

smatrix

User manual

Applicable for smatrix Windows - Version 1.9

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dawin GmbH
Seligenthaler Str. 5
53721 Siegburg
Germany

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1 Introduction

Dear smatrix user,

smatrix is a one-of-a-kind speech recognition software for data collection by voice that operates fully offline.

smatrix is used for a hands and eyes free electronic data collection for research trials in crop protection, phenotyping in seeds and plant breeding and other agricultural disciplines such as animal welfare, veterinary medicine and livestock breeding.

Traditionally the software is used with research related to herbicide, insecticide, fungicide, seed/variety, fertilizer and plant growth regulator studies.

The development started in 2014 and after the official market launch in 2017, smatrix enjoys its growing popularity among experts worldwide.

Generally, the data is collected in Excel sheets. The format of the data is either operator-defined or exported from trial data management programs e.g., ARM.

This manual provides you with a step-by-step guide how to

- configure your trial in smatrix,
- enter assessment data by voice and receive feedback by the system through speech synthesis,
- store the assessment data in an Excel sheet

And now we wish you a productive start with smatrix!

2 General information

2.1 License information and points of contact

You will receive your smatrix license key via e-mail.

When starting smatrix 1.9 for the first time, you need to activate your license key. Internet access is required for license activation. Only one license key can be used per device.

Please contact us if a smatrix license is to be transferred to another device.

You can also find further information in our FAQ section:

<https://smatrix.systems/en/windows/faq-agroscience-for-windows>

and our training videos can be found here:

<https://smatrix.systems/en/branchen/agroscience/windows/tutorials-for-windows>.

We also offer workshops and consulting on your demand.

For questions regarding support or trainings please contact support@smatrix.systems.



2.2 Documentation

Please refer to our documentation manuals. They are automatically installed with smatrix. You can access them from the smatrix application as shown in 3.4

- a. Installation guide
- b. User manual
- c. Expert manual
- d. Speech command overview

3 Setup

3.1 Speech input guidelines

The speech recognition software used by smatrix is a continuous speech recognizer. The software is optimized for natural speech without pausing between individual words. A speech pause will always be interpreted as the end of the speech command.

Unlike Siri or Google Now, smatrix has a limited vocabulary. It recognizes only the phrases that are valid in a specific application context. Out of context speech will be recognized incorrectly or not at all. The speech recognizer will always look for the in-context phrase that matches best the utterance.

3.2 Headset

dawin strongly recommends using approved headsets as shown on our [website](#). Usage of headsets from different brands is possible but might result in degraded recognition performance.

As a rule of thumb, the microphone should be positioned at a distance of about 1 finger width in the corner of the mouth.

If the headset has a noise-canceling microphone, make sure that the correct side points in the direction of your mouth. Typically, a printed dot is visible on this side.

Outside, always use a windscreen around the microphone if your headset has no voice cancelling functionality.



the future of mobile data collection

3.3 Start smatrix

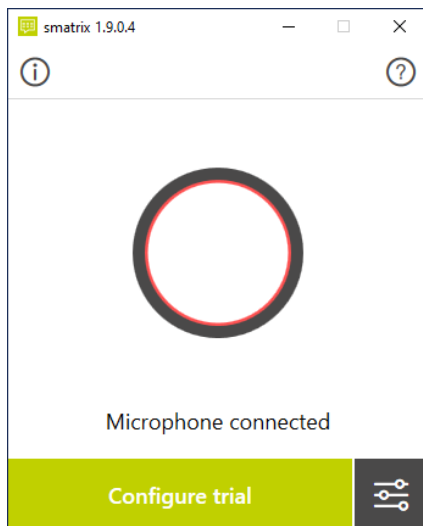
Before starting smatrix connect your headset.

Start the smatrix desktop application from the Windows menus or through the search function.

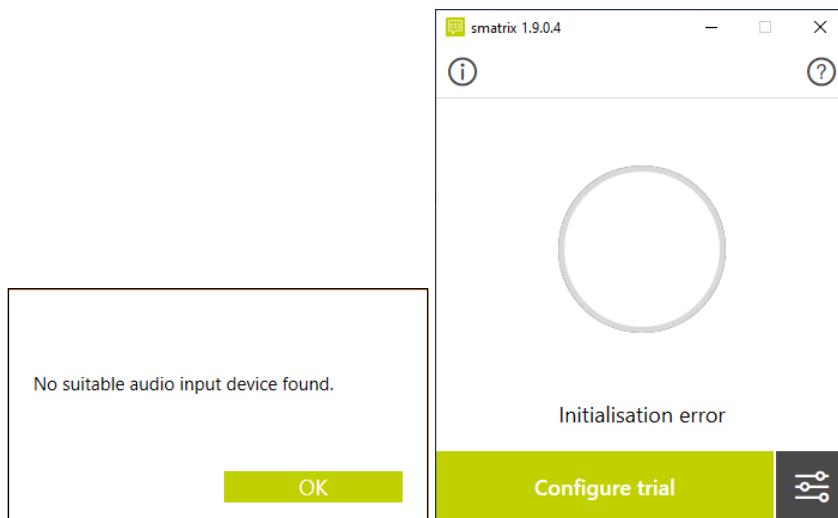
The smatrix splash screen will be shown for 10 seconds. On the splash screen, you will find the version of smatrix that is installed, and the license information.



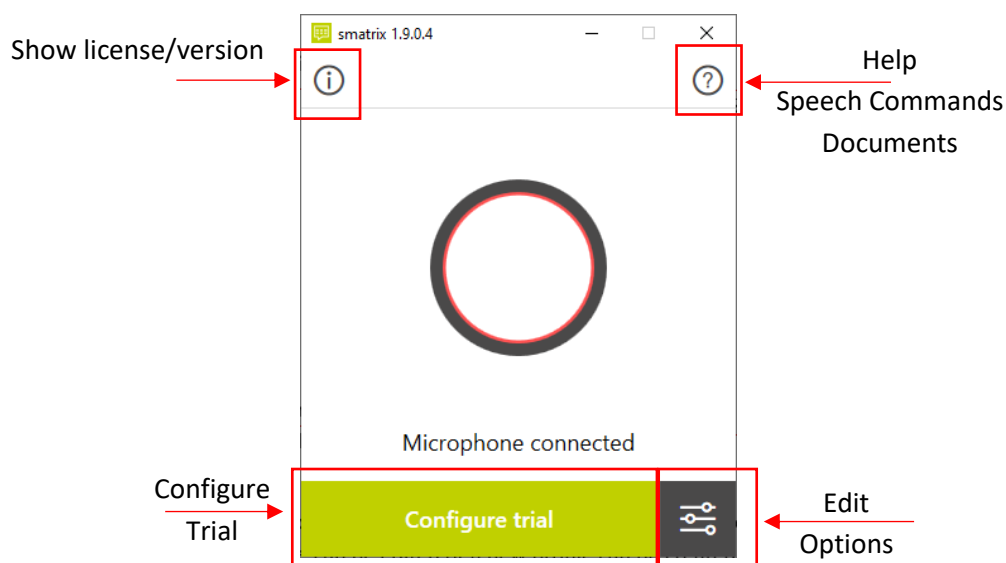
Then the start screen appears with a “live” sound ring.



When no sound input device was found, an error message and a start screen with a stale gray sound ring are shown. In this case check again if your headset is connected correctly.



3.4 Discover the start screen

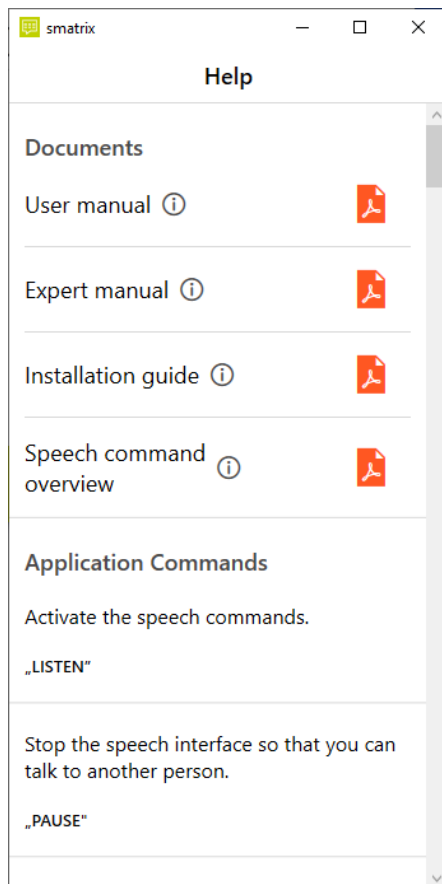


When you start smatrix for the first time, the default settings are applied. Using the “Edit Options” button, you can change language, audio settings and other preferences. They will be stored for the next time you use smatrix.

Push the “Configure Trial” button to configure a new trial or change the currently used configuration. Please refer to chapter 4 for details on trial configuration.

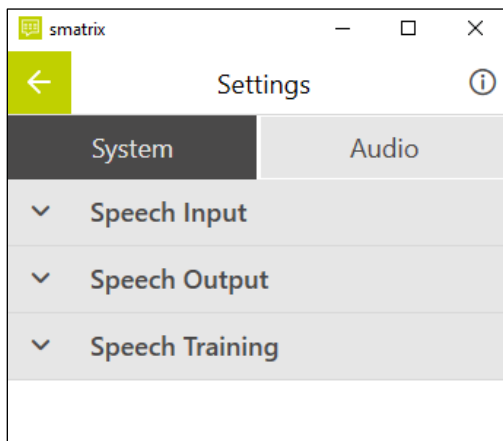
Press the information-icon to view details on the installed smatrix version, the used license and legal information.

From the start screen, you can open the help screen. This opens as a separate window that you can position somewhere on your screen as a reference. It contains links to the documentation and a Speech command overview. Via the PDF icons, you can open the manuals.



