Spectrogram Analysis for Lovebird Voice Characterization Based on Age

Nia Maharika Andhini1*, Nabilla Ika Febiawati1, Herliana Amanda Darmasanti1, Denandra Ferliana Fauzan1, Ancylla Gusti Nugraheni1

1Physics Education Department, Universitas Negeri Yogyakarta
Jl. Colombo Yogyakarta No.1, Karang Malang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281
*email: niamaharika.2022@student.uny.ac.id

Abstract
Lovebirds are known to be energetic and active birds. The chirps produced by these birds are also known to be very melodious. This study aims to analyze the sound characterization of lovebirds of various age ranges such as the amplitude and frequency produced. The method used in this research is a qualitative analysis non-experiment. This research uses spectrogram analysis in the process of processing existing data. The results obtained in this study are the frequency values at the age of 1 month, 2 months, 4 months, and 7 months in a row, namely 3257.81 Hz, 3416.01 Hz, 3533.20 Hz, and 3937.50 Hz. In addition, the amplitude values obtained at the age of 1 month, 2 months, 4 months, and 7 months were 2.96 Pct FS, 2.99 Pct FS, 3.29 Pct FS, and 8.45 Pct FS, respectively. This shows that the increase in frequency and amplitude values is proportional to the increase in age. Then it is also obtained that the frequency value produced in the age range of one to seven months is in the range of 3000 Hz - 4000 Hz.

INTRODUCTION
A wave is a channel energy in the form of vibrations that move using a medium or without using a medium (Halliday & Walker, 2010). Sources of vibration that vibrate continuously will cause waves to occur. A simple example of a wave can be seen from a rope that one end is tied to a pole then one end of the rope is shaken and the movement on the rope can form hills and valleys which are often referred to as waves (Ruwanto, 2005).

Sound belongs to mechanical waves and longitudinal waves. Mechanical waves are waves whose propagation requires a medium. Mechanical waves are characterized by the speed of sound based on the medium. The speed of sound in the air can occur if it is influenced by the temperature of the air and the medium of propagation. When the temperature is high, sound waves will propagate quickly. Furthermore, longitudinal waves are waves whose direction of vibration is in the direction of propagation (Jati & Priyambodo, 2009). For the characteristics of longitudinal waves, namely waves that have the same direction of vibration and propagation, the length of one wave can be calculated from one density and one stretch (Muniarti et al., 2015).

In sound waves, the source of vibration in the form of sound propagates through the air and then enters the human sense of hearing. This is the periodic air pressure in its propagation, this air pressure gives the influence of sound to enter the human sense of hearing. The size of sound that can be reached by humans is at a hearing frequency between 20 Hz and 20 kHz (Soedojo, 2004). Each sound has its own characteristics
based on frequency, amplitude, propagation speed, and others.

In this study, lovebirds were used as research subjects. where the Lovebird itself comes from Africa, lovebirds include species of the genus Agapornis. This bird has an attraction that comes from its striking feather colour, this bird also has a relatively active nature. With the uniqueness contained in lovebirds, many people are interested in keeping these birds, besides that lovebirds are also cultivated. Bird farming, usually known as Aviculture, has the potential to be utilized as an entrepreneur (Misdiyanto et al., 2020). For the natural lovebird peak frequency range, the magnitude is 2000-14000 Hz (Wibowo, 2018).

According to KBBI, characterization is the process of identifying unique properties. Characterization is the process of identifying specific characteristics possessed by living things to distinguish between types and individuals within a type (Suryadi, 2012). Sounds produced by animals or living things are known as bioacoustics. The sound emitted by birds or other living things can be used as a marker to determine the species, because each bird has different characteristics from other birds. Between species can have differences in sound frequency and have different sound spectra (Aliya, 2022).

There are several studies that discuss the characterization of bird sounds, one of which is research conducted by Irwandi et al. (2019). In this research obtained the results of bird sound spectra carried out by the Fast Fourier Transform (FFT) method. Sounds from bird spectra show the time and frequency domains and show unique patterns that lead to bird identification methods. The results produced five birds that have different sound characteristics in both the time domain and frequency domain of the sound spectrum.

