# A new search for acoustic „distinguishing marks" of the Vienna Philharmonic Orchestra

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"Vienna is Different" is the slogan you read when you enter the city on the highways. Differences are also associated with the sound of the famous Vienna Philharmonic Orchestra (VPO). This orchestra's individual sound characteristic is caused partly by different musical instruments (oboe, horn or timpani), and partly through a specific playing style. While the individual sound variations of these instruments have been investigated in previous studies at our Institute, this paper presents a more general approach to the "distinguishing mark" of this orchestra. 21 sound-pairs of orchestral CD-recordings were offered to test subjects: one example from the VPO and a second from the Berlin Philharmonic or New York Philharmonic Orchestras. The task was to listen and to identify the Viennese one. Listener test data are statistically analyzed to find who identified the orchestra correctly most often and through which examples (involved instruments in the example, musical background and origin of the listener, etc. are taken into account). The aim of the study is to find out which instruments do establish the typical Vienna orchestra signature. Which instruments give the best clues for identifying the VPO? The members of the audience are invited to make their own decisions.

## INTRODUCTION

What is special about the Viennese orchestra ? This question exists as long as the world famous orchestra itself. There are thousands of individual hypothesis and millions of ideas for possible reasons among musicians, audiences and scientists. In the 1950's the University of Music founded an institute to provide objective data on that question, but very first studies already showed that the question is much too complex for a simple answer. Too many variables are involved in the process of creation and perception. Since then, single parameters became the focus, which are obvious different in the Viennese orchestra: musical instruments such as the oboe, the horn and the timpani. The particular characteristics of these Viennese musical instruments have been studied in previous projects [1,2,3], but there is still no answer about what the main acoustical trademarks of these Viennese orchestra are. The approach of this project is to carry out an elementary study of musical acoustics: to hear music with a large amount of experienced ears and to collect their analytical power: a large-scale listening test setup including hundreds of musicians and listeners.

## METHOD

The question "Is there a typical orchestra signature in Vienna, Austria ?" has been asked using a listening test in Vienna, which started in March 2001 and is going on till December 2001. Since the aim of the test is to collect about 1000 test persons, this paper presents a documentation of the setup and shows preliminary results from 302 test persons. As the test is still in progress, details on the tasks will not be revealed. The unveiling of the final results will be presented at Forum Acusticum in Seville 2002.
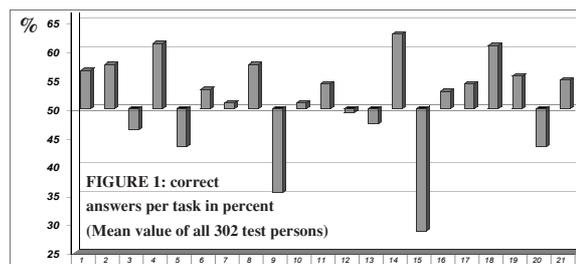
The task of the listening test itself is simply to decide which of two sound examples was recorded by the Vienna Philharmonic Orchestra (VPO). 21 pairs of sound examples from CD-recordings of nine standard orchestral pieces (see LIST "21 tasks"), are played to the test persons. The recording of the alternative sound example in the test pair is either played by the Berlin Philharmonic Orchestra or the New York Philharmonic. The sound examples were unmodified digital copies of pieces from commercial CDs. The duration of the

examples is between 3 and 35 seconds (15 seconds on average). While short examples allow the comparison of timbre and short time elements, longer examples are preferred by most listeners to focus on the interpretation. A compromise for the duration of the tasks and many other variables had to be made for a better chance of comparison of other parameters (e.g. the involved instrumtents ). The availibilty of CD recordings also restricted the possibility to maintain factors as the conductor, the year, place and technique of the recording.

Statistic groups of all 302 listener and there absolute number (n=) can be seen in the first row of table 1. Groups are formed by instrument sections of all test persons playing string, brass, woodwind instruments. For final analysis at least 30-65 listeners in additional groups *(female, male, age0-19years, age20-39years, age40-99years, Austrian, Non-Austrian, professional-musican, student-amateur-musicians, passive-listener., conducters and for each single instrument and persons playing no instrument)* are planned.

## PRELIMINARY RESULTS

Since the test setup is very simple, each single decision has a 50 % chance to be correct. The actual preliminary result over all tasks with 52% is just slightly higher. Also, if the decisions were random, the expected amount of correct answers (k) for each task were 50%. In fact, the preliminary results show a large variation of correct answers for each of the 21 tasks. (FIG 1) While 63% of 302 test persons identified the Vienna orchestra in task 14, only 29% decided the correct answer in task 15. The difference of correct answers varies also between the test groups. All mean values of k can be found in TABLE 1.