3.5 Configure audio devices

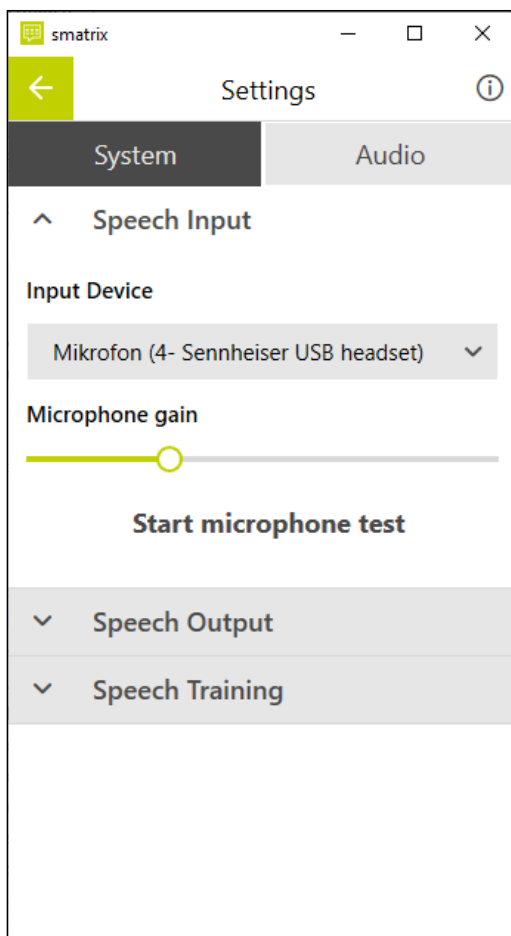
From the start screen, select the “Edit Options” button. Select the Audio tab on the “Settings” screen.



On this screen, several audio related options can be set.

The chosen options will be stored when you exit the screen via the back-arrow.

Expand the “Speech Input” section:



Drop-down list of available sound input devices.

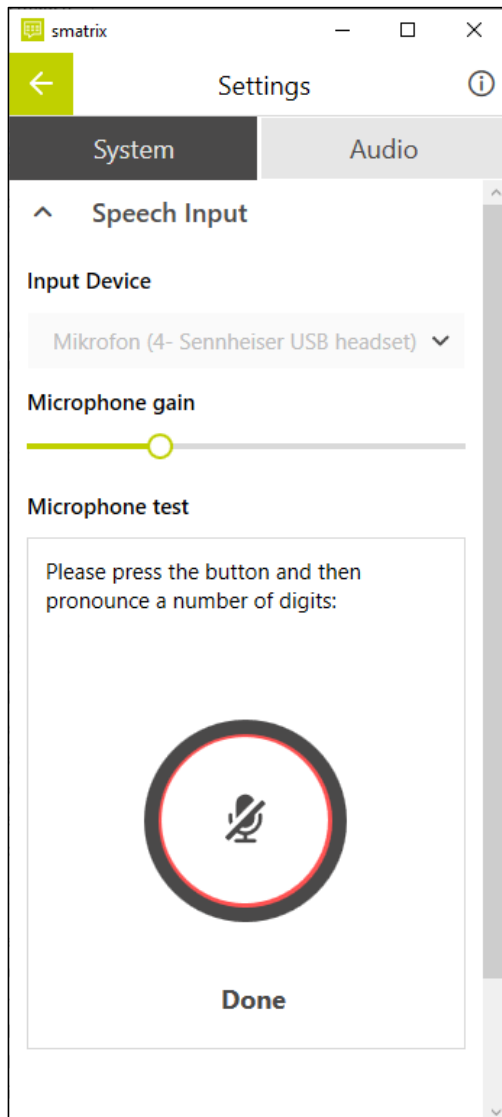
You can change the input volume with the slider.

It is important to set the input level at the right level. The speech recognizer is triggered when the sound input level reaches a minimum energy level.

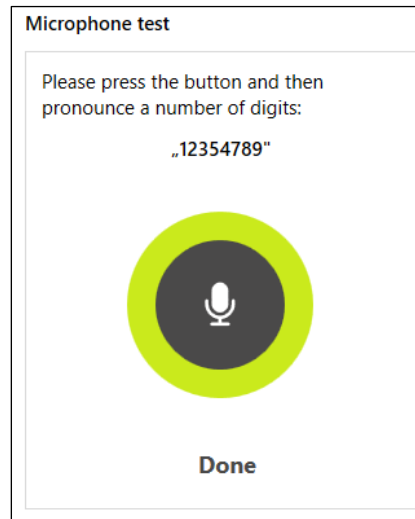
- If the volume is set too low, the user will have to speak loudly to trigger the speech recognizer which is very tiring after a while.
- If the volume is too high, the speech recognizer will be triggered by background noise and/or will not correctly estimate when the user stops speaking. This causes the speech recognizer to be out of sync with the user's perception. Also, speech input can be deformed (clipped) due to too much amplification. This results in bad speech recognition quality.

To set the input volume correctly, a microphone test procedure is available.

Start the microphone test:



After pushing the “Microphone” button please speak out several digits. Observe the sound ring carefully.



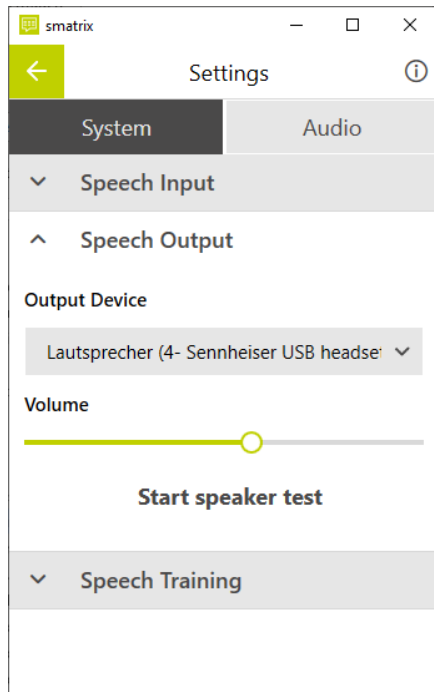
As soon as you speak, the ring should turn green and remain green as long as you speak.

Adjust the volume to the minimum level where:

- 1: You do not have to make a voice effort to get a green level when you speak.
- 2: The sound ring does not turn green while you are silent due to environmental noise.
- 3: The sound ring should never turn red when you are talking.

Press “Done” when you have finished adjusting. You can always come back later to this screen to make further adjustments.

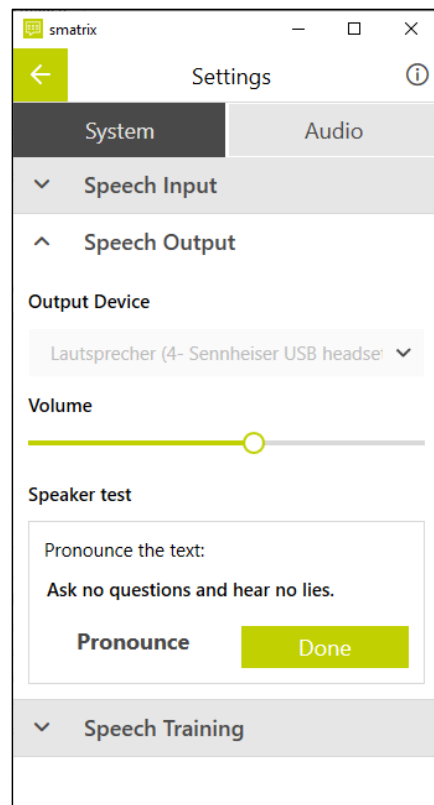
Minimize the “Speech Input” section and proceed to the “Speech Output” section.



Drop-down list of available output devices.

You can change the output volume with the slider. The slider affects the windows sound level for this device.


To set the most comfortable level for you, start the speaker test.



Push the “Pronounce” button to have the speech synthesis engine pronounce the phrase just above. You can alter this phrase to any phrase by typing over it.

Repeat this procedure several times and use the slider to set the volume to a comfortable level.

Note: while executing the trial, you can still change the sound level with the “Louder” / “Softer” voice commands or the volume up/down buttons on the headset.

Use the back arrow  to save the changed settings and go back to the start screen.

4 Trial Configuration

smatrix interacts with Excel sheets:

- some information will be read from the sheet (e.g., the trial unit numbers)
- data values will be written into the Excel sheet

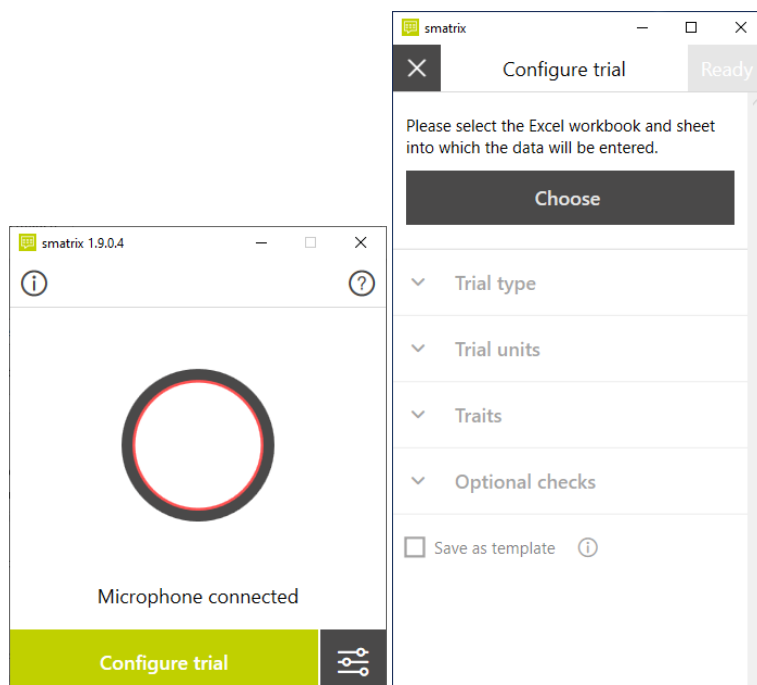
To achieve this, smatrix needs to know

- Which sheet to interact with
- Which cells contain information that should be read
- Which cells should be filled with data (and what is valid data)?