When determining the sound of lovebirds, most of them are done manually, namely listening or seeing the species directly so that some people do not know the characteristics of birds based on their sound. Based on these problems, the purpose of this research is to analyze the sound characterization of lovebirds, with the intention of knowing the characteristics of lovebirds based on the age range of birds.

**METHOD**

The method used in this lovebird sound characterisation research uses a type of non-experimental research with quantitative analysis research methods. Quantitative research methods are research methods that are consistent with research variables, focus on actual problems and phenomena that are happening, and present research results in the form of meaningful numbers (Sugiyono, 2018). The subjects of this study used male lovebirds of various age ranges. the age ranges used in this study ranged from 1 month, 2 months, 4 months, and 7 months.

The instruments used in this research are a laptop, Spectraplus software, YouTube, and stationery. Data was collected from the results of downloading videos uploaded through several YouTube channels Kaladin Joyo Muhammad, L Smart Channel, Candra Gty, and Brandy Watch Channel. The collection of bird sound data was not carried out directly due to the constraints of the research object that was not in the researcher's place so that the data was taken from the youtube channel. The audio sounds that have been obtained are then analysed using SpectraPlus software by analysing each sound of each lovebird of various ages. From the analysis using Spectraplus software, frequencies and amplitudes were obtained. The results taken and used are only one sample for lovebird chirping in each age range used.

SpectraPlus uses a concept with the FFT (Fast Fourier Transform) feature equipped with a soundcard found on every computer device (Nuzul & Mitrayana, 2017). The data resulting from the FFT feature is then expressed in the form of frequency and amplitude which is referred to as a spectrogram (Irwandi et al., 2019). Another concept used is Time Domain Analysis. Time domain analysis involves observing a signal in its original form as time passes. It is often used to look at the waveform of a signal and identify transient characteristics such as spikes or rapid changes.

In this study, spectrogram analysis was used to analyze the data. Spectrogram analysis is an approach in signal processing to analyze frequency information from time-domain signals. A spectrogram is a visual representation of the frequency spectrum of a signal in three-dimensional form, where the horizontal axis
shows time, the vertical axis shows frequency, and the color intensity or brightness level indicates the amplitude of the signal at a particular frequency and time (Irawan et al., 2022).

RESULT AND DISCUSSION

Lovebirds have a melodious voice that produces sound waves that can be analyzed using SpectraPlus software. In this study, the results of the data obtained show the chirping sound of lovebirds based on observations at the age of 1 month, 2 months, 4 months, and 7 months. It is known that lovebirds are male. The sound of chirping lovebirds is obtained from the youtube channel and the recording process uses a digital voice recorder that is positioned through the closest distance to the sound source in order to get clear and good sound results. However, at the time of taking the sound, there were some obstacles that caused a little disturbance in the recorded sound or noise. The noise must be removed in order to get a good image or wave, the peak of the bird's voice can be seen clearly in SpectraPlus software. The sound recording produces different sound wave characteristics and time distance. This can be seen in Figure 1.

Figure 1. Sound waves of a lovebird's full recording

Figure 1. the sound waveform of a complete recording made on a lovebird using SpectraPlus software. The image shows that the chirps produced by birds are periodic or take place continuously with almost the same sound waveform. Therefore, only one chirp period is taken to be analyzed and this sampling is done randomly. From the analysis of this one period, it can be seen the frequency produced and the amplitude of the sound waves of lovebird birds. Data was obtained from analysis using SpectraPlus software in the form of frequency (Hz) and amplitude (Pct FS). The results of the analysis of lovebird sounds from various age ranges are then displayed in the form of Table 1 and graphs in Figure 2, Figure 3, Figure 4 and Figure 5.

