

## Guinea Pig as a Model of Human Musical Preference?

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### Abstract

The use of guinea pig has many advantages in auditory researches. The goal of the present study is to provide data about the basic behaviour in silent and to elucidate the effect of human music on the welfare, behaviour and circadian rhythm of the guinea pigs. A group of three females and one castrated, 2-year-old Abessine guinea pigs were involved in the trial. After a week of habituation the following acoustic stimuli were used: 24h silence (control), 24h Bach music, 24h silence, 24h Schönberg music, 24h silence, 24h white noise (positive control), 24h silence. The used Bach music was the Goldberg variations (BWV 988), the used Schönberg music were the Concerto for Cello and Orchestra, Chamber Symphony no.2. op. 38., Concerto for Piano and Orchestra op. 42. and Die Glückliche Hand op. 18. The differences in behavioural elements show tendencies, but owing to the few number of animals are not significant, with the exception of the drinking time ( $p = 0.02$ ). Listening to the Bach music the guinea pigs spent more time with drinking ( $1.1 \pm 0.1$ h) than during the Schönberg pieces ( $0.9 \pm 0.1$ h). During the Schönberg musical day the animals slept in a sitting-crouching posture, they contracted many times or woke up. On the contrary, during the Bach music they slept soundly, relaxed, leant on their side. There was no transient dozy phase between the wakefulness and resting, making the circadian rhythm more balanced. The behaviour patterns of the silent day and the Bach musical stimulus are similar. On the contrary, the Schönberg music changed the behaviour, the proportion of the sleeping increased, the eating, drinking, interaction and movement decreased. During the white noise, the sleeping and sitting increased, too, on the account of the eating, drinking, interactions and movement. The present results provide basic data of the adult guinea pigs' behaviour. The background musical stimuli of Bach improved the animal well-being. Their preference of Bach instead of the inharmonious Schönberg music and the white noise allows the presumption that their „musical taste” may be a model for the human.

**Keywords:** Guinea Pig; Model; Music; Preference; Behaviour

### Introduction

The noise and the music are parts of our everyday life. The environmental voices may derive from natura and artificial sources. The zoomusicology aims to detect the influence of human music on the animals' physiology and behaviour [2]. If the animal model is well chosen, the results - at least partly - may be extrapolated to the human, too. The use of guinea pig has many advantages in the noise induced hearing loss, because they are more sensitive to the voices of lower frequency than the rat or mouse [6]. The music may influence the

stress state and behaviour of the animals and humans. The appropriate music may not only calm the shelter dogs [3], but even improve the learning performance in humans [9] and rats [5,8], and even the pattern of the gene expression in the brain [4]. The vocalisation and its understanding is the primary communication form of the guinea pigs. They have eleven different types of vocalisation, used in special situations [1]. The goal of the present study is to provide data about the basic behaviour in silent and to elucidate the effect of human music on the welfare, behaviour and circadian rhythm of the guinea pigs. Comparing the musical preference of these animals with the human's one, conclusion can be made: are the guinea pigs suitable to serve as a model for human in this respect. The beneficial effect of the soft background music has been proved [7].

## Materials and Methods

A group of three females and one castrated, 2-year-old Abyssinian guinea pigs were involved in the trial. After a week of habituation the following acoustic stimuli were used: 24h silence (control), 24h Bach music, 24h silence, 24h Schönberg music, 24h silence, 24h white noise, 24h silence. Animals were kept in a cage of 50 x 25 cm of surface, placed in a silent room with 24-hour artificial light of 150 lux. Pelleted feed and drinking water were offered ad libitum. There was a continuous video recording using Zetta Z11 mini camera. The acoustic stimuli were given by PC-controlled speakers at a Sound Pressure Level of 65 dB. The broadcasted Bach music was the Goldberg variations played by Glenn Gould (BWV 988), the used Schönberg music were the Concerto for Cello and Orchestra (Allegro moderato; Andante, alla Marcia; Tempo di Minuetto), Chamber Symphony no.2. op. 38. (Adagio, Con fuoco), Concerto for Piano and Orchestra op. 42 (Andante, Moltoallegro-Agitato, Adagio-Piú largo, A tempo giocoso (Moderato-Stretto), Die Glückliche Hand op. 18. As a positive control, for 24h the white noise was applied. The analysis of the recorded behaviour elements were done using Noldus software. The statistical evaluation of the data (One-way ANOVA, post hoc Tukey-HSD tests) were executed by means of the SPSS-software.

## Results

The length of the different behaviour elements are given in table. The differences show tendencies, but owing to the few number of animals are not significant, with the exception of the drinking time (one-way ANOVA,  $p = 0,0177$ ). Listening to the Bach music the guinea pigs spent significantly more time with drinking ( $3827 \pm 229$ s) than during the Schönberg pieces ( $3290 \pm 327$ s).