Whereas the selection of the sheet always must be done manually, the other information does not need to be configured manually. It can be achieved either by using templates, or via autoconfiguration. To get autoconfiguration working optimally, smatrix must be customized. Further information on that can be found in the expert manual.

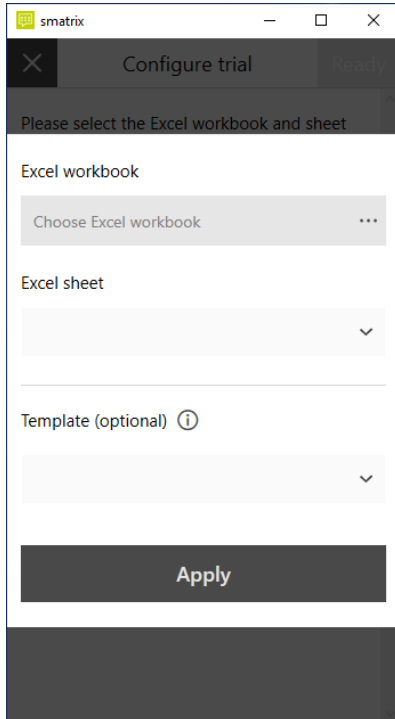
4.1 Enter configuration screen

On the main smatrix screen, push the “Configure trial” button to enter the configuration screen.



4.2 Choose Excel workbook and sheet

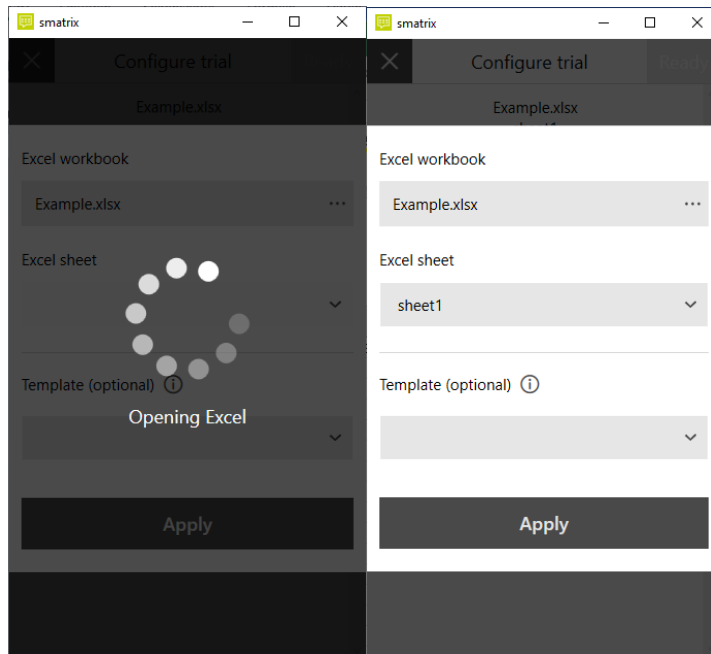
Initially, the configuration is empty. To get started, smatrix needs to know which excel-sheet it should interact with. The selection process is started by pushing the “Choose” button. This will open the following overlay:



4.2.1 Select Excel workbook

Push “Choose Excel workbook” and select the file you want smatrix to interact with. Note that smatrix remembers the directory and file name of the last Excel you opened.

After a file is selected, Excel will be started, and the selected workbook is opened.



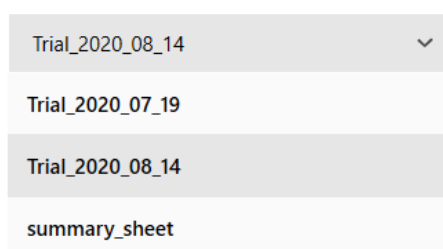
Notes:

- The Excel files used by smatrix must be located locally on your PC/Laptop/Tablet. Opening files directly from e.g., a network drive can cause errors!
- The Excel file may not be opened in parallel by another Excel process. If smatrix will not open the sheet, make sure the sheet is not opened in Excel already, and that you have read & write permissions for this file.

4.2.2 Select Excel sheet

By default, the first sheet of the workbook is selected. Other sheets of this workbook can be selected from the drop-down list in smatrix.

Excel sheet



4.2.3 Initial configuration

Now smatrix knows what sheet to interact with. The next action will be to apply an initial configuration for the selected sheet. Configuring in this context means to specify which columns will be filled for each plot and what are the value ranges for each column.

Before pushing the “apply” button, please make yourself familiar with the following options of initial configuration.

Note: The initial configuration can be kept or modified in further steps.

4.2.3.1 Re-use existing configuration

If you have configured the same sheet at an earlier point in time, smatrix can re-use the existing configuration. To achieve this, smatrix stores the configuration data in a parameter file once the configuration is completed.

When you push the “Apply” button, smatrix automatically looks for the parameter file and applies the configuration if found.

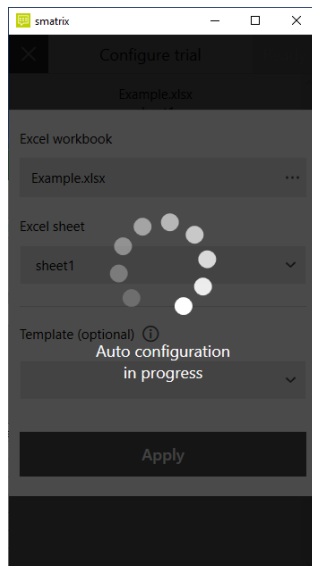
Note: The parameters will be stored in a file within the same directory as the Excel file. The name of the parameter file is: *excel_file_name.sheet_name.params.xml*

4.2.3.2 Autoconfiguration

When you push the “Apply” button, and smatrix does not find the parameter file, smatrix will do its best to autoconfigure the sheet.

Notes:

- The autoconfiguration can take several seconds to execute, depending on the size of the sheet and the size of the customization files. smatrix will show a busy screen while processing.
- The result of the auto-configuration may be incomplete or even wrong. Therefore, you can complete or override it in the next steps.
- To improve auto-configuration, please have a look at the expert manual.

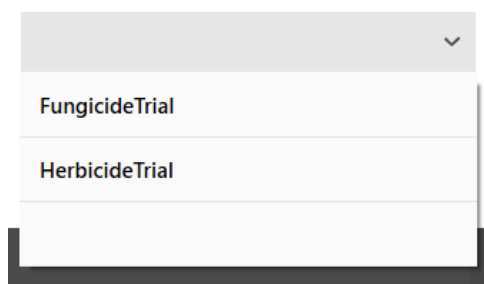


4.2.3.3 Apply a configuration template

When you want to share the same configuration for a lot of sheets with essentially the same structure, parameter files can be saved as a template – see section 4.3.5

To use parameters from a configuration template, select the template in the drop-down.

Template (optional) ⓘ



When pushing “Apply”, smatrix will use this template as initial configuration. It will not look for a previous parameter file and it will not attempt autoconfiguration, as described in the previous sections.

4.3 Finalize Configuration

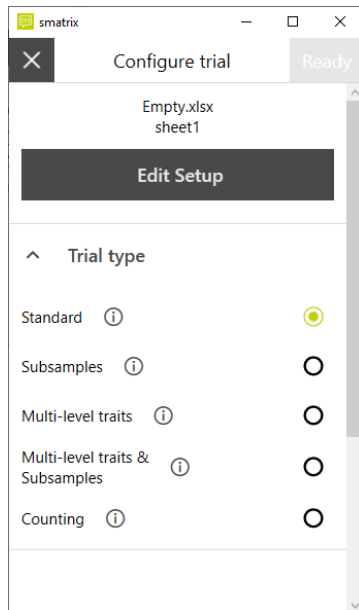
The configuration of a trial is divided into several sections, which are described in detail below. The order in which the sections are filled is not enforced. However, it is best to proceed top-down as e.g., changes to the first section will automatically impact the fields to be specified in other sections.

If smatrix was able to re-use a parameter file from the last usage, the configuration will already be complete. If required/desired, you can modify the configuration at this stage as well.

4.3.1 Trial type

smatrix can be used with a large variety of trials. By selecting a type, the remaining sections will show only the part of the configuration required for this type.

There are 5 different trial types in smatrix:



Note: Configuration examples can be found in 4.4 for each of these types.

4.3.1.1 Standard

This is the most common trial type and rather simple to configure. The trial has a list of trial units (represented by rows), and a list of traits (represented by columns). For each combination of trial unit and trait, one data value needs to be entered.

	A	B	C	D
1	Parcel	Leaf Rust	Phyto	Pest severity
2	1			
3	2			
4	3			
5	4			
6	5			

4.3.1.2 Subsamples

Extends the “Standard” trial type, adding support for subsamples. This allows to specify more than one value per trait & trial unit combination.

This requires an additional column in Excel, containing the subsample number.

	A	B	C	D	E
1	Plot	Sub	Leaf Rust	Phyto	Pest severity
2	1	1			
3	1	2			
4	1	3			
5	2	1			
6	2	2			
7	2	3			

Note: The number of subsamples can be configured per trait. For the above example, it is possible to collect 3 subsamples for the one trait (here Leaf Rust), but only one sample for the other traits (Phyto, Pest severity).

4.3.1.3 Multi-level traits

Extends the “Standard” trial type, allowing a trait as combination (“multi-level traits”). This can be used to collect the same trait (e.g., Leaf rust) on different leaf levels.

