=Singer Voice Tester= (SVT)

See: https://intontrainer.by

SVT version from 2022-12-05

USER'S GUIDE

1. Functional features

The SingerVoiceTester (SVT) program is designed to test the user's singing abilities by analyzing a sufficiently long interval (about 10 seconds) of the acoustic signal of his singing. To do this, a histogram of the frequency distribution of the pitch frequency (F0) of the singer's voice on a 4-octave musical scale is calculated.

Based on the obtained histogram, two modes of program operation are implemented:

• Determination of the type of singing voice (bass, baritone, tenor, contralto, mezzo-soprano, soprano);

• Testing and evaluating the practical possession of the singing voice in the game mode by evaluating its differences from the reference performance in terms of voice pitch and range.

***SVT is implemented as a separate application for Windows (7, 8, 10).***

2. Applications

Using SVT can be useful in the following cases:
- As a means for primary education in singing lessons;
- As a game program for lovers of singing (voice competition);
- As a simulator of normative characteristics of singing melody;
- As a vocal trainer as a means of combating stuttering;
- As a means of monitoring the singing in roadcasts on radio and TV.

1. Getting Started

The SVT Start Window, which opens after the program is launched, is shown in Fig. 1.
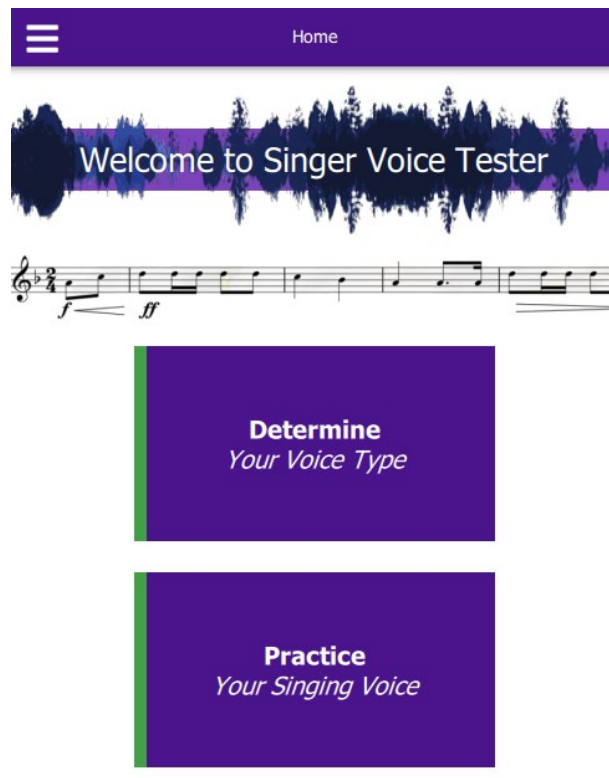
Fig. 1 Start Window

After starting the program, the user is provided with the functionality to test the singer's voice in 2 modes:
1) Determination of the type of singing voices (bass, baritone, tenor, contralto, mezzo-soprano, soprano);
2) Testing practical skills of singing in a playful way.
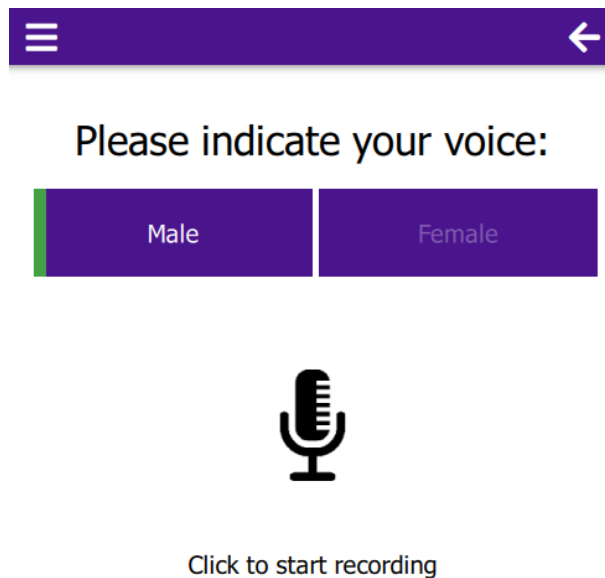
The first mode is implemented by clicking on the icon:
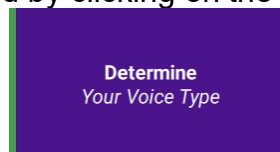
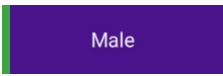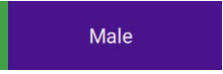**The second mode** is implemented by clicking on the icon:
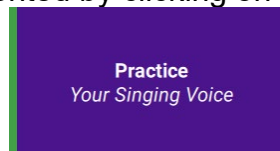
4. THE FIRST MODE: *Determination of the singing voice type*