	<b>Aggression</b>	<b>Sleep</b>	<b>Eating</b>	<b>Interaction</b>	<b>Drinking</b>
Bach	141 ± 68	30118 ± 2692	38702 ± 2552	2147 ± 290	3827 ± 229
White noise	138 ± 127	37044 ± 1362	32594 ± 455	1349 ± 265	2584 ± 660
Silence	224 ± 167	32162 ± 3655	36284 ± 4472	1674 ± 254	3460 ± 292
Schönberg	168 ± 4	33108 ± 4001	35860 ± 3802	1723 ± 699	3290 ± 327
	<b>Play</b>	<b>Self-washing</b>	<b>Washing</b>	<b>Movement</b>	<b>Grid biting</b>
Bach	288 ± 99,17	5466 ± 1187	20 ± 17	2194 ± 674	2 ± 3
White noise	60 ± 33	5743 ± 1302	10 ± 17	1669 ± 204	0,00 ± 0,00
Silence	264 ± 185	5595 ± 1061	14 ± 12	2290 ± 163	4 ± 3
Schönberg	204 ± 109	5601 ± 1627	15 ± 17	2051 ± 367	2 ± 2
	<b>Mating movement</b>	<b>Sitting</b>	<b>Sratching</b>		
Bach	416 ± 715	1115 ± 119	1965 ± 689		
White noise	606 ± 917	2485 ± 716	2118 ± 1118		
Silence	343 ± 583	1973 ± 1031	2114 ± 553		
Schönberg	455 ± 809	1858 ± 4100	2065 ± 718		

**Table:** The length of the different behavioural elements in 24 hours, second (mean ± standard deviation).

### Clinical observations

During the Schönberg musical 24 hours the animals slept in a sitting-crouching posture, they contracted many times or woke up, then dozing further. On the contrary, during the Bach music they slept soundly, relaxed, leant on their side. There was no transient dozy phase between the wakefulness and resting, making the circadian rhythm more balanced.

### Discussion

There was a tendency in the proportion of the behaviour elements. The behaviour patterns of the silent day and the Bach musical stimulus are similar. On the contrary, the Schönberg music changed the behaviour, the proportion of the sleeping increased, the eating, drinking, interaction and movement decreased, the cratching did not change. During the white noise, the sleeping and sitting increased, too, on the account of the eating, drinking, interactions and movement. It means that the white noise is an activity decreasing acoustic stimulus.

Considering all the data (Table) one can state that the Bach music and the silence had a beneficial effect on the useful activity of the guinea pig, compared with the Schönberg music and white noise. Compared to the Schönberg music, the Bach music increased the eating ( $10.0 \pm 1.1\text{h}$  vs  $10.8 \pm 0.7\text{h}$ , mean  $\pm$  SD) and significantly the drinking time ( $0.9 \pm 0.1\text{h}$  vs  $1.1 \pm 0.1\text{h}$  mean  $\pm$  SD,  $p < 0.05$ ). It can be supposed that the animals preferred the Bach music to the Schönberg one: feeling well they spent more time actively. The shortest sleeping time was detected during the Bach musical stimuli, on the other hand, the longest during the white noise ( $8.4 \pm 0.7\text{h}$  vs  $10.3 \pm 0.4\text{h}$ , mean  $\pm$  SD).

Compared to the silence, the white noise decreased the animals' activity which reflected in the sitting time ( $32.8 \pm 17.1$  min vs  $41.4 \pm 11.9$  min). At the same time, the sitting time was the shortest during the Bach musical day ( $18.6 \pm 2.0$  min). The movement is opposite to the previous: the continuous moving during the silent ( $38.2 \pm 2.7$  min) and Bach music ( $36.6 \pm 1.1$  min) are longer than during the white noise day ( $27.8 \pm 3.4$  min). The animals spent more time with playing (running and jumping) during the Bach musical stimuli ( $4.8 \pm 1.7$  min) and in silent ( $4.4 \pm 3.1$  min) than during the Schönberg ( $3.4 \pm 1.8$  min) or white noise sessions ( $1.0 \pm 0.6$  min).

All the three acoustic stimuli decreased the aggressive behaviour, which was more frequent and longer during the silent day ( $3.7 \pm 3.1$  min). The length of the friendly interactions (sniffing each other) sharply differed between the Bach ( $35.8 \pm 4.8$  min) and white noise ( $22.5 \pm 4.4$ ) days. The acoustic stimuli practically did not influence the time of the self-washing and scratching. The number grid biting, as a stereotypical behaviour, was very low showing a general well-being of the animals.

Owing to the acoustic stimuli the circadian rhythm of the guinea pigs changed: during the white noise 24 hours the sleeping time achieved the  $10.3 \pm 0.4\text{h}$ ; the other days were markedly shorter (Bach:  $8.4 \pm 0.7\text{h}$ , silence:  $8.9 \pm 1.0\text{h}$  and Schönberg:  $9.2 \pm 1.1\text{h}$ ). The average sleeping time during the white noise session was longer (15.0 minutes) than during the Bach treatment (13.7 minutes). It means that the white noise modified the circadian rhythm: the length of the waking periods get shorter, but the animals waked up more frequently.

### Conclusion

The present results provide basic data of the adult guinea pigs' behaviour. The background musical stimuli of Bach improved the animal well-being. Their preference of Bach instead of the inharmonious Schönberg music and the white noise allows the presumption that their „musical taste“ may be similar that of the human.

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