FIGURE 1: correct answers per task in percent (Mean value of all 302 test persons)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALL, n = 302 | 56,6 | 57,6 | 46,3 | 61,3 | 43,4 | 53,3 | 51,0 | 57,6 | 35,4 | 51,0 | 54,3 | 49,3 | 47,4 | 62,9 | 28,8 | 53,0 | 54,3 | 60,9 | 55,6 | 43,4 | 55,0 |
| BRASS = 38 | 50,0 | 57,9 | 42,1 | 52,6 | 63,2 | 50,0 | 39,5 | 44,7 | 55,3 | 52,6 | 60,5 | 57,9 | 55,3 | 52,6 | 23,7 | 63,2 | 60,5 | 71,1 | 55,3 | 47,4 | 60,5 |
| WOOD = 86 | 62,8 | 64,0 | 57,6 | 69,8 | 47,7 | 58,1 | 62,8 | 59,3 | 37,2 | 52,3 | 54,7 | 40,7 | 46,5 | 60,5 | 29,1 | 46,5 | 65,1 | 62,8 | 54,7 | 47,7 | 52,3 |
| STRING = 94 | 54,3 | 62,8 | 42,9 | 64,9 | 40,4 | 59,6 | 44,7 | 56,4 | 27,7 | 58,5 | 57,4 | 51,1 | 53,2 | 61,7 | 27,7 | 52,1 | 52,1 | 59,6 | 59,6 | 40,4 | 57,4 |
| **p (k≥Ø)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| ALL, n = 302 | 0,009 | 0,003 | 0,907 | 0,000 | 0,991 | 0,113 | 0,387 | 0,003 | 1,000 | 0,387 | 0,075 | 0,569 | 0,836 | 0,000 | 1,000 | 0,164 | 0,075 | 0,000 | 0,022 | 0,991 | 0,048 |
| BRASS = 38 | 0,564 | 0,128 | 0,872 | 0,436 | 0,072 | 0,564 | 0,928 | 0,686 | 0,314 | 0,436 | 0,072 | 0,128 | 0,314 | 0,436 | 1,000 | 0,072 | 0,072 | 0,003 | 0,314 | 0,564 | 0,072 |
| WOOD = 86 | 0,011 | 0,006 | 0,080 | 0,000 | 0,627 | 0,080 | 0,011 | 0,033 | 0,994 | 0,373 | 0,166 | 0,947 | 0,775 | 0,020 | 1,000 | 0,775 | 0,003 | 0,011 | 0,166 | 0,627 | 0,373 |
| STRING = 94 | 0,177 | 0,009 | 0,910 | 0,003 | 0,975 | 0,025 | 0,823 | 0,090 | 1,000 | 0,061 | 0,090 | 0,459 | 0,303 | 0,009 | 1,000 | 0,303 | 0,303 | 0,025 | 0,025 | 0,975 | 0,090 |

TABLE 1 (top): Mean value (ø) of correct answers (k) of groups per task in %   TABLE 2 (below) corresponding values of their probabilities [P(X)≥k]