4.1. Preparatory procedures

When choosing the first mode, an additional window appears (see Fig. 2).

Fig. 2 Additional window of the first mode

Using the button: Male or Female , the users must specify their gender. Note that the button is enabled by default: Male .

After specifying their gender, the user is provided with the following options:
    1) Recording through a microphone of a sufficiently long segment of the analyzed singing (preferably at least 10 seconds);
    2) Calling one of the pre-prepared test audio files stored in the "**data-tests**" folder.

The first option is implemented by clicking on the microphone icon: 🎤.

Then, after the icon 🔵 appears, recording of the song fragment being played begins. To stop recording, you must click this icon again.
    The executable fragment of the song is recorded in the **"data/records"** folder and prepared for further processing and displaying the results.

The second option is implemented by clicking on the icon: 📂.

It is designed to call pre-prepared vocal audio files of famous performers from the "data/tests" folder. In the "tests" folder, as examples of singing, there are two samples for each of the 3 types of male and 3 types of female voices (see Fig. 3).
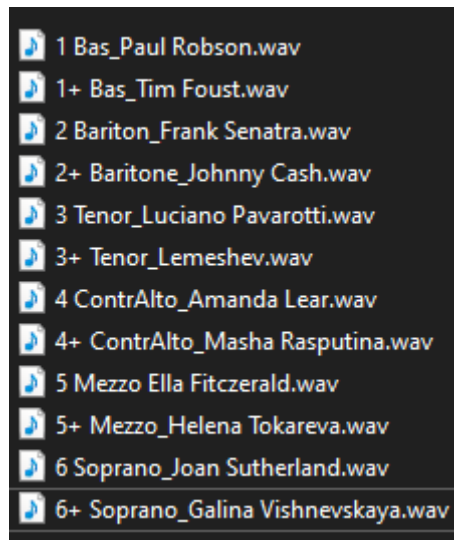
Fig. 3. The contents of the "tests" folder

4.2. Determining the type of male voice

After selecting the "Male" button and performing the actions for the 1st or 2nd option, a window opens with the results of determination the type of the singer's singing voice (see Fig. 4).
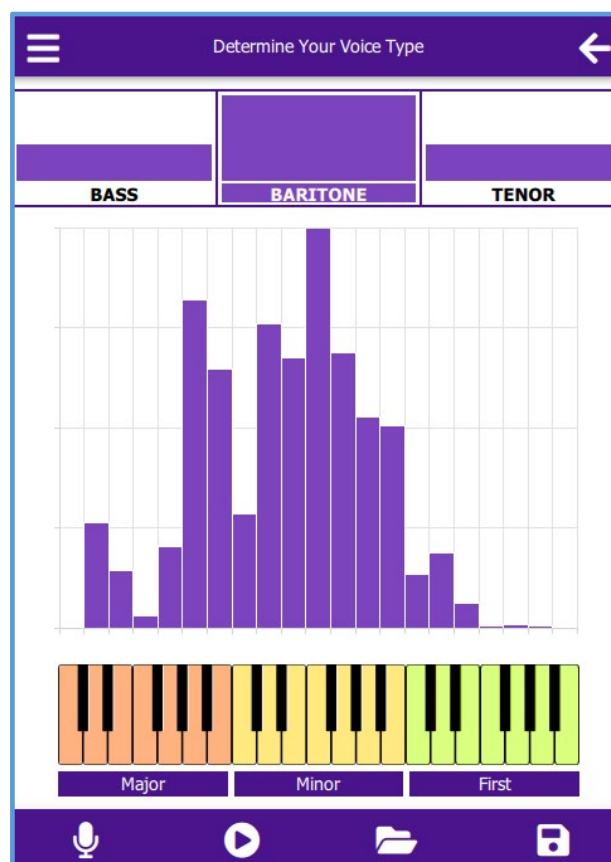
Fig. 3. Window for determining the type of male voice
(sings Frank Sinatra)

