

# Electrolux Lab Study

on Music Assisted Vacuum Cleaning and Effects  
on Cleaning Performance

Electrolux Centre for Acoustics Research, June 2009, Stockholm



*Thinking of you*

 **Electrolux**

## About the study

This study was carried out in June 2009 with 10 randomly selected people between the ages of 20 and 40, with various tastes in music and with even numbers of men and women. In order to minimise any errors in measurements, all tests were carried out on the same day at the Electrolux test laboratory for sound-based research in Stockholm.

The primary aim of this study was to investigate the correlation between music and vacuum cleaning; more specifically 1) to analyse whether and how subjective experiences of vacuum cleaning are affected by music and 2) to investigate any influence that music has on the objective results of vacuum cleaning. A number of different tests were carried out on vacuum cleaning with or without musical assistance in order to chart any correlations. Tests were also carried out to determine what tempo (Beats per Minute) is the most comfortable tempo to vacuum to and whether the style of music can affect subjective experiences and objective results of vacuum cleaning in different ways.

## Primary study results

- Music-assisted vacuuming improves the cleaning experience and results in better cleaning performance than vacuum cleaning without music.
- Different music styles affect cleaning performance in different ways. Overall, classical music is the best music style for vacuum cleaning.
- The optimum tempo for vacuum cleaning in time to is 70 Beats per Minute. Higher tempos than 130 Beats per Minute are uncomfortable to vacuum in time to.

## Vacuum cleaning with or without musical assistance

The study started with qualitative interviews to analyse the previous experiences of vacuum cleaning among the participants. Follow-up interviews were then carried out after the first test, in which participants were asked to do some vacuum cleaning without any music. On both occasions, the majority of participants said that they experienced negative feelings; gloominess and monotony.

A visual evaluation of posture, facial expressions and sweeping movements was also carried out in parallel during the first test. This showed that the participants had serious and concentrated expressions and moved in a stiff way.

*"I feel frustrated and tired"* (Woman participant after the test without music)

A different image of vacuum cleaning was portrayed after the first music-assisted test. The participants now moved in a freer way, most of them smiled and some danced in time to the music. In the interviews that followed, most said that vacuum cleaning was made easier by the musical assistance. Several thought that the cleaning result was better.

*“Music gave me energy”* (Woman participant after the music-assisted test)

*“I wasn’t concentrating as much on the cleaning, but I still think the result was better”* (Male participant after the music-assisted test)

All participants thought that their vacuum cleaning flowed better with musical assistance. They scored their cleaning flow on a scale of 1 to 10 for all tests, and the average improved from 7.2 to 8.5 with musical assistance.

The highest measured pulse of the participants also decreased with musical. The number of heart beats per minute was 105 without musical assistance and 94 for jazz. Most of the participants also said that vacuuming with musical assistance felt less strenuous. Calorie burning also increased between the first and second test from 4.2 kcal/minute to 4.7 kcal/minute with musical assistance.

This study also showed that music-assisted vacuum cleaning actually gives better cleaning results than vacuum cleaning without music. The number of vacuum sweeps per minute (SPM) increased by 19% with musical assistance compared to vacuum cleaning without music. In addition, the quantitative volume of dust sucked up increased slightly when vacuum cleaning with musical assistance.

### **The optimum tempo for vacuum cleaning**

In order to investigate the best tempo to vacuum to, a test was carried out in which participants had to vacuum with sweeping movements in time to an increasing tempo scale. The result shows that a tempo that is lower than 50 Beats per Minute feels too slow to vacuum in time to. At 110 Beats per Minute the tempo feels quick, bordering on too quick, while at 130 Beats per Minute the tempo is much too quick, with the level of comfort falling dramatically. In the green zone, when the tempo does not feel too slow or too quick, the highest level of comfort is achieved at 70 Beats per Minute, which means that this can be said to be the optimum tempo to vacuum in time to.

