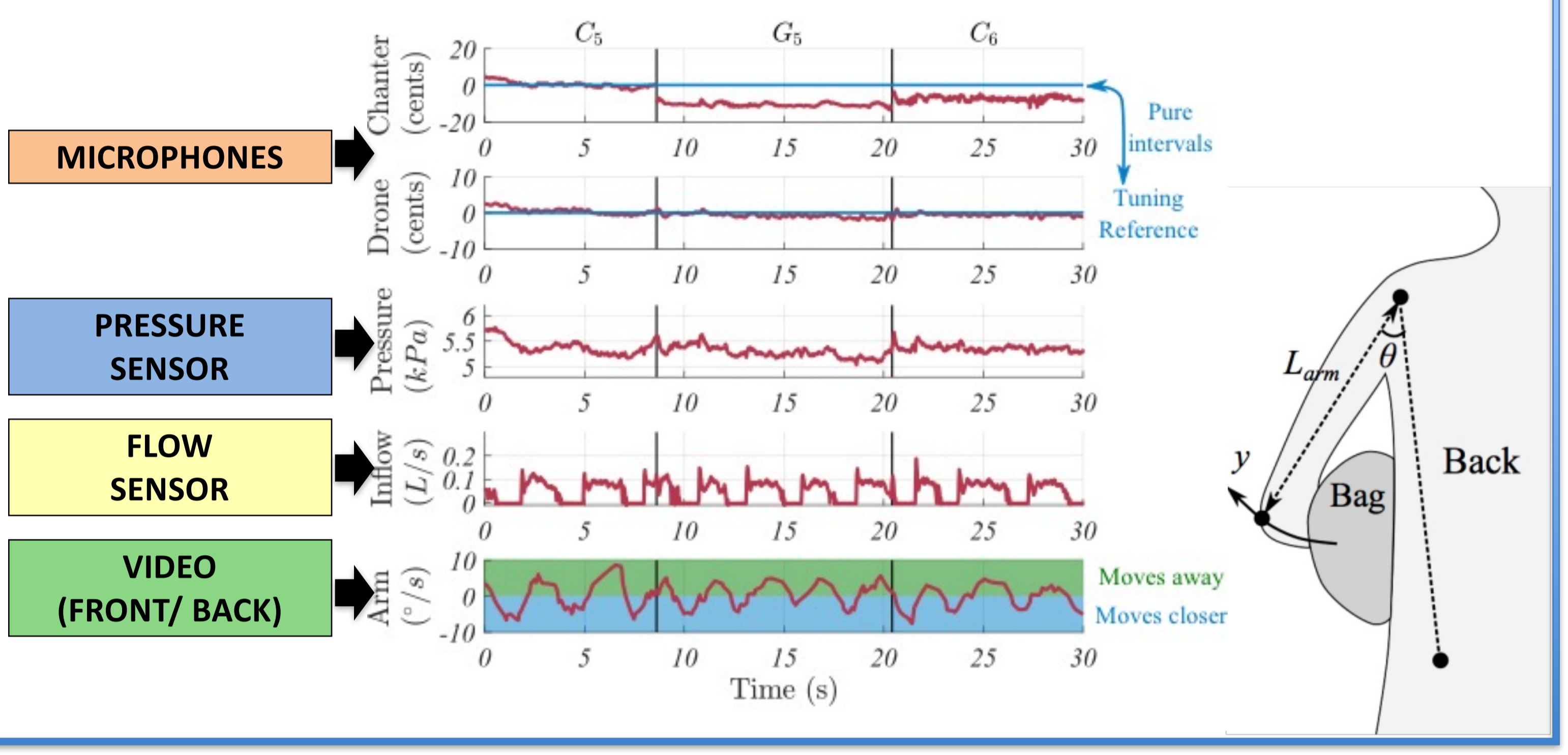


Instrument comparison

	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		$\approx 5 \text{ cL/s}$	$\approx 7.5 \text{ cL/s}$