In the upper part of the window, in the form of the height of the blue bars, the degrees of belonging of the male singing voice to **Bass, Baritone and Tenor** are shown.

In the middle of the window there is a histogram of the frequency distribution of the analyzed singer's voice pitch on a 3-octave musical scale.
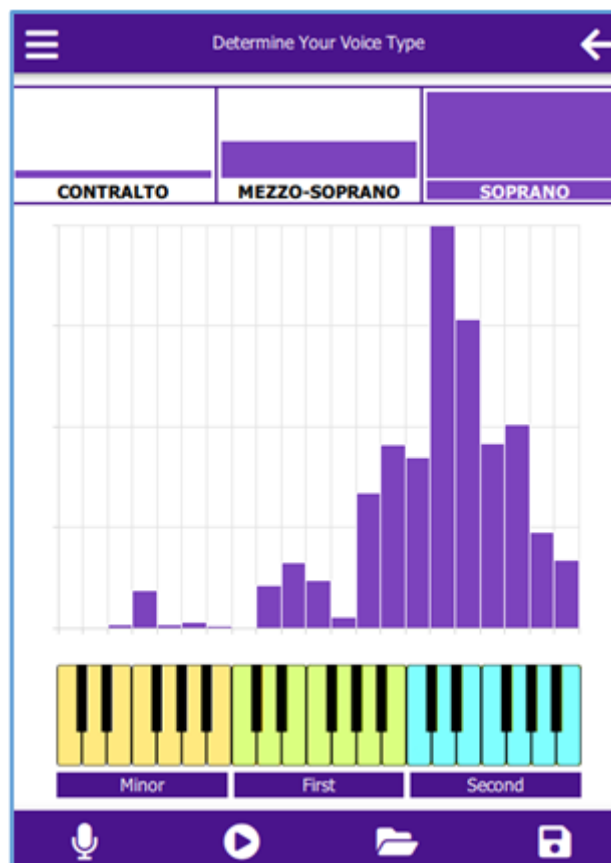
The bottom part of the window shows the location of the piano keys, which act as a musical scale. To cover the range of change in the pitch of male voices, a keyboard of 3 octaves (**Major, Minor and First**) is used.

4.3. Determining the type of female voice

After selecting the "Female" button:

and performing the actions for the 1st or 2nd option, a window opens with the results of verifying the type of the singer's singing voice (see Fig. 5).

Fig. 5. The result of verifying the type of female voice
(sings Galina Vishnevskaya)

The upper part of the window shows the normalized values of the degree of belonging of the female singing voice to **Contralto, Mezzo-soprano and Soprano**.

In the middle part of the window there is a histogram of the frequency distribution of the main tone of the analyzed voice on a 3-octave musical scale.

The bottom part of the window shows the location of the piano keys, which act as a musical scale. To cover the range of change in the pitch of female voices, a keyboard of 3 octaves (**Minor, First and Second**) is used.

We note the well-known fact of overlapping ranges of male and female voices (common – <u>Minor and First octaves</u>). For male voices, a <u>Major octave</u> is added to these two octaves, and for female voices, a <u>Second one</u> (compare Fig.4 and Fig. 5).