	A	B	C	D	E
1		Leaf Rust	Leaf Rust	Leaf Rust	
2	Plot	F-1	F-2	F-3	Phyto
3	1				
4	2				
5	3				
6	4				
7	5				

Note: The used number of levels is defined per trait. E.g., it is possible to have one trait with 2 levels, and another trait with just one level.

4.3.1.4 Multi-level traits & Subsamples

This extends the standard trial, allowing both: Subsamples and multi-level traits described above. This type is very rarely used. Please have a look at the example in 4.4.4 for more details.

4.3.1.5 Counting

This trial type is completely different from the previous ones!

It is helpful if a classification is of interest rather than individual subsample values. Each class is represented by a certain value range.

Upon entering a value, smatrix increments the count of that class, to which the value belongs. That is why it is called “counting” trial.

Please look at the example 4.4.5 for more details.

4.3.2 Trial units

The second section configures the trial units. In detail:

- Which rows in the Excel sheet shall be used as trial units?
- How can these trial units be addressed (by speech commands)?

4.3.2.1 Addressing Trial units

Firstly, the addressing of the trial units needs to be configured.

A trial unit is always addressed by a combination of two things: A name (e.g., “Parcel”) and an identifier (usually a number).

In the Excel below you would have “Parcel” as the name and e.g., “1” for the identifier. So “Parcel 1” addresses the second Excel row, “Parcel 5” the sixth Excel row.

	A	B	C	D
1	Parcel	Leaf Rust	Phyto	Pest severity
2	1			
3	2			
4	3			
5	4			
6	5			

This is configured in smatrix by choosing the “ID column range” and associating a name with each ID column. The notation in “ID column range” allows to order and combine columns and column ranges. It even allows multiple identifiers contained within one column. Please have a look at the examples in 4.4.

C, E	columns C and E
F, Y-AA	columns F and the columns in range Y to AA
A/3	column A contains id-group with 3 identifiers separated by ‘/’
B, A	columns B and A

4.3.2.2 Excel row selection

Secondly, smatrix needs to know which Excel rows contain trial units. This is done in “Rows selection”:

Rows selection ⓘ

The notation allows combinations of individual rows and row ranges.

2-21	row range from 2 to 21
2,4,6,7	rows 2,4,6,8
2-8,10,13-18,20	row range from 2 to 8, row 10, row range from 13 to 18, row 20

Note that the order of the rows cannot be re-sorted - it is always ascending!

4.3.3 Traits

The third section configures the traits. We need to tell smatrix what each selected column represents. E.g., a disease, a trait, a growth length. On top of that, we need to specify what kind of data will be entered in the cells of each column e.g., which numbers.

The required information is:

- Which columns in the Excel sheet contain traits. The “Traits column range” can be configured as e.g.

<input type="radio"/> C, E	columns C and E
<input type="radio"/> F, Y-AA	columns F and the columns in range Y to AA
<input type="radio"/> D, F, E	columns D, F and E

Note that the sequence of the columns does not have to be the regular sequence. The specified sequence will influence **the sequence in which traits are evaluated**.

- Then, for each trait:
 - ☐ How to address the trait (by speech commands)
 - ☐ What value range is allowed for the data collected for the trait
- Additionally, you can specify the representation of the “unavailable” value. This value is supported for all traits, independent of the chosen value range.

4.3.4 Optional Checks

The fourth section allows enabling optional checks.

smatrix can verify that no cells are left empty. The check can be made at different occasions during the trial. When one or more empty cells are detected, the location of the first one is read to the user.

By default, all optional checks are disabled.

^ Optional checks ⓘ

- ☐ Upon leaving the column
- ☐ Upon leaving the row
- ☐ Before saving

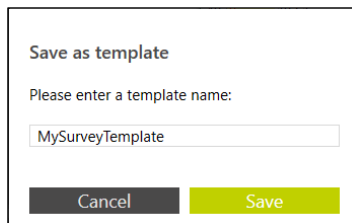
4.3.5 Save as template

Last part of the configuration is a checkbox allowing to save this configuration as a template.

☐ Save as template ⓘ

If you want to re-use the same configuration for other sheets you can store the current configuration as a template by checking this option.

Note that the actual storing will not be done when checking this box, but when saving the configuration pushing the “READY” button. A popup will be shown which asks you for the desired template name:



Save as template

Please enter a template name:

MySurveyTemplate

Cancel Save

4.3.6 Incomplete/invalid configuration

If the configuration is incomplete or invalid, it is not possible to finalize the configuration and start the trial. The “Ready” button is displayed in grey and cannot be pushed.

In this situation, smatrix indicates which sections / fields need to be reviewed. The respective locations are highlighted in red color and have an additional warning-icon ⚠. You can see this highlighting in several screenshots shown in this document as well.

This highlighting impacts also the parent sections. Thus, you can easily track down from top level where the issues are located. E.g., if a value range was not yet set for a trait, the “Traits” section, the section of the trait column and the drop-down list for the value range are highlighted. Setting the missing field will implicitly remove the highlighting on all levels (if the other configuration is fine):

^ Traits ▲

Traits column range ⓘ
X,B-D

Edit

Please specify value range and trait for each column.

^ Column X ▲

Category
Generic ▼

Trait
Characteristic 1 ▼

Value range ⓘ

^ Traits

Traits column range ⓘ
X,B-D

Edit

Please specify value range and trait for each column.



^ Column X

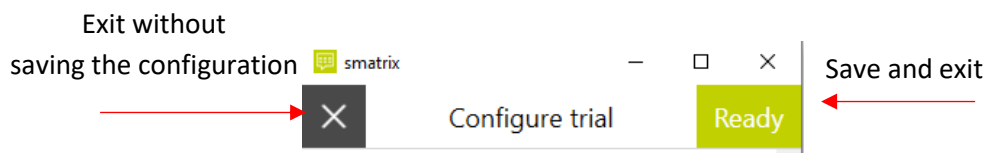
Category
Generic ▼

Trait
Characteristic 1 ▼

Value range ⓘ
1 - 9 ▼

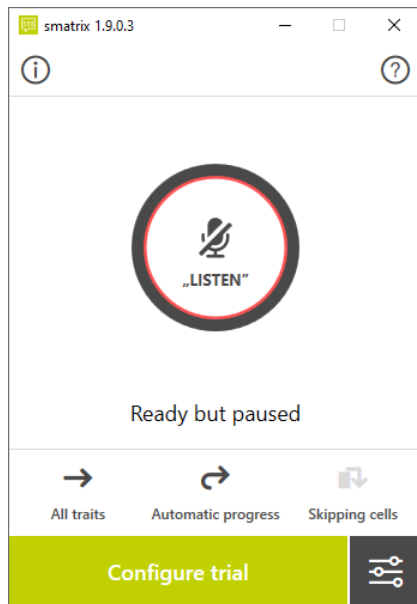
4.3.7 Start the trial

When the configuration is complete the Ready button changes from  to  and is enabled. You can now:



The “Ready” button saves the configuration data and brings you back to the start screen, ready for inputting data.

smatrix is now ready for data input. The configuration can be changed at any moment by using the “Configure trial” button. Also, the settings button is still available for changing application options e.g., audio settings.



4.4 Examples

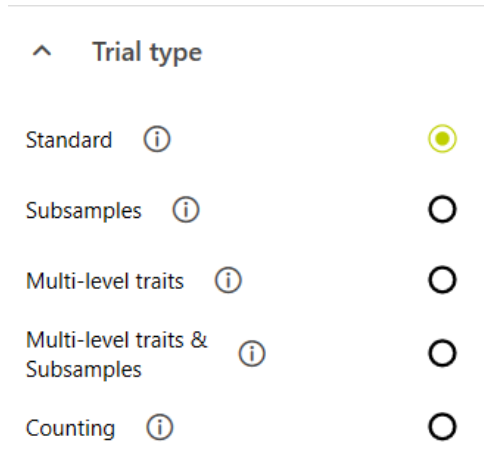
4.4.1 Example: Standard trial

This example demonstrates the configuration of a standard trial using the following Excel sheet:

	A	B	C	D
1	Parcel	Leaf Rust	Phyto	Pest severity
2	1			
3	2			
4	3			
5	4			
6	5			

4.4.1.1 Trial type

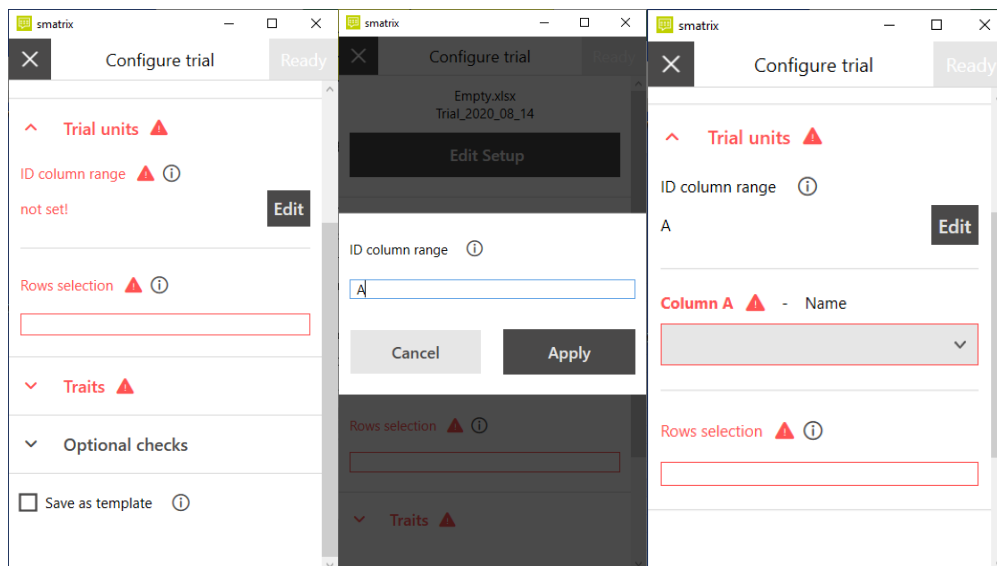
Obviously, the trial type has to be selected as “Standard”

