

# The Correlation between the law of Bernoulli and vocalization- Description of the production of vocal sound -

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**Abstract-** Law of Bernoulli explains the principle of lift force of the airplane. Lift force occurs in the plane due to shape of the wing. The upper part of the wing is curved which speeds up the air leading to decrease in pressure, on the other hand, the lower part of the wing is straightforward so the velocity decreases leading to increase in pressure. This difference of air pressure enables the plane to lift.

Sound is produced by the body. In fact, it is made by the movement of the air. This thesis will analyze the scientific principal of vocalization and efficient method for this mechanism.

**Keyword-** Bernoulli's theorem, Vocal, Music, Sound, Breath, Pop

## 1. Introduction

K-POP became a global music tune from Korea. This is a dramatic accomplishment which took only 10 years. In fact, this success was made not by the government but through talented producers. Considering the fact that Japan's J-POP success was made by the assist of the central government, the success of K-POP is astonishing. Popular music started to emerge in college majors about 20 years ago. Recently, about 130 schools have a popular music majors and some of them have approximately 100 to 1 rate competition. This is clear evidence that entertainment field went beyond from a common interest among people to an industry [1].

However, plenty of news is appearing through the media that China is pushing on the competition with Korean companies. This is also happening in the entertainment industry. Obviously, it is more difficult to keep the glory than to achieve. Now it's time to think about sustainability and several factors are necessary. First of all, a systematic support from the central government is needed. Enhancement of infrastructure and strong investment is required. Secondly, human resource development is necessary. Competitiveness of the entertainment industry comes from human resource so it is crucial to make this right. A social system to enable talented artist to concentrate on their artistic activity is needed. Finally, the most crucial requirement is research activity. Every necessities written above needs to go through scrutinized research process. Therefore, it is important to have a solid research process.

Compared to the outer size of K-POP, research process is rigid. A short time of development; which is only 10 years, could be a reason, but lack of awareness and lack of

researchers are the critical reasons. Now it is time to keep this momentum and attempts of research is necessary

K-POP's most serious problem is weak vocalization. This is a problem which was pointed out a long time ago. Even though breathing and vocalization is the most crucial part for singers, most vocal trainings are focused on correlation with dance, tune, tone, and techniques. This is because making a quality sound through training takes a long time to be completed.

This thesis is about breathing and vocalization which could solve this problem. Scientific theory can be applied to vocal and through this analysis, a range and efficiency of vocal training can be finalized [2].

## 2. Bernoulli's law

In 1738, Switzerland physicists Daniel Bernoulli wrote in his book 'fluid dynamics' that the pressure decreases as the fluid's velocity increase, and the sum of potential energy and kinetic energy is always constant. Through the law of Bernoulli, the lift force of the airplane in Fig. 1 can be explained. The upper part of the wing is curved which increases the velocity of the fluid and decreases its pressure. The lower part of the wing is straight which decreases the velocity and increases the pressure. As the matter of fact, the gap of pressure of the upper and lower part of the wing occurs the lift force [3].

As displayed in Fig. 2 the gap of pressure due to the flow of air occurs because of the same reason when the gate get closed when wind blows through it.

The law of Bernoulli can explain the process of sound production in our body. When we speak, the vocal cords open and air goes through it. After that the air vibrates the vocal cords and this vibration create the vibration of the air which is voice.

Fig. 3 shows the process of voice production through breath precisely.

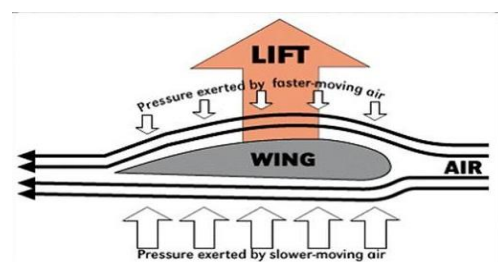


Fig. 1. Bernoulli's law applied to airplane wings

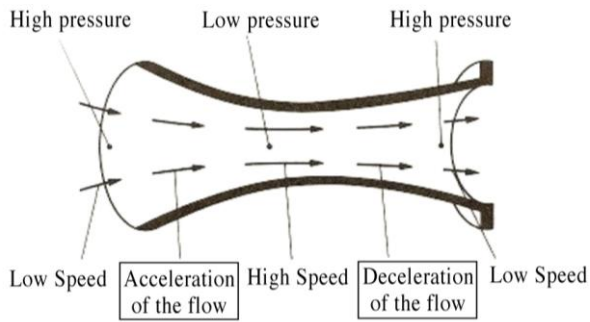


Fig. 2. The flow of air

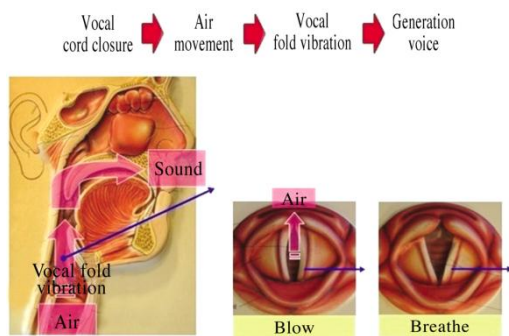


Fig. 3. Process sound is made [4]

### 3. Air and vocalization

There are a variety of breathing and vocal methods. Every music has its own unique tone of vocal according to its field, geology and genre. However, breathing skill is common among various music tunes. Since breath is the core of the sound, vocalists train to have as much as breathe as possible. Moreover, breath could prevent vocal cords to become overloaded. All this methodology is connected to the 'amount' of breath so it is crucial to have a high volume breathe.

As shown in the law of Bernoulli, the flow of air vibrates the vocal codes and makes sound. If the amount of air increases, so does the volume of sound. When the amount air decreases, so does the volume of sound. Considering the fact that the volume of sound is the fundamental for vocalists so we can know that the volume of sound can be controlled by basic breathing skills. Breathing skill displayed in Fig. 4 is a skill using upper abdominal which can maximize the amount of breath of vocalists [5].



Fig. 4. Breathing exercises

There are a variety of breathing skills. For instance, there are breathing skills using the upper abdominal explained above which is a classical method, and breathing skills using the lower part of abdominal. There are all appropriate methods but makes a different sound so it should be used according to the genre and style of music sung [6].

K-POP is derived from American pop music. Therefore, a lot of breath should be in the vocal sound to express the style of pop music and the methods to do this have been researched. However, they aren't used in the field. The reason is due to the difficulty and complexity of the training process, they aren't much instructors who can drill on this process to trainees.

Moreover, since entertainment industry is focused on the profitability and productivity as group, they lack interest in enhancing the individuals vocal ability [7].

### 4. Conclusion

Commonly it is said that the fundamentals vocal is interval and rhythm. However there are additional requirements to become a good vocalist such as tone, groove, feel, and various techniques. However, the most difficult quality is volume. Since K-POP origin from American pop music, K-POP musicians are singing a music appropriate for a westerners' body with Korean lyrics.

This is the main cause of the vocal issues occurring recently. Of course, the fact that vocal ability is not a fundamental factor for a debut is a core systematic problem. However, more fundamentally, limitation exists for an Asian vocalist to have a sound of a western vocalist. However, K-POP is on a rush of growth to ignore this issue and it is pointed out by several experts. The answer is harsh training supported with systematic program for breath and vocal training. It the doubt headed up to K-POP musicians with vocal ability issues, the future of K-POP can be devastating.

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Received: Month xx, 20xx