5. <u>THE SECOND MODE:</u> *Testing practical skills of singing*

5.1. Preparing Reference Vocal Samples for Testing

The singing reference signal can be entered directly into the microphone by a competent performer or singing teacher. The input of the reference signal directly from the microphone is carried out as follows.

Practice
Your Singing Voice
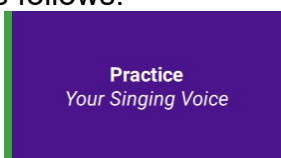
After pressing the button ⎢⎯⎯⎯⎯⎯⎯⎯⎯⎯, an <u>additional window</u> of the second mode (Fig. 6) opens, in which the acoustic signal of the reference performance of the song is input (see 1st option, p. 4.1).

Please sing the verse
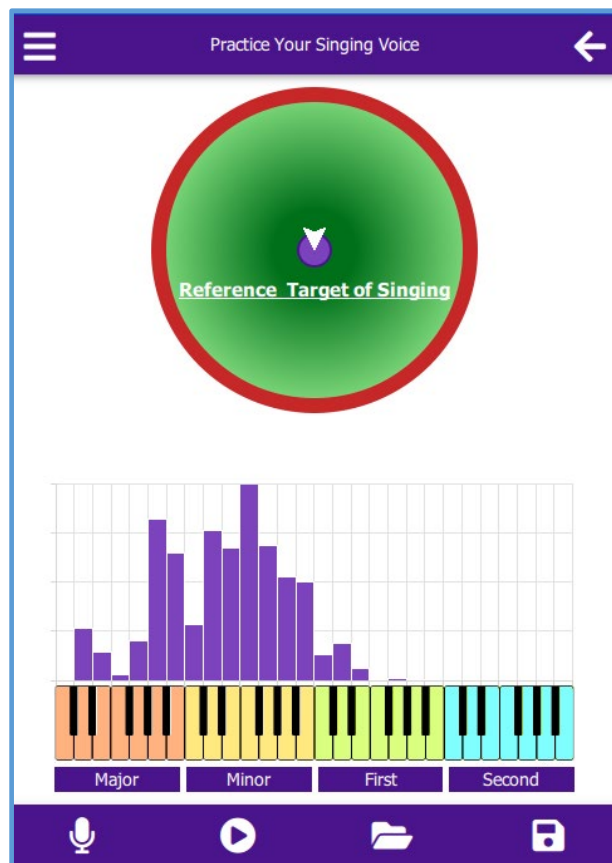of the **Reference** song!

Click to start recording

Fig.6. Additional window of the 2nd mode (REFERENCE)

The reference signal of singing can also be entered by calling pre-prepared audio files of famous vocal performers from the "data/tests" folder (see Option 2, Section 4.1).

The user is given the opportunity to record an unlimited number of their own reference audio files. To do this, he needs to open the "*SingerVoiceTesterBin*" folder, select the "*data*" folder in it, and then the "*tests*" folder. The contents of the "tests" folder can be updated using available tools (e.g. *Sound Forge*).

It should be borne in mind that this version of SVT provides the possibility of analysis only for signals in the following format: *wav, mono, 8 kHz*. Any other formats should be adapted to this format using suitable software tools.

After entering the reference vocal signal, the initial window of the 2nd mode opens (see Fig. 7).


Fig. 7. The initial window of the 2nd mode

In the upper half of the window there is an image of a target, in the center of which there is a blue circle, which is the reference target for singing when testing practical skills. The center of the target indicates the reference characteristics of the histogram of the vocal fragment: pitch and range.

The lower half of the window shows a histogram of the frequency distribution of the main tone of the reference performance of the song, as well as the piano keys corresponding to them, which act as a musical scale. To cover the range of changes in

the pitches of male and female voices, a keyboard of 4 octaves (*Major, Minor, First and Second)* is used*.