### **The effect of the style of music on vacuum cleaning**

Having established the link between music and vacuum cleaning, the investigation continued with extensive tests to study the relationship between different music styles and the subjective and objective performance of the vacuum cleaning. Measurement variables were summarised in four dimensions that form the basis for the Vacuum cleaning Performance Index (VPI). The four dimensions of the VPI are:

- 1) Fortitude; estimated time required and the amount of effort that was needed
- 2) Mood; contentment and well-being
- 3) Efficiency; the amount of dust sucked up and how effective it felt

4) Precision; number of vacuum sweeps per minute

A total of six different music styles were investigated: 1) Classical, 2) Pop, 3) Rock, 4) Electronica/dance, 5) Hip hop/r'n'b, 6) Jazz.

### **Classical music**

According to the participants, classical music made the act of vacuum cleaning feel pleasant and elegant. The music made them feel happy.

A total appraisal of the VPI shows that classical music is the best music overall for vacuum cleaning, with a combined score of 30. High values were given for all variables, but particularly for fortitude and precision.

Vacuum cleaning assisted by classical music is most suitable for:

Space: Middle-sized to large

Furniture: Heavily furnished

Floor types: Wooden plank floor, concrete floor, difficult to clean carpets (i.e. Oriental carpets, long-pile rugs)

### **Pop**

After vacuum cleaning, the participants thought that cleaning felt light and smooth.

Pop music shows a high value primarily for fortitude. However, pop comes second lowest for mood among the different genres and also shows a relatively low value for precision. The total VPI value is average in comparison to all the genres studied, at 22.

Vacuum cleaning assisted by pop is most suitable for:

Space: Middle-sized to large

Furniture: Scarcely furnished

Floor types: Linoleum carpet, parquet

### **Rock**

According to the participants, Rock made the act of vacuum cleaning feel energetic, quick and fun.

Rock shows the highest value for fortitude of all the music styles. Mood and precision are also affected relatively strongly by rock. The total appraisal of the VPI for this music style is an average value of 25.

Vacuuming cleaning assisted by rock is most suitable for:

Space: Large and spacious

Furniture: Scarcely to normally furnished

Floor types: Concrete floor, tiles, wooden plank floor, easy to clean carpets (i.e. needle-felt carpets, wilton wool carpets)

### **Electronica/dance**

According to the participants, electronica/dance made the act of vacuum cleaning feel quick but boring.

This music style scores the lowest value of all for fortitude, mood and efficiency, but the highest value for precision, i.e. sweeping frequency. Electronica/dance has a combined VPI of 20, which places it second last among all the music styles that have been studied.

Vacuum cleaning assisted by electronica/dance is most suitable for:

Space: Small and incommodious

Furniture: Heavily furnished

Floor types: Linoleum carpet, parquet

### **Hip hop/r'n'b**

According to the participants, hip hop/r'n'b made the act of vacuum cleaning light and pleasant.

Firstly, this music style shows high values for precision, and it also scores well for efficiency and fortitude. Hip hop/r'n'b has less impact on mood. In total, this music style records the second highest VPI of all those studied with a combined value of 28.

Vacuuming cleaning assisted by hip hop/r'n'b is most suitable for:

Space: Small to middle-sized

Furniture: Heavily furnished

Floor types: Tiles, parquet, easy to clean carpets (i.e. needle-felt carpets, wilton wool carpets)

### **Jazz**

According to the participants, vacuum cleaning to jazz feels pleasant and calm.

The total appraisal of VPI gives jazz the lowest score of all music styles at 17. This music style shows extremely low values for precision. However, average values were given for the other measurement variables.

