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► **To cite this version:**

Vincent Koehl, Amélie Gaillard, Bruno Gazengel, Matilde de Quarti, Thomas Blondel, et al.. Repeatability of perceptual assessments on single cane reeds. InterNoise 2024, the 53rd International Congress on Noise Control Engineering, Aug 2024, Nantes, France. hal-04681532

**HAL Id: hal-04681532**

**<https://hal.univ-brest.fr/hal-04681532>**

Submitted on 2 Sep 2024

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# Repeatability of perceptual assessments on single cane reeds

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## ABSTRACT

*Instruments such as clarinet and saxophone require a single reed to produce sound. Despite numerous perceptual and physical studies about cane reeds, it is still difficult to relate perceptual qualities to physical parameters. However, the perceptual experiments are often carried out with few subjects that do not repeat the task over time, which calls the reliability of the assessments into question. Some recent results, obtained with 10 experienced musicians that assessed 4 times a panel of 20 reeds, showed that consistent assessments were obtained only at the fourth repetition and for half of the subjects. An explanation may rely in the experimental conditions as all musicians had to carry out a standard procedure: same reeds, same mouthpiece, same global quality assessment*

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*task. The current study aims at evaluating the repeatability of perceptual assessments by placing the subjects in natural conditions. As he would normally do when opening a box of new reeds, the musician has to evaluate the quality by using his own material and by defining his own assessment task. The robustness of the perceptual judgments is assessed by repeating the operation 10 times.*

## 1. INTRODUCTION

Music instruments such as clarinet and saxophone produce sound with the help of a single reed, generally made of cane. The reed acts as a pressure-controlled valve that creates a pulsating flow. This way, a constant pressure in the musician's mouth is converted into an acoustic pressure in the air column of the instrument. The single reed appears to have little effect on the pitch compared to free reeds or lips (for brass instruments) but it can largely affect other playing parameters such as ease of playing, timbre and intonation [1].

Therefore, musicians pay a lot of attention to the choice of their reeds. They are usually classified by manufacturers according to their strength and cut, but large perceptual differences are reported between assumed identical reeds (same manufacturer, strength and cut). According to large-scale surveys [2, 3], clarinet and saxophone players consider that in a box of new reeds, roughly 30% are of good quality, 40% are of medium quality, and 30% are of bad quality.

Reed Manufacturers aim at better understanding and predicting the quality of reeds on the basis of their physical characteristics. In this way, several studies have tried to relate perceptual assessments to physical measurements. As an example, the reeds can be perceptually assessed on the basis of their global (or musical) quality [4]. As large discrepancies can be observed among global quality assessments [2, 3], specific descriptors such as "ease of playing" may be preferred to describe the reed perception [5]. The overall quality can also be derived from specific parameters such as "ease of attack" [6]. However most of these perceptual studies were carried out with few subjects (sometimes including the experimenters themselves) that did not repeat the assessment task over time. As a result, these rather sparse perceptual assessments could not so easily be related to physical properties of reeds.

In a recent study carried out by Gaillard *et al.* [7], 10 experienced clarinetist were asked to assess four times a panel of 20 identical reeds that were pre-selected by an expert subject. Since large intra- as well as inter-individual variability can be observed, especially for medium quality reeds [8], 10 "bad" and 10 "good" reeds were selected. In each test session, a given subject was asked to assess each reed as "bad", "medium" or "good". The test was repeated four times, on two different days. The results show that consistent assessments (i.e. a significant effect of the reed on the assessment) were obtained only at the fourth repetition and for half of the subjects (the most experienced ones). Several explanations can be found to interpret this result. In order to achieve a controllable experimental design, the 10 musicians were asked to assess the same 10 reeds (Vandoren V12, strength 3), on the same mouthpiece (Vandoren BD4) with the same perceptual test protocol (global quality assessment). The fact that the test was standardized for the 10 subjects could have reduced their reliability. The reeds and mouthpiece under test, despite being commonly used by classical musicians, were not the preferred material for all listeners. In addition, all 10 listeners would not spontaneously assess the global quality of a reed as "bad", "medium" or "good"; but can eventually be more or less subtle in their assessments.

The current study aims at evaluating the repeatability of perceptual assessments by placing the musician under natural conditions. As he would normally do when opening a box of new reeds of his own choice, the musician has to evaluate the quality by using his own material and by defining his own assessment task. The robustness of the perceptual judgments is assessed by

repeating the operation 10 times, on 10 different days. Preliminary results are here presented for two clarinet players.