### 5.2. Testing and evaluation of practical singing skills

The procedure for testing and evaluating the practical skills of singing is as follows. After the input of the reference signal has been made and the initial window of the 2nd mode has opened (see Fig. 7), the user clicks on the microphone icon 🎤 in the lower left corner. This again opens an additional window (see Fig. 8) for entering the test signal of the song. The test signal can be entered directly into the microphone or by calling pre-prepared test audio song files from the "data/tests" folder (see section 4.1).

Please sing the **Same Verse**
of the reference song
for **Testing**

Click to start recording
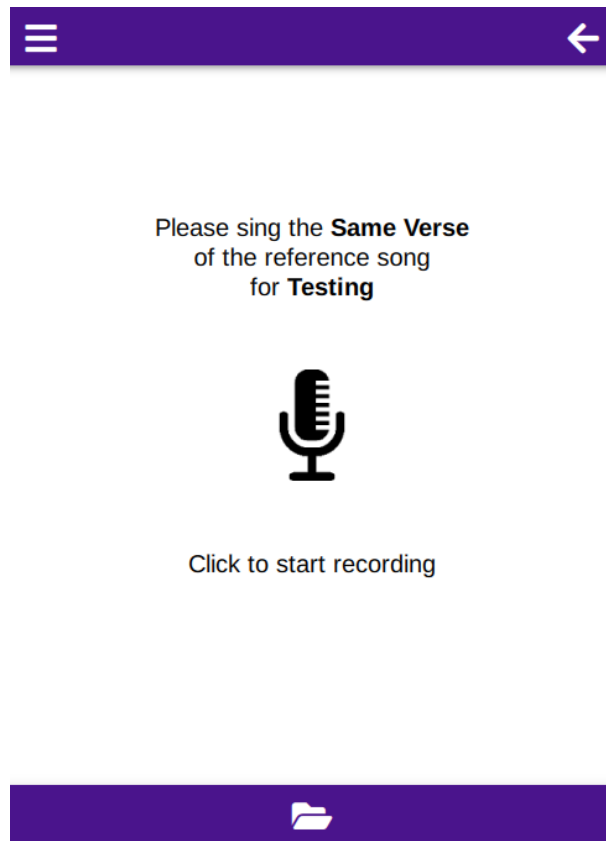
Fig.8. Additional window of the 2nd mode (TESTING)

After entering the test signal, the operating window of the 2nd mode program opens (see Fig. 9).
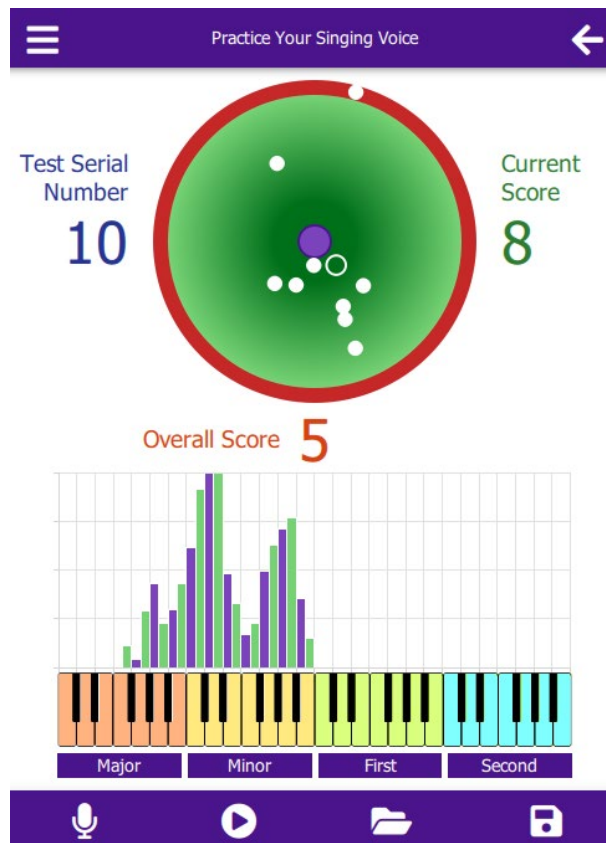
Fig. 9. The operating window of the 2nd mode

In the upper half of the working window (Fig. 9) there is an image of a voice target. The center of the target corresponds to the characteristics of the histogram of the reference performance of the song fragment.