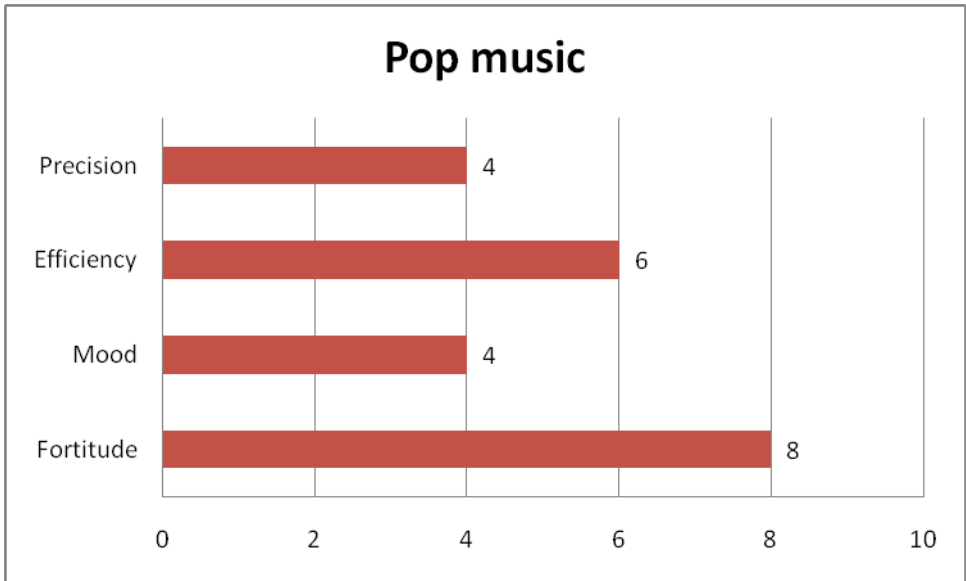
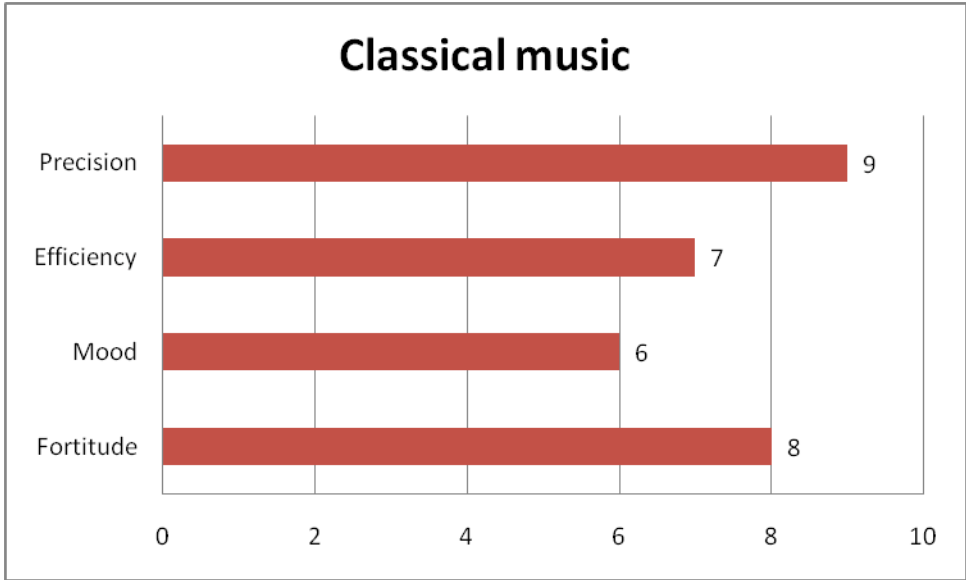
Vacuum cleaning assisted by jazz is most suitable for:

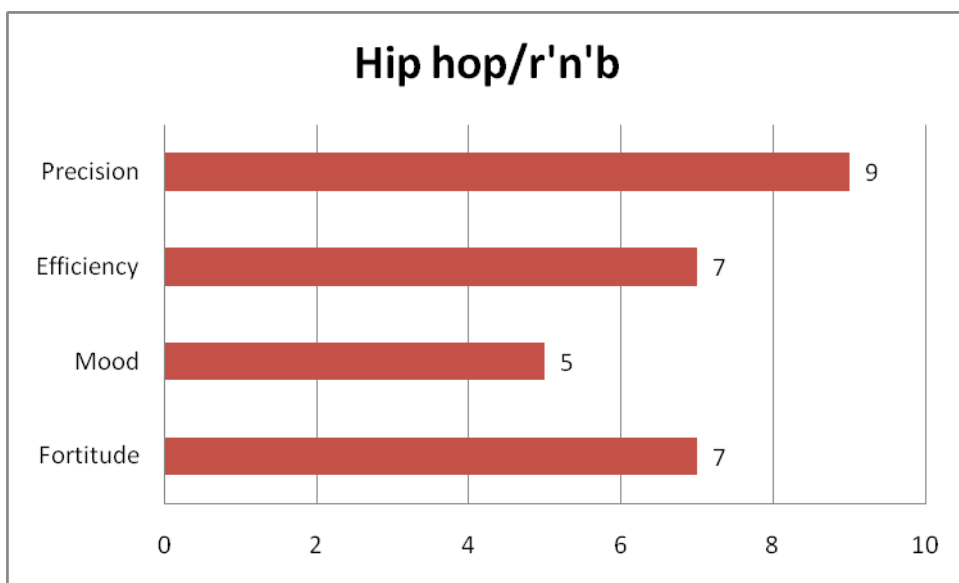
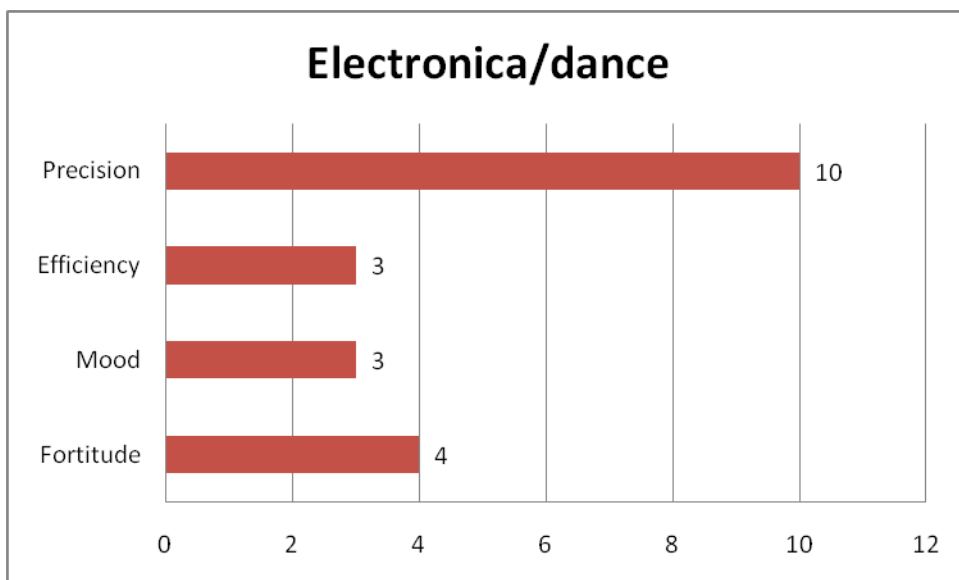
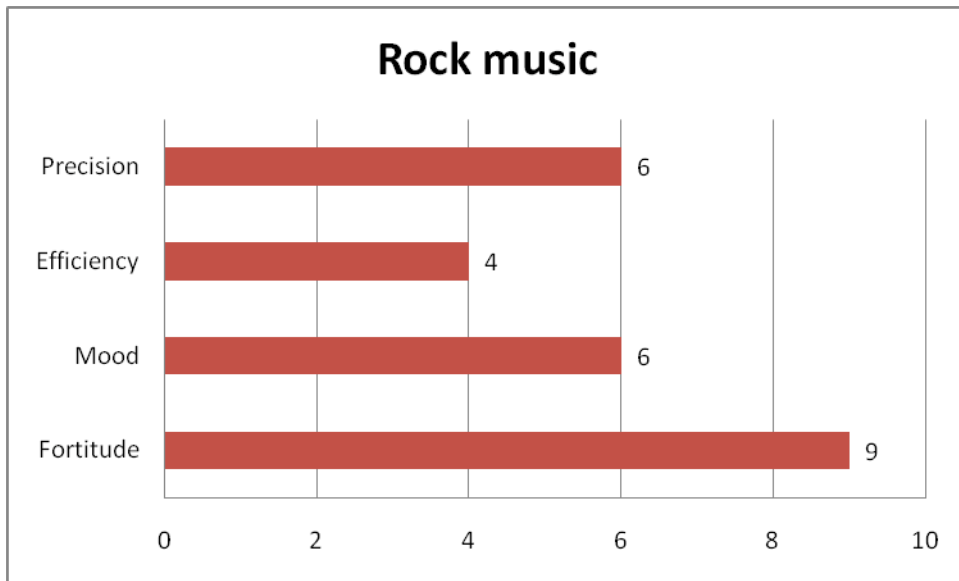
Space: Small to middle-sized