Table 1. Research results data

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency (Hz)</th>
<th>Amplitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month</td>
<td>3257.81</td>
<td>2.96</td>
</tr>
<tr>
<td>2 month</td>
<td>3416.02</td>
<td>2.99</td>
</tr>
<tr>
<td>4 month</td>
<td>3533.20</td>
<td>3.29</td>
</tr>
<tr>
<td>7 month</td>
<td>3937.50</td>
<td>8.45</td>
</tr>
</tbody>
</table>

Based on the data in Table 1, it shows that the frequency value of lovebirds, the older the age, the higher the frequency value produced. At the age of 1 month, lovebirds can produce frequencies up to 3257.81 Hz. Then, at the age of 2 months, there is an increase in the frequency produced to reach 3416.02 Hz. In the age range of 4 months and 7 months, there is also an increase in the frequency of the resulting sound of 3533.20 Hz and 3937.50 Hz.

The amplitude resulting from the analysis in Table 1. shows an increase in value with age.
At 1 month of age, lovebirds have an amplitude value of 2.96 Pct FS. At 2 months of age, lovebirds have an amplitude value of 2.99 Pct FS. At 4 months of age it has an amplitude value of 3.29 Pct FS. And at 7 months of age it has an amplitude value of 8.45 Pct FS. This increased amplitude indicates that the value is proportional to the frequency produced by the lovebird.

Figure 2. Sound waves of lovebirds at 1 month old

Figure 3. Sound waves of lovebirds at 2 month old

Figure 4. Sound waves of lovebirds at 4 month old
Figure 5. Sound waves of lovebirds at 7-month-old

The graph above shows the highest frequency values that lovebirds can produce at various age ranges. From the graph data, in one period of bird chirping, the highest frequency is produced. Based on these results, it can be stated that as the age of lovebirds increases, the frequency produced will be greater as well as the amplitude produced will also be greater. From the research conducted, it was found that the sound frequency produced by lovebirds in the age range of one to seven months is in the range of 3000 Hz.

Voice frequency in lovebirds is influenced by several factors, including sex, age, and environmental conditions. Gender plays an important role in determining the vocal characteristics of lovebirds. In general, male lovebirds tend to have louder and more varied voices than female lovebirds. However, this study can still prove the effect of gender differences on the frequency of lovebird sounds. This is due to the limited resources and objects for research data in the area where the researcher took the data. The bird's voice can also change with age, which may be due to the process of physical development or vocal learning.

A lovebird's surroundings also affect the frequency of its voice. Bird sounds can change according to their environment, and things like other birds, weather, or noise levels can affect a lovebird's vocal characteristics. Based on the results of a study by Svetlana in 2020 entitled "Effects of ecological factors on the acoustic parameters of passerine species in a tropical lowland forest in southern Vietnam" show that abiotic habitat conditions, such as temperature, humidity, and air movement, as well as the vegetation structure of the habitat, affect the acoustic parameters of passerine vocalizations.

CONCLUSION

After conducting research on the frequency of lovebird sounds with the variation used is the age range. The age ranges used in this study are 1 month, 2 months, 4 months, and 7 months of age. The results obtained in this study are the frequency values at the ages of 1 month, 2 months, 4 months, and 7 months in a row, namely 3257.81 Hz, 3416.01 Hz, 3533.20 Hz, and 3937.50 Hz. In addition, the amplitude values obtained at the age of 1 month, 2 months, 4 months, and 7 months were 2.96 Pct FS, 2.99 Pct FS, 3.29 Pct FS, and 8.45 Pct FS, respectively. This shows that as the age of lovebirds increases, the frequency produced will be greater as well as the amplitude will be greater. Therefore, it can be concluded that there is a linear relationship between the increase in frequency and amplitude values with age. It can also be interpreted that the increase in age is proportional to the increase in frequency and amplitude values. In addition, it is also obtained that the frequency produced by lovebirds in the age range of one to seven months is in the range of 3000 Hz - 4000 Hz. From these results, it is hoped that it can be used as a reference material for future research.
REFERENCES