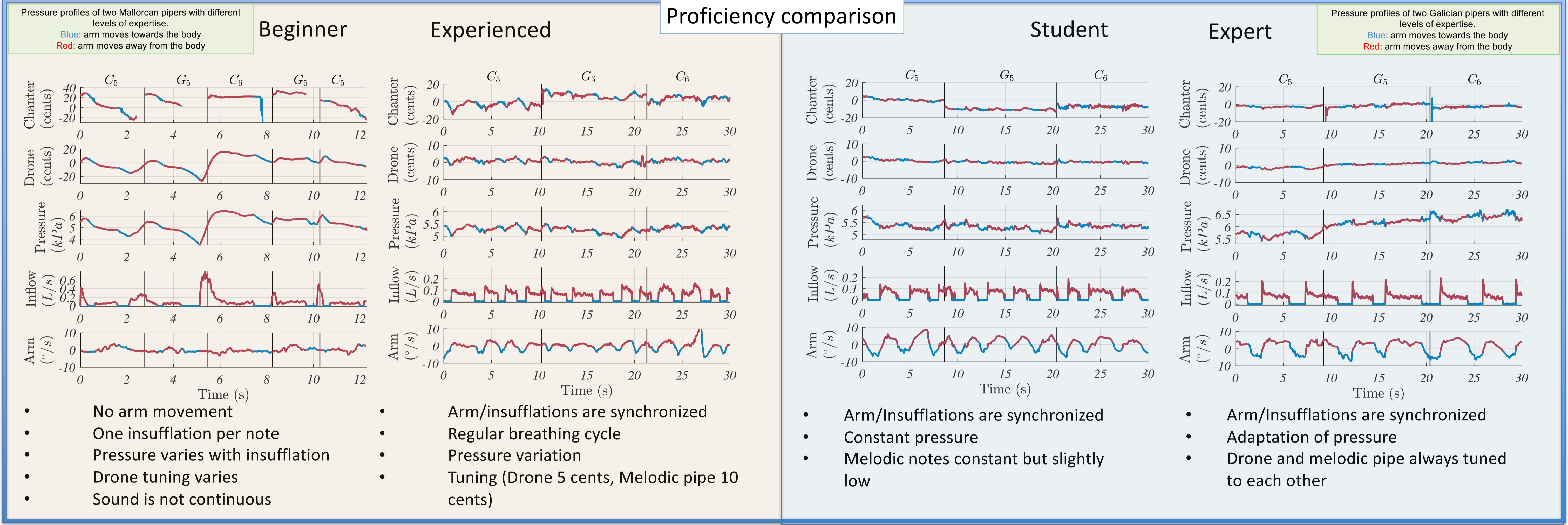
Portable experimental setup



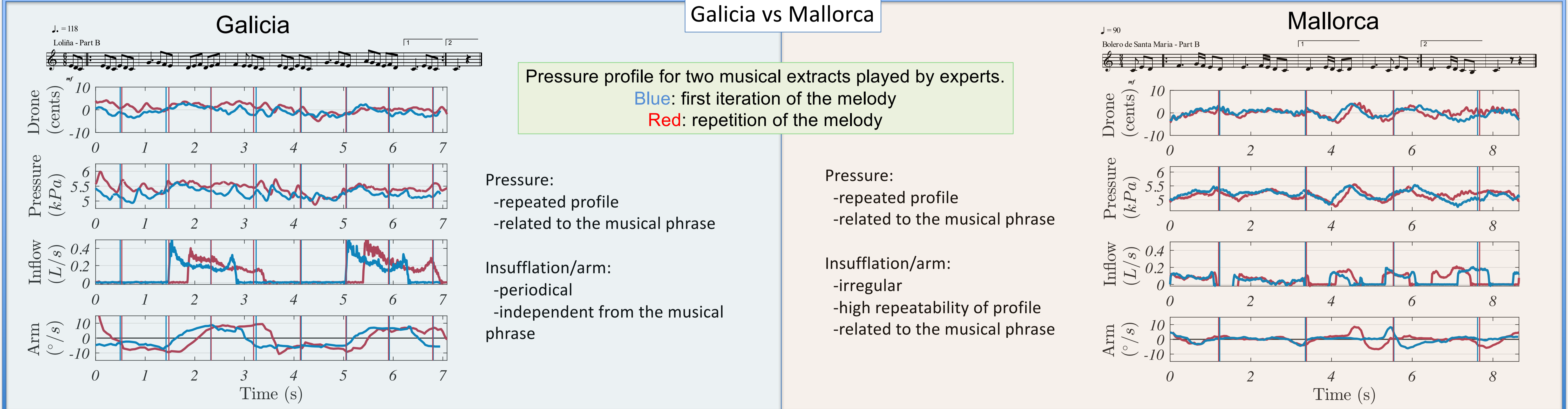
The bag is modelled by a piston to determine the controls parameters of the pressure: arm + insufflation identify the influence of the bag size (a larger bag => lower sensitivity for the arm displacement and insufflation)

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.

Instrument Control Proficiency comparison



Fine Control Galicia vs Mallorca



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)