After the first test performance by the user of the same song fragment, a mark in the form of a white ring appears in the zone of the circle of the voice target. The coordinates of this mark on the target depend on the degree of deviation of the test histogram from the reference performance in terms of two characteristics of the voice - pitch and range. On the voice target, they have the following correspondence:

• horizontal axis X – deviation from the reference in terms of voice range,
• vertical axis Y – deviation from the reference in terms of voice pitch.

In subsequent tests, the previous mark from the ring turns into a white dot, and the result of the current test is reflected again in the form of a white ring.

The position of the test mark can be either inside the area bounded by the red ring or directly on the red ring. The position of the label inside the field is determined by the permissible degree of deviation of the characteristics of the test execution from the reference.

Permissible degrees of deviation in the range and pitch of the voice are set by the

Permissible deviations X (Range)

2

Permissible deviations Y (Pitch)

user in the "Settings" section ⚙ Settings   2   .

The allowed degree of deviation is set by the number of notes (by default, both values are 2). The position of the marks on the red ring indicates the excess of the permissible degree of deviation of the test execution from the reference one.

The testing process can continue up to a certain number of tests specified by the user. To the left of the voice target, the serial number of the test is shown, to the right of the target - the current result, directly below the target - the final result, as an average value for the number of tests selected by the user.

Test results are evaluated on a 10-point system. The highest score "10" - when hitting the center of the target. Zero score - when hit in the red ring.

The coordinates of the label of the current result inside the red ring and on the ring itself characterize the corresponding deviation from the standard:
• X-axis – voice range deviation (narrower – wider),
• Y-axis – voice pitch deviation (lower – higher).

In the lower half of the working window there is a histogram of the frequency distribution of the main tone of the reference performance of a song fragment (blue bars) and the current test performance by the user of the same song fragment (green), as well as the corresponding piano keys that act as a musical 4-octave musical scale.

6. Auxiliary icons

In the lower blue bar of the main window, in addition to the icons for inputting a signal from a microphone 🎤 and calling test audio files from the "**data/tests**" folder 📂, there are also two other icons.

Using icon ▶, you can listen to the speech recorded through the microphone or called from the "data/tests" file.
With the second icon 💾 the results of testing in the "**results**" file.

In the upper blue bar of the main window on the left is an icon ☰, when clicked, an additional information window opens (see Fig. 10).
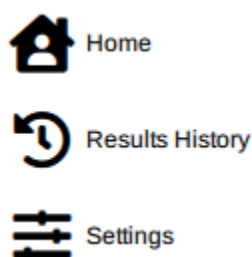

🏠 Home

🕓 Results History

🎚 Settings

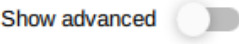**Fig. 10. Information window**

By choosing an icon: 🕓 Results History   the contents of the "results" file are called (see Figure 11).

1. Recording started: 2022-12-9 10:48:12
2. End of the recording: 2022-12-9 10:48:20
3. Overall Score: 5
4. Tests Number: 3

1. Recording started: 2022-12-9 10:51:32
2. End of the recording: 2022-12-9 10:51:58
3. Overall Score: 6
4. Tests Number: 4

Fig. 11. The contents of the "results" file

ATTENTION! The internal information in Settings called up by ticking the top right box Show advanced is for the developer only. Changing its contents by the user is highly undesirable.

CONCLUDING REMARKS

We encourage users to check our site from time to time for useful SMM updates.

To learn more about the theoretical foundations and code of SMM development see additional information posted on this site.