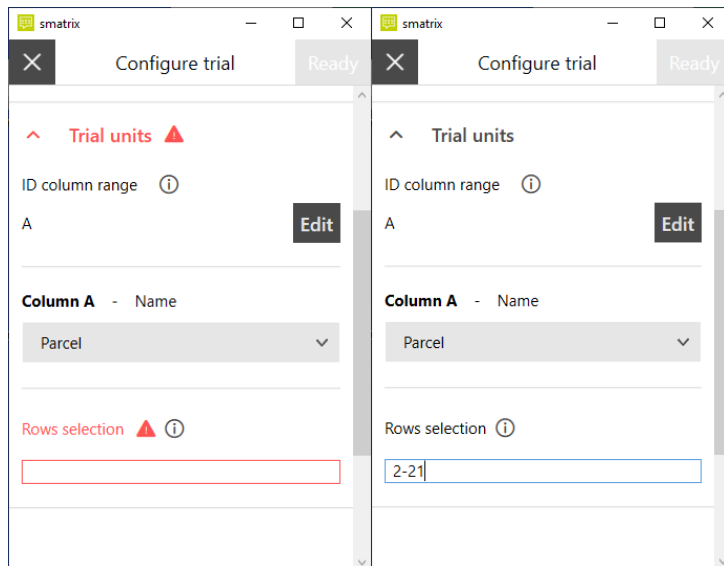


4.4.1.2 Trial units

Opening the second section, the trial units can be configured:

- If “ID column range” is not set (picture1) or wrong, push the “Edit” button. This opens an overlay where you can change the column(s).
- Specify the column that contains the identifiers (here the Parcel numbers) for the rows. In this example, type the column name “A” and confirm with “Apply” (picture2)
- This will bring up an additional field (picture3) asking to define a name for this column.
- Select the name from the drop-down list (picture4) – here “Parcel”
- Finally, we need to specify which Excel rows are trial units (picture5). For details, see 4.3.2.2





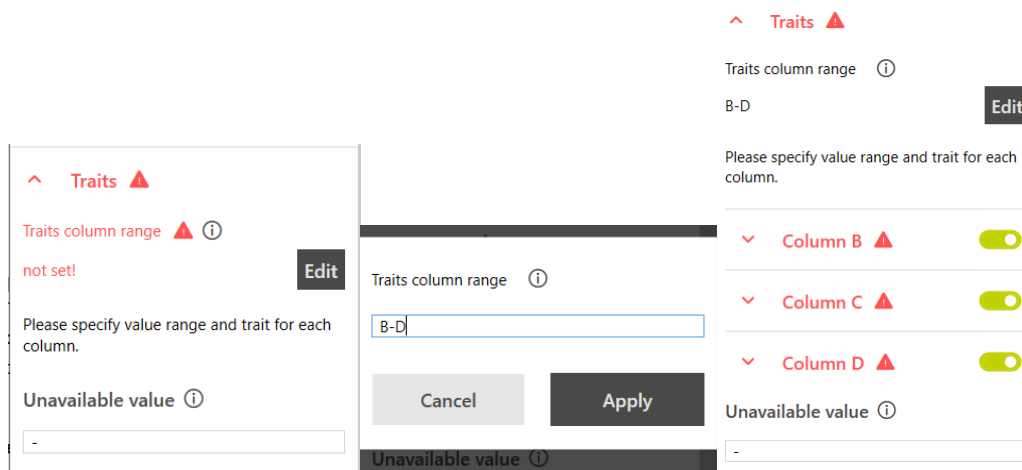
Important: “standard” trials can also use more complex definition of the trial units. Please refer to section 6.3 for details on

- hierarchical naming of trial units
- PIAF identifiers

4.4.1.3 Traits

Next, the traits need to be configured.

- If the “Traits column range” is not set (picture1) or wrong, push the “Edit” button. This opens an overlay (picture2) where you can change the column(s).
- Enter the columns that represent traits – here “B-D” – and push “Apply”
- This will bring up an additional list with one section per trait (picture3).



- Next, each trait needs to be configured. Open one trait after the other and complete the configuration, selecting the following:
 - o Category – This is a way of managing traits in catalogues. Please contact the person responsible of the customization of smatrix within your company or have a look at the expert manual.
 - o Trait – the name of the trait is used for addressing by speech commands.
 - o Value range: Defines what data is valid for this trait. In this example traits allow values from 0 to 100.

Column B	Column C	Column D
Category Example traits	Category Example traits	Category Example traits
Trait Leaf Rust	Trait Phytotoxicity	Trait Pest Severity
Value range ⓘ 0 - 100	Value range ⓘ 0 - 100	Value range ⓘ 0 - 100

Note: Each trait has an associated switch, allowing do deactivate it. The trait is active if the switch is on. This means that this trait will be evaluated when we run the trial. This feature allows you to deactivate certain configured traits for a trial.

- The representation which will be entered in Excel when an 'unavailable' value is specified. Please refer to 5.2.1.3 for the details on the unavailable value. Most users leave this to the default setting.

Unavailable value ⓘ

-

Note: smatrix will enter only values that are defined in the corresponding value range (plus the unavailable value). There is no data validation on data that is already present in the sheet, or that is entered by hand.

4.4.2 Example: Trial with subsamples

This example demonstrates the configuration of a subsample trial using the following Excel sheet:

	A	B	C	D	E	F
1	Subsamples		5	10	5	1
2						
3			Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4
4	Parcel	Sub	0-100	0,0 - 500,0	0-3000	0-100
5	100	1				
6	100	2				
7	100	3				
8	100	4				
9	100	5				
10	100	6				
11	100	7				
12	100	8				
13	100	9				
14	100	10				
15	101	1				
16	101	2				

4.4.2.1 Trial type

The trial type has to be selected as “Subsamples”

^ Trial type

Standard ⓘ ☐

Subsamples ⓘ ☒

Multi-level traits ⓘ ☐

Multi-level traits & Subsamples ⓘ ☐

Counting ⓘ ☐

4.4.2.2 Trial units

If the trial type supports subsamples, multiple values need to be recorded per trait & trial unit combination. To store those additional values, smatrix uses additional Excel rows.

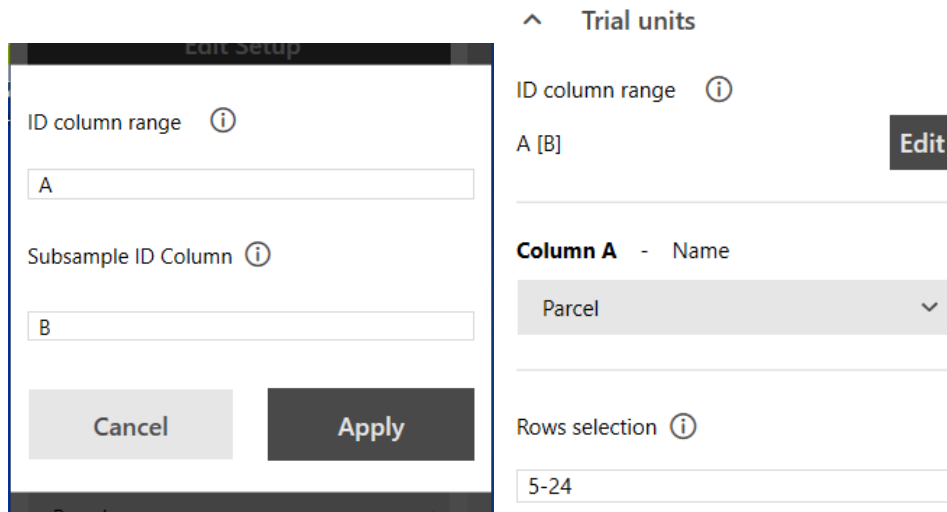
In the given example we have 10 rows for “Parcel 100” and therefore support for up to 10 subsamples (up to 10 values per trait/trial unit combination).

To configure this, an additional field must be set for the “ID column range”

- Push the “Edit” button for the “ID column range”. This opens an overlay where you can change the column(s).
- As for the standard trial, specify the column that contains the identifiers (here the Parcel numbers) for the trial units. In this example, type the column name “A”.
- In “Subsample ID column”, specify the column that contains the identifiers for the subsamples. In our example “B”

Note: It is possible that one ID column contains both: the identifier for the trial units and the subsamples, separated by space. For that case you would have to specify “A” in both fields!

- confirm with “Apply”
- The remaining trial unit configuration is identical to the standard trial configuration.

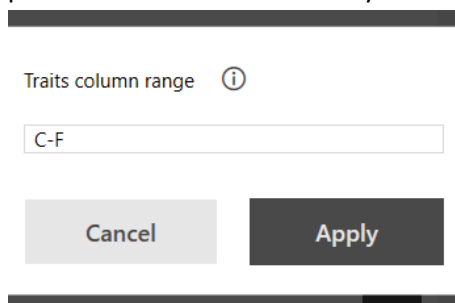


The screenshot shows the 'Edit Setup' dialog for 'Trial units'. It has two main sections. The left section, titled 'Edit Setup', contains 'ID column range' with a value of 'A' and 'Subsample ID Column' with a value of 'B'. It has 'Cancel' and 'Apply' buttons at the bottom. The right section, titled 'Trial units', contains 'ID column range' with a value of 'A [B]' and an 'Edit' button. Below that is 'Column A' with a dropdown menu showing 'Parcel'. At the bottom is 'Rows selection' with a value of '5-24'.

4.4.2.3 Traits

The sheet is now set up to support up to 10 subsamples. However, not all traits require the same number of subsamples. Therefore, the actual number of subsamples is to be configured per trait.