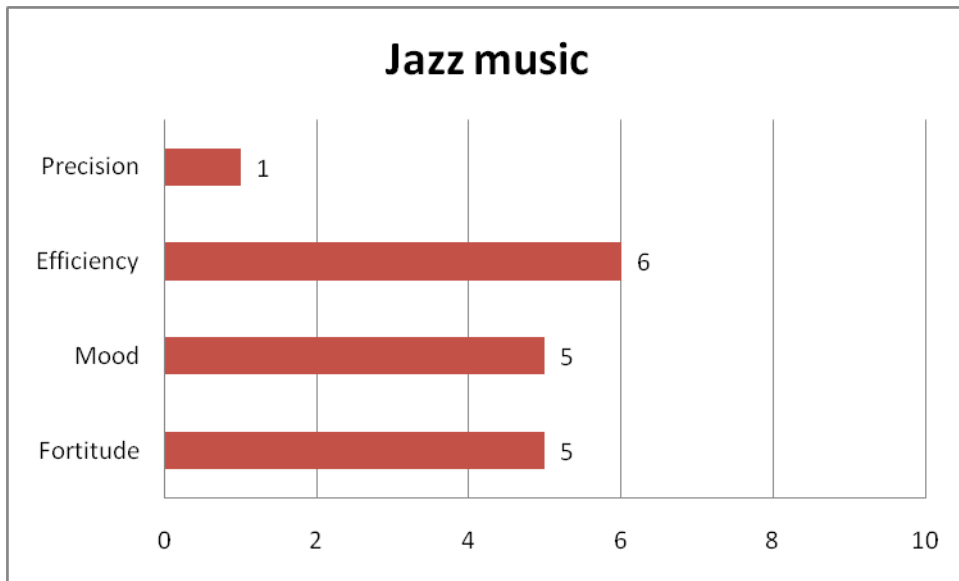
Furniture: Scarcely furnished

Floor types: Linoleum carpet, parquet

**(Figures 1-6) Vacuum cleaning Performance Index (VPI) for each music style. The higher the value of each variable, the better the performance.**