## 2. EXPERIMENTAL SETUP

The experimenters provided each musician with a box of new reeds of her/his choice. The musician was then asked to assess these 10 new reeds with her/his own material (instrument + mouthpiece) on her/his own rating scale. The test was repeated 10 times, on 10 different days and took place in a recording studio with a reverberation time of around 0.5 s, measured between 125 and 4000 Hz [9]. The experimenters presented the reeds in random order to the musician in each test. Several pre-tests were conducted with each musician to refine the assessment protocol with respect to the actual reed box she/he was provided with.

- The first musician chose to classify her usual reeds (Vandoren 56 rue Lepic, strength 3.5) into 7 categories : “bad”, “medium–”, “medium”, “medium+”, “good–”, “good” and “good+”.
- The second musician chose to rate his usual reeds (Vandoren Traditional, strength 3) on a 20-point scale.

## 3. RESULTS

Friedman tests were conducted on the perceptual assessments that were respectively carried out by the two musicians (see Figure 1) to evaluate the effects of repetition and reed factors.

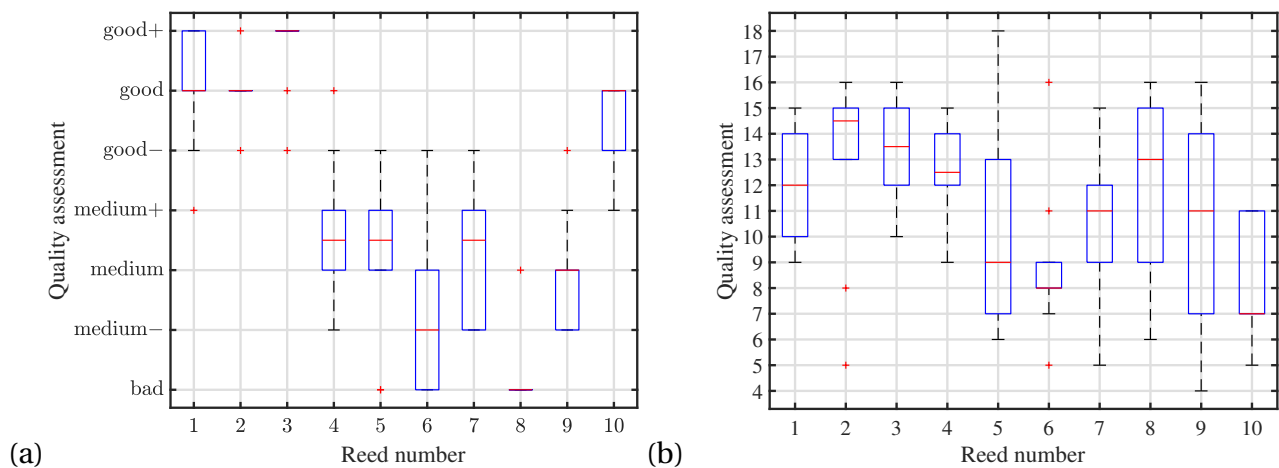


Figure 1: Box plots of the repeated quality assessments on 10 reeds (Vandoren 56 rue Lepic, strength 3.5) by the first musician (a) and on 10 reeds (Vandoren Traditional, strength 3) by the second musician (b).

The results do not show any significant effect of the repetition on the perceptual assessments:

- $\chi^2(9) = 15.510$ ,  $p = 0.078$ , for the first musician;
- $\chi^2(9) = 8.232$ ,  $p = 0.511$ , for the second musician.

On the other hand, the reed factor proved to have a significant effect on the quality assessment, for both musicians:

- $\chi^2(9) = 72.807$ ,  $p < 0.001^{***}$  for the first one, as illustrated in Figure 1(a);
- $\chi^2(9) = 24.443$ ,  $p = 0.004^{***}$  for the second one, as illustrated in Figure 1(b);

which indicates that they provided perceptual assessments that were consistent over the repetitions.

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#### 4. DISCUSSION AND CONCLUSION

The results showed a significant reed effect for both musicians, which indicates that their perceptual assessments significantly depended on the reed under test. In contrast the repetition did not prove to have any significant effect, which indicates that the perceptual assessments did not significantly vary over the repetitions. These results indicate that the two musicians were able to provide consistent perceptual judgments when assessing their usual reeds on their own material with their own criteria. These preliminary results tend to show that placing the musician under natural conditions will favor reliable perceptual assessments. However, more musicians are needed to generalize this finding.

#### ACKNOWLEDGEMENTS

The authors wish to thank the two musicians that participated in this experiment.

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