FIGURE 2

## 21 tasks of the listening test

**[Task 1-2] Mozart: Symph. Nr. 41 (3. Menuetto) [1788]** Task 1: tutti in 3/4 - [ bar 52 - 59]. (dynamic =f) - flute, oboe, bassoon, horn, trump., timp., 1. viol., 2. viol., cello, bass, viola Task 2: - downward phrase, 3/4 - [ bar 44 - 51]. (dynamic =p) - flute, oboe, bassoon **[Task 3-5] Beethoven: Symph. Nr. 3 "Eroica" (4. Finale) [1804]** Task 3: - strings pizzicato, woodwind staccato - [ bar 12 - 27]. (dynamic =p) - flute, clar., bassoon, 1. viol., 2. viol., viola, cello, bass Task 4: flute solo (16th) above orchestra - [ bar 182 - 198]. (dynamic =p) - flute, oboe, 1. viol., 2. viol., viola, cello, bass Task 5: tutti passage, theme played by horn and basses - [ bar 380 - 388]. (dynamic =ff) - flute, oboe, clar., bassoon, horn, trump., timp., 1. viol., 2. viol., viola, cello, bass **[Task 6] Beethoven: Symph. Nr. 7 (2. Allegretto) [1812]** Task 6: - slow theme played by strings; poco a poco crescendo - [ bar 51 - 66]. (dynamic =p-mf) - 1. viol., 2. viol., viola, cello, bass **[Task 7-8] Schubert : Symph. Nr. 8 "Unvollendete" (1. Allegro) [1822]** Task 7: celli theme, syncopic contrapunct - [ bar 44 - 47]. (dynamic =pp) - clar., viola, cello, bass Task 8: strings theme - [ bar 312 - 316]. (dynamic =p) - flute, oboe, bassoon, horn, 1. viol., 2. viol., viola, cello, bass **[Task 9] Brahms: Symph. No. 4 e-moll op. 98 ( 4. Allegro) [1885]** Task 9: begin, accord theme played by all wind players - [ bar 1 - 8]. (dynamic =f) - flute, oboe, clar., bassoon, horn, trump., tromb., timp. [**Task 10-13] Bruckner: Symph. Nr. 7 E-Dur (3.Scherzo) [1883]** Task 10: trumpet - theme, strings rhythmic accomp. - [ bar 5 - 8]. (dynamic =p) - trump., 1. viol., 2. viol., viola, cello, bass Task 11: tutti, trumpet ff punctated motifs - [ bar 77 - 89]. (dynamic =ff) - flute, oboe, clar., bassoon, horn, trump., tromb., tuba, timp., 1. viol., 2. viol., viola, cello, bass Task 12: begin, timpani solo - [ bar 273 - 276]. (dynamic =pp) - timp. Task 13: end of trio, flute melodic motifs - [ bar 397 - 405]. (dynamic =p) - flute, oboe, clar., timp., 1. viol., 2. viol., viola, cello, bass **[Task 14] Berlioz: Symph. fantastique (1. Rêveries) [1831]** Task 14: oboe and bassoon motivs - [ bar 456 - 460]. (dynamic =p) - oboe, clar., bassoon, horn, bass **[Task 15,16,17] Mahler: Symph. Nr. 1 "Der Titan" (2. Kräftig bewegt) [1889]** Task 15: beginn, 3/4 "Ländler", rough motifs - [ bar 1 - 22]. (dynamic =f) - flute, oboe, bassoon, horn, triangel, 1. viol., 2. viol., viola, cello, bass Task 16: stringendo, climax, "Ländler"-theme, tutti - [ bar 132 - 169]. (dynamic =ff-fff) - flute, oboe, clar., bassoon, horn, trump., tromb., tuba, timp., triangel, 1. viol., 2. viol., viola, cello, bass Task 17: - horn solo, rit. dim. - [ bar 171 - 175]. (dynamic =mf-pp) - horn **[Task 18-21] Mahler: Symph. Nr. 5 (1. Trauermarsch) [1904]** Task 18: - trumpet solo - [ bar 0 - 5]. (dynamic =p-mf) - trump. Task 19: strings "Weinend" (sad), legato - [ bar 42 - 50]. (dynamic =pp-ppp) - clar., bassoon, 1. viol., 2. viol., viola, cello, bass Task 20: tutti, triplets, tuba solo - [ bar 254 - 265]. (dynamic =ff-pp) - clar., bassoon, horn, trump., tromb., tuba, timp., drum, l.drum Task 21: horn theme, 1.violin contrapart, strings triplet motifs - [ bar 337 - 344]. (dynamic =f-ff) - horn, 1. viol., 2. viol., viola, cello, bass
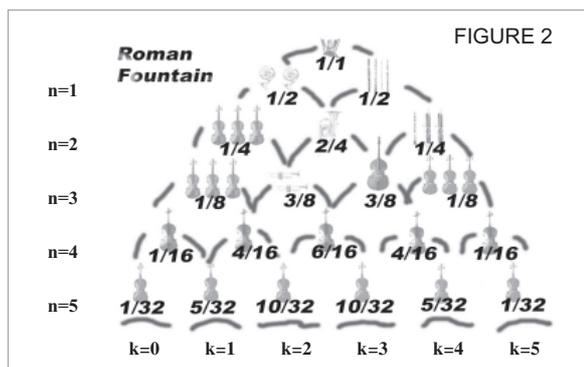
The first statistical approach was to find the probability of these results. The statistical probability of success in a binominal test can be demonstrated in a 'roman fountain'. FIGURE 2 gives an example for 5 decisions. The probability for 5 correct answers (k=5or k=100%) in 5 decisions (n=5) is 1/32 (p=0,03125). The probability to have at least 4 correct answers (n=5, k≥4 or k≥80%, cumulated probability) is 6/32 (p=0,18750).

The preliminary results (X) in TABLE 1 represent the percentage of correct answers. TABLE 2 shows the corresponding values of their probabilities [P(X)≥k]. Values of p below 0.001 (highly significant), below 0,01 (very significant) and below 0,05 (significant) can be found. This indicates that the decisions of the test persons are not always random, (as many of the comments of the test persons and there overall tasks result indicates). For example, in task 4, test persons playing a woodwind or string instrument had significant better identification of the Vienna orchestra than brass players. This and many more comparisons of the results from test persons playing brass, woodwind or string instruments can be concluded from TABLE 1 and 2.

## REFERENCES

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[3] Online Publications of our Institute can be found at **http://iwk.mdw.ac.at**