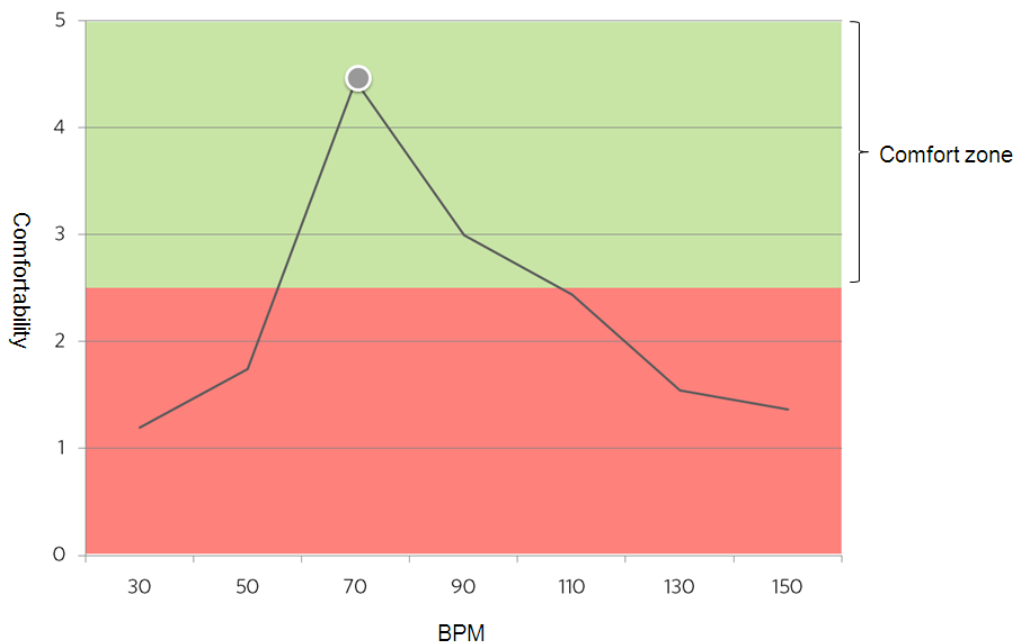






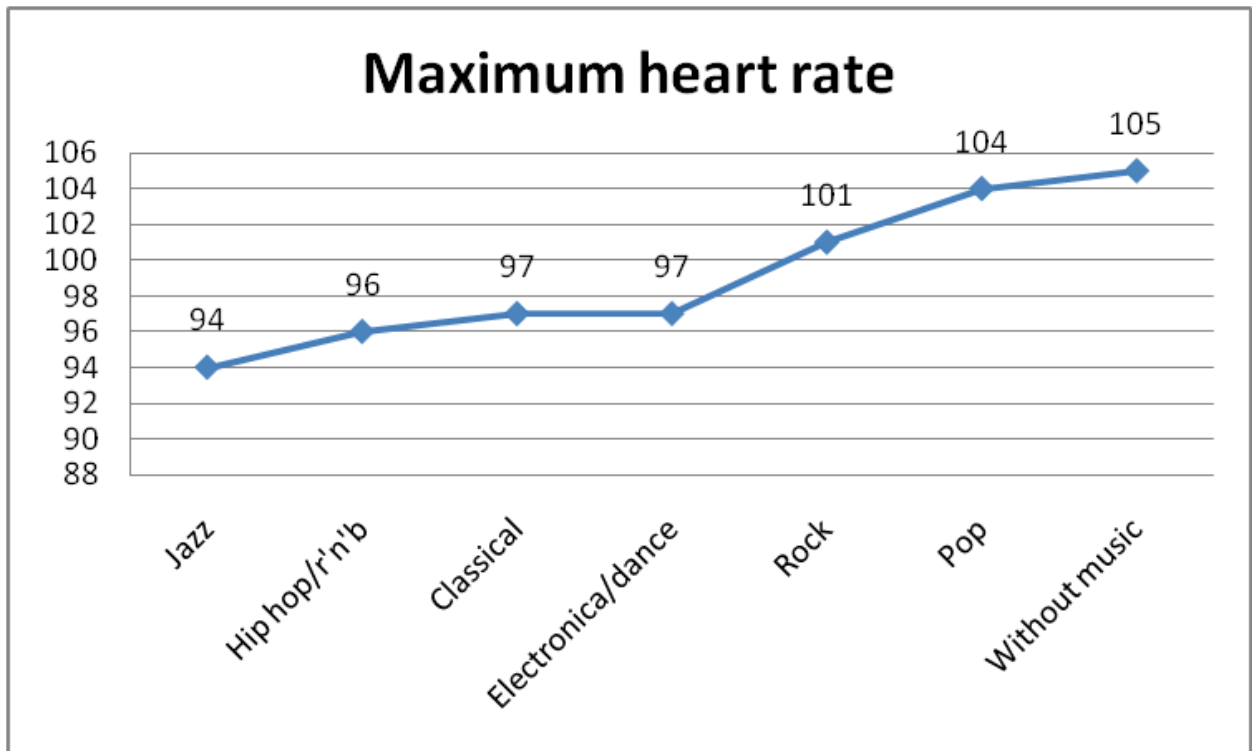
**(Figure 7) Curve for the optimum tempo of vacuum cleaning.**

In the figure below the optimum tempo for vacuum cleaning is indicated with a grey dot (70 Beats per Minute). The Y-axis shows the level of comfortability while vacuuming, and the X-axis represent tempo (Beats per Minute). The green field (between ~60 and ~110 Beats per Minute) indicates the interval in which it is comfortable to vacuum according to the group in the study.