- First, the columns are configured. In this example, we have 4 traits to be evaluated for each parcel: Characteristic 1-4. They are contained in columns “C-F”



The screenshot shows a dialog box for 'Traits column range'. It has a text input field with the value 'C-F' and 'Cancel' and 'Apply' buttons at the bottom.

- For each trait, two additional fields show up in the configuration: “Subsample Count” and “Subsample Group”.
 - o The “Subsample Count” is straight forward. Characteristic 1 and 3 are evaluated by taking 5 subsamples, characteristic 2 requires 10 subsamples and characteristic 4 only 1.
 - o The “Subsample Group” is optional and only impacts the order in which the subsamples will be collected. Here we leave it empty. Details on subsample groups can be found in 5.3.1.

- Find the example configuration for column C below. Other columns are configured in the same way.

^ Column C ☒

Category
Generic ▼

Trait
Characteristic 1 ▼

Value range ⓘ
0 - 100 ▼

Subsample Group
▼

Subsample Count
5

4.4.3 Example: Trial with multi-level traits

For some trials it is desired to define a column as a combined (“multi-level”) trait. You have several columns that all intend to measure the same trait e.g., “Leaf Rust”, but on different leaf levels.

	A	B	C	D	E
1		Leaf Rust	Leaf Rust	Leaf Rust	
2	Plot	F-1	F-2	F-3	Phyto
3	1				
4	2				
5	3				
6	4				
7	5				

4.4.3.1 Trial type

To allow such configuration, the trial type “Multi-level traits” needs to be chosen:

^ Trial type

- Standard ⓘ ☐
- Subsamples ⓘ ☐
- Multi-level traits ⓘ ☒
- Multi-level traits & Subsamples ⓘ ☐
- Counting ⓘ ☐

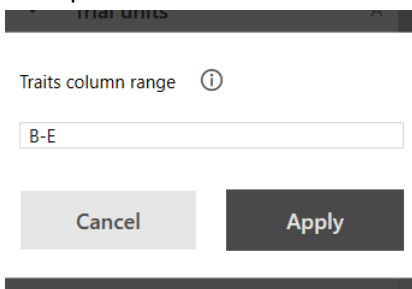
Note that the autoconfiguration can detect this as well, but if it was not detected you can change the type manually.

4.4.3.2 Trial units

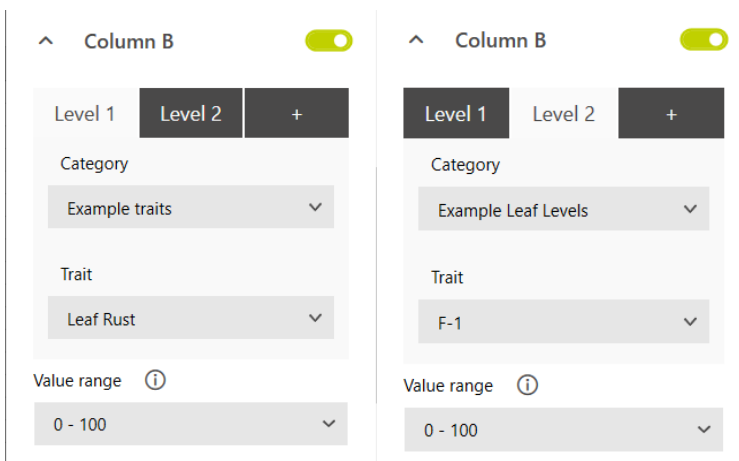
The trial units are configured identical to a standard trial => see 4.4.1.2

4.4.3.3 Traits

- The configuration for the “Traits column range” is identical to the standard trial. In our example columns “B-E”



- Each column can now be defined in up to three levels. In the above example, “Leaf Rust” is the highest level for columns B-D.
- To configure the leaf level, you can switch to the tab “Level 2” and select the corresponding leaf level.



- Repeat the same for columns C and D

- Column E is a trait that has only one level. Configure “Level 1” like a standard trial and ignore further levels

Column E 🔴

Level 1 +

Category

Example traits ▼

Trait

Phytotoxicity ▼

Value range ⓘ

0 - 100 ▼

Note that the value range is independent of the currently shown level. Modifying it will change it for the column.

If autoconfiguration did not detect the correct number of levels (maximum 3), you can also add another level using the “+” tab or remove a level by selecting the “delete” option in the drop-down menu of the category. This deletes the currently active tab (here “Level 2”) and all levels below it.

Column B 🔴

Level 1 Level 2 +

Category

Example Leaf Levels ▼

Delete level

Example Leaf Levels

Example traits

Generic

Predefined

Note on navigation:

The navigation can now be used in a hierarchical manor like the identifiers. If succeeding columns have the same trait chosen on “Level 1”, only the name of “Level 2” can be used to navigate between them. Using the above example, the speech command “Leaf level F-2” will navigate as follows:

- If current column is B or D, it navigates to C
- If current column is H, this command is invalid as there is no column with “Phytotoxicity” and “Leaf level F-2”. The speech command is rejected, and the current cell remains the same.

It is possible to say the name of highest level of any multi-level trait. If this is not unique, it will navigate to the first column that has the matching name in “Level 1”. The command “Leaf Rust” navigates as follows:

- If current column is F it navigates to E (first column with Leaf Rust)
- If current column is B, C or D it is ignored (already in Leaf Rust)

You can also concatenate the names of the levels to address a column in a unique way. The command “Leaf Rust, Leaf level F-2” always navigates to column C.

4.4.4 Example: Trial with multi-level traits and subsamples

This rarely used trial type allows a combination of the two previously described types – Subsamples and multi-level traits.

	A	B	C	D	E	F
1			Leaf Rust	Leaf Rust	Leaf Rust	
2	Plot	Sub	F-1	F-2	F-3	Phyto
3	1	1				
4	1	2				
5	1	3				
6	1	4				
7	2	1				
8	2	2				
9	2	3				
10	2	4				

4.4.4.1 Trial type

^ Trial type

- Standard ⓘ ☐
- Subsamples ⓘ ☐
- Multi-level traits ⓘ ☐
- Multi-level traits & Subsamples ⓘ ☒
- Counting ⓘ ☐

4.4.4.2 Trial units

The trial units are defined as for Subsample trials – see 4.4.2.2

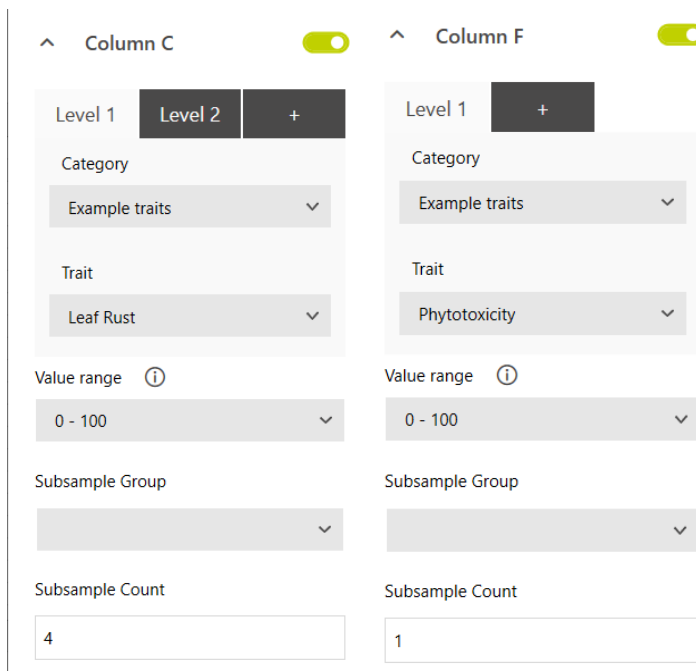
4.4.4.3 Traits

The configuration for each column has now all fields to define:

- The configuration on subsamples (subsample count & subsample group) - see 4.4.2.3
- The configuration of multi-level traits - see 4.4.3.3

Note: Even for such trials, you can define “standard” traits – in our example column F

- Using only “level 1”, setting category and trait as for a standard trial
- Setting value range as for a standard trial
- Leaving subsample group empty
- Setting “Subsample count” to 1



Column C	Column F
Level 1 Level 2 +	Level 1 +
Category: Example traits	Category: Example traits
Trait: Leaf Rust	Trait: Phytotoxicity
Value range: 0 - 100	Value range: 0 - 100
Subsample Group:	Subsample Group:
Subsample Count: 4	Subsample Count: 1

4.4.5 Example: Counting

Consider the following use case: One wants to evaluate the wireworm damage of potatoes. From each identified lot of potatoes, a number (100 e.g.) of potatoes are randomly selected. For each potato, the number of wireworm holes is counted and recorded.

We are interested in a classification rather than individual subsample values. The “classes” we want to use are:

- 0
- 1 or 2
- 3 to 5
- more than 5

Upon entering a value, smatrix increments the count of that class, to which the value belongs. The actual values are not stored. In the Excel sheet, one column is assigned to each “class” (corresponding to traits in other trial types).

	A	B	C	D	E	F
1	#Subsamples	100	100	100	100	
2		Wireworm damage				
3	Plot	class A	class B	class C	class D	Total
4		0	1-2	3-5	> 5	
5	1	33	26	26	15	100
6	2	22	24	28	26	100
7	3					0
8	4					0
9	5					0
10	6					0

When judging a potato, the surveyor will say e.g., the exact number of damages. The count of the class, which contains this value will then be incremented.

Note: Using customization of smatrix, you can also use value ranges that support class names instead of number ranges.

4.4.5.1 Trial type

The required trial type is “Counting”:

^ Trial type

- Standard ⓘ ☐
- Subsamples ⓘ ☐
- Multi-level traits ⓘ ☐
- Multi-level traits & Subsamples ⓘ ☐
- Counting ⓘ ☒

4.4.5.2 Trial units

The configuration of the trial units is identical to the standard trial in 4.4.1.2.