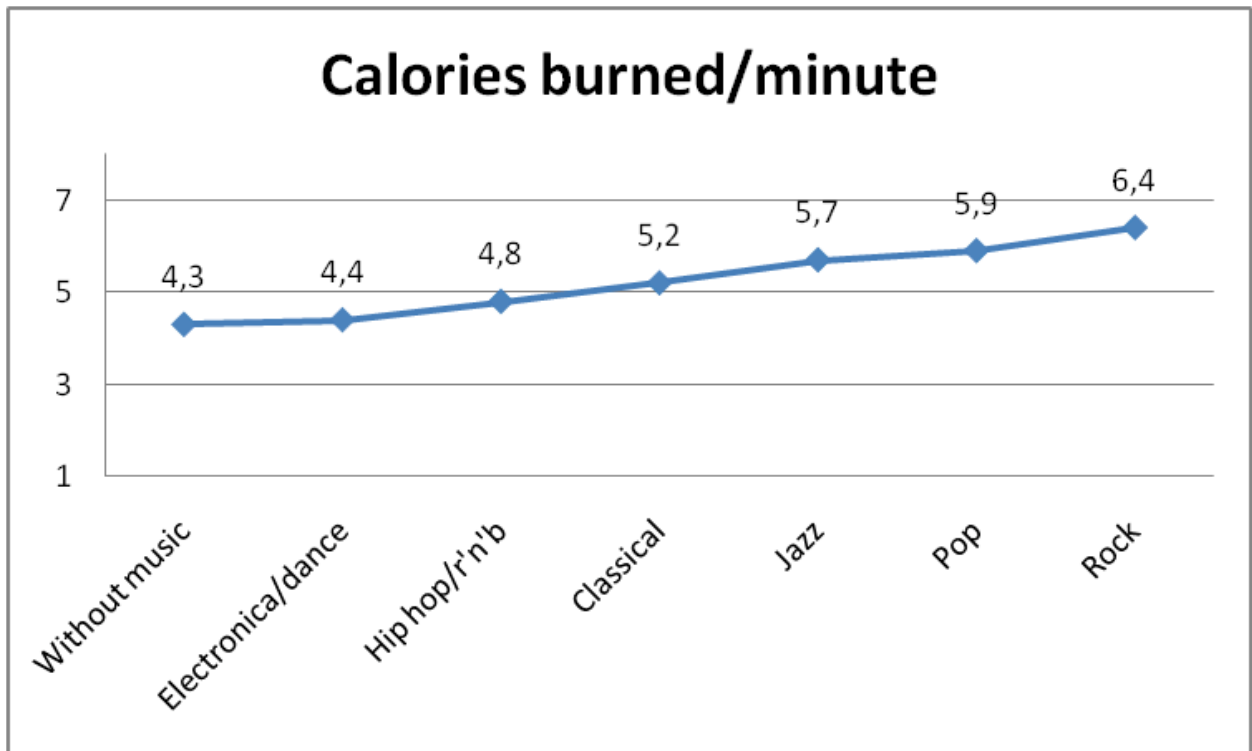


**(Figure 8) Highest measured heart rate per genre**

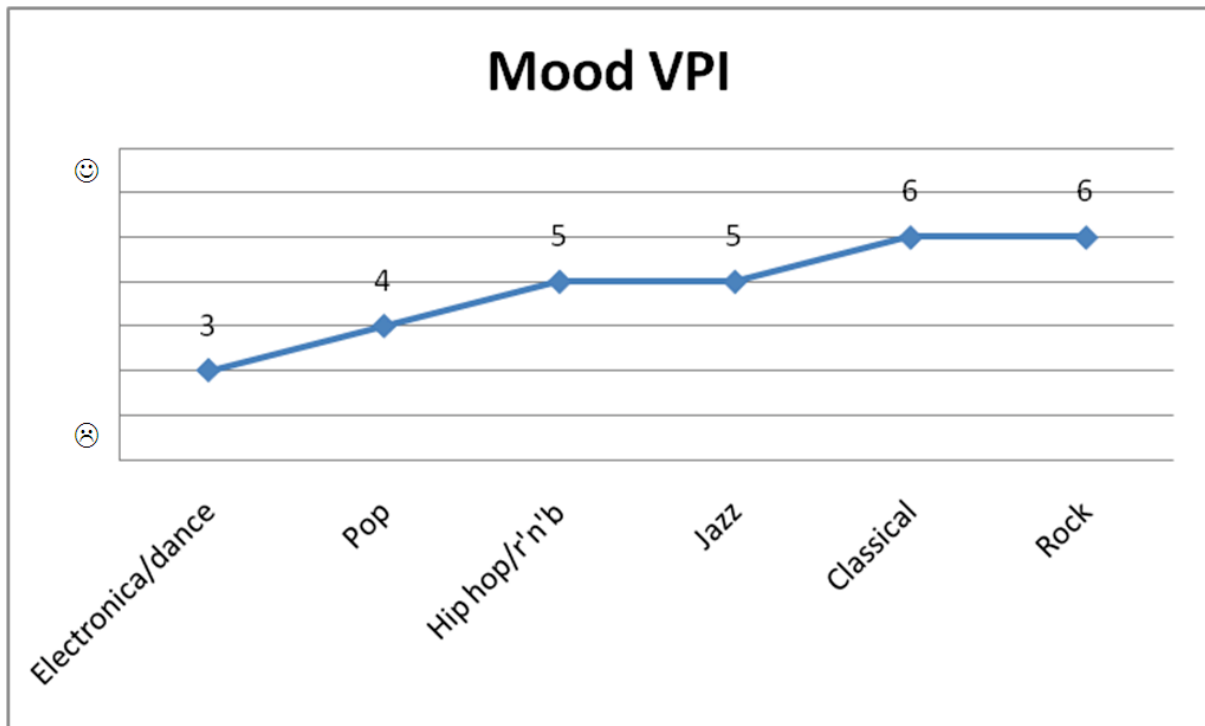
Music assisted vacuum cleaning slows the heart. It may indicate decreased sense of stress.