4.4.5.3 Traits

- For counting trials, each trait/column is representing a “counting class”. In our example we have 4 different classes we want to differentiate, located in columns B-E:

^ Traits

Traits column range ⓘ

B-E

Edit

- Then each column needs to be configured:
 - As trait names are not required for this type of trial, we can choose

- Category “Predefined”
- Trait “Use Excel column name”
- Value range: This is used for the classification. When entering a value, smatrix checks which column has a value range containing that value. When found, it will increment the count of that column.

In our example we use

- Column B “no damage”
- Column C “1 to 2”
- Column B “3-5”
- Column B “more than 5”

Important: The chosen value ranges may not overlap! Otherwise, classes would be ambiguous leading to unpredictable behavior.

- Subsample group: The same subsample group needs to be chosen in all traits! We choose “Wireworm #Holes” for this example
- Subsample count: This is the number of subsamples we want to evaluate per Parcel – in our example this is 100

^ Column B ☒

Category

Predefined

Trait

Use Excel column name

Value range ⓘ

no damage

Subsample Group

Wireworm #Holes

Subsample Count

100

Notes:

- Creation of custom subsample groups and value ranges are described in the expert manual.
- Entering data into counting trials is handled differently compared to other types of trials. Please refer to section 5.2.4 to see some examples.
- Some speech commands are not supported for counting trials (like the progress settings) due to the different nature of this trial.

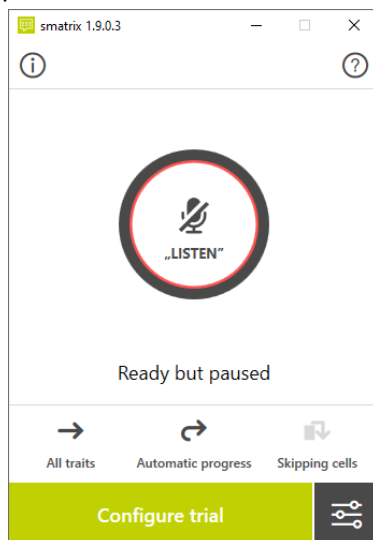
5 Trial execution

5.1 Listening <-> Paused

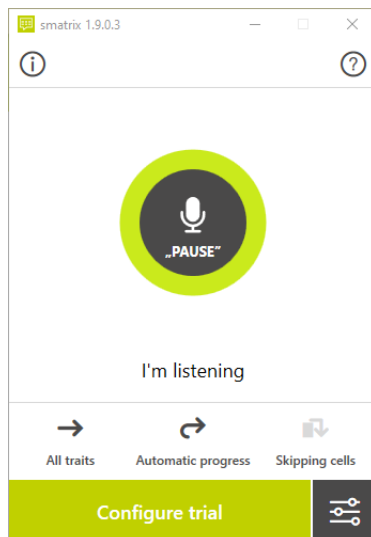
smatrix has two states once a trial is configured: Paused and Listening.

You can change from on state to the other, either by pushing the microphone button or by speaking the respective speech command.

- Paused: The application does not accept any speech commands until the user says “Listen” or pushes the “Listen” button.



- **Listening:** The application accepts all speech commands described in the next section. If you want to talk someone other than smatrix, we recommend changing to the Paused state to avoid unintended value entry. Say “Pause” to enter the paused status or push the “Pause” button.



5.2 Speech commands

5.2.1 Entering data

To enter data, it is important to know what the value range of the current trait allows. Depending on that value range, the user can enter numbers (within a certain range), dates, words, or the “unavailable” value. The following sections give an overview on how to pronounce each of these types of data.

5.2.1.1 Numbers

Numbers can be pronounced as natural numbers or digit by digit. As **general rule**, you can use:

- Before the decimal point: natural pronunciation or digit by digit
- After the decimal point: ALWAYS digit by digit

Examples:

105 = one hundred and five OR one zero five

25,7 = twenty-five point seven OR two five point seven

0,23 = zero point two three NOT zero point twenty-three

5.2.1.2 Dates

Dates can be entered by reference, specifying day and month, or specifying day, month, and year.

Examples:

referenced date = Today, tomorrow, yesterday, day before yesterday, day after tomorrow

the 20th of January of the current year = The 20th of January

the 20th of January of the year 2018 = The 20th of January 2018

5.2.1.3 ‘Unavailable’ value

A cell containing the ‘unavailable’ value will be considered by smatrix as deliberately left open. This value is supported for all traits, independent of the chosen value range. Therefore, you can always enter this value by saying ‘unavailable’.

Note that the representation of this value (i.e., the value that will be written into the Excel sheet), is stored in the configuration file of each sheet. You can modify the representation in the “Traits” section of the trial configuration – see 4.4.1.3

5.2.1.4 Words

If a value range supports words, smatrix makes a guess on the pronunciation. The pronunciation might be different from what you expect, especially if you are using abbreviations or codes that are no regular words. For such cases, alternative pronunciations can be defined in the customization files of smatrix (see expert manual).

5.2.2 Entering multiple values

smatrix supports a command that is the equivalent of entering several times the same value.

“1...99 times **value**”

The next 1...99 cells in the evaluation order are filled with the same **value**. This command is the equivalent of repeatedly entering the same **value**. Data entry stops:

- If the **value** is not valid for a cell OR
- At the end of the row-range

Important: If the “skipping cells” option is on, only empty cells will receive a value. Otherwise, this command **may overwrite existing values!**

Examples:

“ten times five” => The next 10 cells in the evaluation order are filled with the value 5.

“five times ‘unavailable’” => The next 5 cells will receive the ‘unavailable’ value.

5.2.3 Filling empty cells

This command is used to fill **empty** cells (skipped, left-over). This command will **never** overwrite existing values!

There are 3 variants of the fill command:

- “fill with **value**”
Example: “fill with **5**” => The current cell (if empty) is filled with 5. If the current trait has subsamples configured, all empty subsample-cells for the current trial unit + trait are filled with the value 5.
- “fill **id-level** with **value**”
Example “fill **parcel** with ‘unavailable’” => All cells (all subsamples, all traits) for the current parcel are set to ‘unavailable’.
Note: The only values that can be used to fill an id-level are 0, 100 and the ‘unavailable’ value. Only cells for which the value is valid are filled. The ‘unavailable’ value is valid for all.
- “fill **trait-name** with **value**”
Example: “fill **black rust** with **12**” => All empty cells (all subsamples, all trial units) for this trait are filled with the value 12

If more than one cell will be filled, smatrix will ask for an extra confirmation.

- If you answer with “yes”, the filling will be executed
- If you answer with “no”, the operation will be cancelled

5.2.4 Enter data for counting trials

In counting trials, the individual numbers are not written to the sheet, but occurrences are counted. Consider the following utterances and their impact on the recorded data:

Examples:

“2” => The value (‘2’) belongs to a value range of exactly one class. The value in the associated column will be incremented by 1.

“10 times ‘class A’” => Is the same as saying 10 times ‘class A’. The value in the associated column will be incremented by the amount given (10 in this example).

“fill with ‘no damage’” => The value in the associated column will be incremented by the amount needed to complete the number of subsamples. E.g., if you have 100 subsamples to collect, and 77 subsamples were already collected (accumulated across all classes), the count of the class ‘no damage’ is incremented by 23.

5.2.5 Correction

When you detect that a value was wrongly entered you can correct the value using a speech command.

- If **automatic progress** is off, correction is done by repeating the correct value before navigating to another cell.
- If **automatic progress** is on, the cursor has already moved on when the user hears the mistaken data entry. The ‘correction’ prefix will make the cursor backtrack to the previous cell, then correct the value and move forward again.

Example with automatic progress on:

“twenty-four” => the number 24 is added, the next cell is selected

“correction, twenty-five” => the previous cell is selected, the value 25 overwrites the previous value 24, and automatic progress moves forward again.

Note the above “correction, twenty-five” can be done also in two steps:

“correction” => moves back to the cell where the previous value was entered

“twenty-five” => overwrites the 24 by 25 and moves forward according to automatic progress.

5.2.6 Clearing cells

These commands are used to erase cells. There are 3 variants of the clear command:

- “clear”
The current cell is erased. If the current trait has subsamples configured, all subsample-cells for the current trial unit / trait combination are erased.

- “clear **id-level**”
Example “clear **parcel**” => All cells (all subsamples, all traits) for the current parcel are erased.
- “clear **trait-name**”
Example: “clear **black rust**” => All cells (all subsamples, all trial units) for this trait are erased.

If more than one cell will be erased, an extra confirmation will be asked by smatrix.

5.2.7 Undo and Redo

When you realize that your last command was a mistake, you can use the ‘undo’ command to go back in time. ‘redo’ repeats the action of the last undone command.

Important: This only applies to commands that enter, fill or clear data. The undo/redo commands do not support reverting settings or navigation commands.

Note: The undo/redo operation remembers up to 100 commands.

Example (all traits, skip cells off), starting in the first picture.

	A	B	C	D		A	B	C	D
1	Parcel	Leaf Rust	Phyto	Pest severity	1	Parcel	Leaf Rust	Phyto	Pest severity
2	1		1	3	2	1	5	5	5
3	2		2		3	2	5	5	5
4	3				4	3	5	5	5
5	4				5	4	5		

- “ten times five” => system asks for confirmation
- “yes” => 10 times the value 5 is written according to the progress settings. Here, it overwrote other data (second picture)
- “undo” => the command reverts the last operation. All previous values are restored. We are back in the state shown in the first picture.
- “redo” => brings back what the last “undo” operation reverted (we are back in the second picture)

5.2.8 Navigating

Speech commands can also be used to navigate within the trial:

- Using the progress settings as described in section 5.3.2 (implicitly or by command)
- Using absolute or relative commands to change the trait, trial unit or subsample.