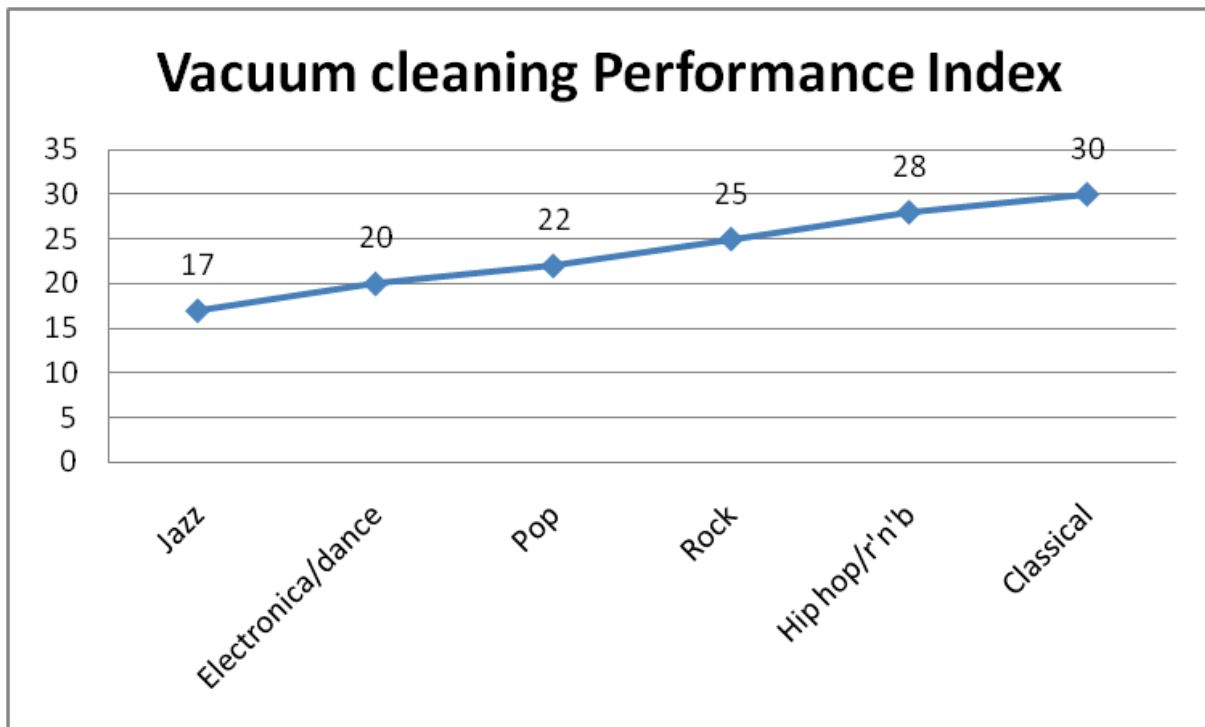
**(Figure 9) Kcal burned per minute**



(Figure 10) Effect on the VPI-parameter "Mood"



(Figure 11) Total VPI per Genre



(Figure 12) Sweeps per minute and genre

SPM is a precision-measure. The more sweeps, the more accurate the vacuum cleaning. The background being that broader sweeps makes it harder to for example, get to corners and in between legs of furniture.