Examples:

- “parcel one hundred and four”
The cursor is advanced to the **first** row with parcel number (ending in) 104.
- “next parcel”
The cursor is advanced to the first row with a different parcel number than the current one.
- “next parcel 4”
The cursor is advanced to the **next** row with a parcel number ending in 4.
- “next subsample”
The cursor is advanced to the next subsample for the current trait.
- “characteristic 1”
The cursor is positioned in the column corresponding to “characteristic 1”.
- “subsample 19”
The cursor is moved to subsample 19 for the current trait.
- “parcel 10 characteristic 1”
The cursor is moved to the first row with a parcel number 10 and positioned in the column corresponding to “characteristic 1”.

5.2.9 Speech dialog settings

The following settings change the dialog between you and smatrix. It impacts the point in time you can speak, and the feedback smatrix provides via speech synthesis.

- “barge-in on / off”
When barge-in is on, the user can interrupt a spoken message by giving the next speech command. If barge-in is off, the user must wait until the message is read before starting to talk.
- “louder / softer / faster / slower”
Changes the loudness or the speed of the speech synthesis.
- “repeat”
Repeats the last read message.
- “echo on / off”
Switches the echoing of the understood values on or off.
- “position feedback on / off”
When position feedback is on, the system prompts the user with a message describing the current cell (e.g., parcel, subsample). When switched off, a short beep is used to indicate that the user can speak.

Note: If position feedback is off, additional prompts will be played when collecting subsamples. The “subsample countdown” is played when there is a multiple of 10 subsamples, 5 subsamples or one subsample left to be filled.

5.2.10 Always on Top

When always on top is on, the smatrix window will position itself always in front of other windows, hence always remaining visible. This setting can be changed using the speech commands “always on top on / off”.

5.2.11 Inserting a new column

If you require an additional column/trait for an already configured trial, you have the following options:

- If it is sufficient to add the column at the end of the currently defined range in Excel:
 - push the “configure trial” button to go back to the trial configuration
 - open the “trial units” section
 - “Edit” the ID column range by adding another column
 - configure the new column choosing the trait and value range
 - push the “ready”-button to store the changes and start the trial execution.
- If you need to add new column(s) in between already configured columns, the above approach is not possible. The reason for this is that the configuration of existing columns needs to be shifted to another location. To allow for that use case we have 3 different voice commands you can use while executing a trial:
 - “insert column after ‘yellow rust’”
This command inserts a new column in the excel sheet after the column associated with trait ‘yellow rust’. The speech recognition stops and smatrix changes back to the configuration screen. You need to configure the new column with a trait and a value range. When you are done, press the “Ready” button to complete the configuration.
 - “insert ‘black rust’ before ‘yellow rust’”
This command inserts a new column in the excel sheet after the column associated with trait ‘yellow rust’. The speech recognition stops and smatrix changes back to the configuration screen. The new column is configured with the trait ‘black rust’. You need to finalize the configuration, choosing the value range and pressing the “Ready” button.
 - “insert ‘black rust’ with levels before ‘yellow rust’”
This command is only valid when using multi-level traits. It inserts multiple columns that have same levels as the mentioned ‘yellow rust’, just with ‘black rust’.

Example: Consider the picture below, where two adjacent columns (D and E) have ‘yellow rust’ on level 1. For level 2, column D uses “level F” and column E uses “level F-1”.

	A	B	C	D	E
1	Plot	Symptom 1	Symptom 2	Yellow Rust	Yellow Rust
2	Plot			Leaf level F	Leaf level F-1
3	1				
4	2				
5	3				
6	4				
7	5				

The above command would not introduce one but rather two new columns (D and E) with ‘black rust’ on level 1. For level 2, column D uses “level F” and column E uses “level F-1”.

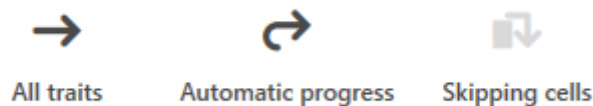
	A	B	C	D	E	F	G
1	Plot	Symptom 1	Symptom 2	Black Rust	Black Rust	Yellow Rust	Yellow Rust
2	Plot			Leaf level F	Leaf level F-1	Leaf level F	Leaf level F-1
3	1						
4	2						
5	3						
6	4						
7	5						

Everything else is like the above command without “with levels”. The speech recognition stops and smatrix changes back to the configuration screen. You need to finalize the configuration and press the “Ready” button.

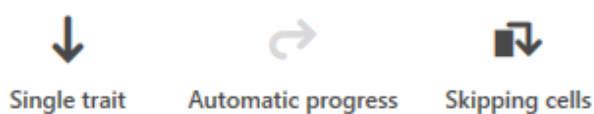
Important: Adding columns by name is only supported for traits that are defined in the customization files! Traits that are not defined there cannot be recognized by smatrix. Refer to the expert manual for information about customization.

5.3 Progress logic

smatrix has a built-in progress logic that impacts in which order cells are selected. The following settings can be used to modify this order. This can be done using the buttons in toolbar, or by the corresponding speech commands.



With inverse settings the toolbar looks like this:



5.3.1 Single trait / All traits

smatrix supports two types of progress: **single trait** and **all traits**.

- If the trial does not support subsamples, the two types correspond to vertical and horizontal progress in the Excel sheet

8	008	Ass-Code:	A1	A1
9	009	Date:		
10	009	Plot (Sub)		
11	4	101		
12	10	102		
13	7	103		
14	5	104		
15		105		

- In **single trait mode**, the next cell is always in the same column. The cursor skips to the next row. An explicit navigation command is needed to switch between columns.
- In **all traits mode**, the next cell is the one in the same row but in the next column. When the last column has been reached, the cursor skips to the next row.

- If the trial supports subsamples, all subsamples of a trial unit / trait combination are filled

9	009	ZeitpCod.:	A3	A3
10	009	Plot (Sub)		
11	6	101 1		
12	6	101 2		
13	6	101 3		
14	6	101 4		
15	6	101 5		
16	1	102 1		
17	1	102 2		
18	1	102 3		
19	1	102 4		
20	1	102 5		
21	7	103 1		
22	7	103 2		
23	7	103 3		
24	7	103 4		
25	7	103 5		

- **Single trait mode** works as before.
- In **all traits mode**, the next cell is the next subsample for the current trait. When all subsamples are evaluated, the next cell is the first subsample of the next trait. When all traits are evaluated, the next cell is the first subsample of the first trait of the next trial unit.

- If the trial supports subsamples and subsample groups are used:

9	009	ZeitpCod.:	A3	A3	A3
10	009	Plot (Sub)			
11	6	101 1			
12	6	101 2			
13	6	101 3			
14	6	101 4			
15	6	101 5			
16	1	102 1			
17	1	102 2			
18	1	102 3			
19	1	102 4			
20	1	102 5			
21	7	103 1			
22	7	103 2			
23	7	103 3			
24	7	103 4			
25	7	103 5			

- **Single trait mode** works as before.
- In **all traits mode**, the logic is the same except that the group is treated as one single trait. Thus, subsamples of traits within a group are collected alternating. The shown example has the first two columns in the same group and the third column is in another group (or none at all).

Note: Traits within the same subsample group always have the same number of subsamples.

5.3.2 Automatic Progress

- If **automatic progress** is off, the cursor remains in the same cell until an explicit navigation command is given. Successive value-commands will overwrite the value in the current cell.

- If **automatic progress** is on, the cursor automatically moves to the next cell after a value was entered. Note that navigation commands can also be used in this mode.

This setting can be changed with the speech commands “automatic progress on / off” or via the corresponding button in the toolbar.

Examples:

	A	B	C
1	Parcel	Leaf Rust	Phyto
2	1		
3	2		
4	3		
5	4		

Given the Excel sheet on the left, this example shows the impact of the same command sequence with automatic progress off (left) and automatic progress on (right).

Note: single trait progress is used

Automatic progress off	Automatic progress on																																																
"14"																																																	
Writes to 14 to the current cell.	Writes 14 to the current cell and moves the cursor to the next cell.																																																
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4	3																																																
5	4																																																

5.3.3 Skipping Cells

The last setting for the progress instructs smatrix if already filled cells can be skipped.

- If **skipping cells** is on, smatrix will jump over already filled cells
- If **skipping cells** is off, smatrix will also select cells that are already filled

You can switch between the two modes with a voice command “skipping cells on” / “skipping cells off” or by pressing the corresponding button in the toolbar.

Note: The “skipping cells” setting impacts the progress (by automatic progress or “next” command) as well as the commands for entering multiple values at once, see 5.2.2.

5.3.4 Special case “all traits per id-level”

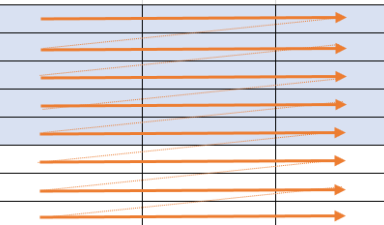
In addition to the above settings, a speech command is available for a special variation of progress.

Regular “all traits” progress selects the next cell the same row or the next row if the last column was reached. The speech command “all traits per **id-level**”, changes the progress to handle one trait for all samples within the same **id-level** before moving to the next trait or the following sample with a different id at the given level. (similar as for subsampling).

Example:

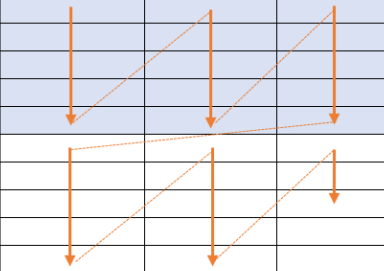
In the example, all traits for a plant are evaluated before moving to the next plant. This command is equivalent to ‘multiple traits per **plant**’.

	A	B	C	D	E	F
1						
2				Yellow Rust	Brown Rust	Black Rust
3	Treatment	Tray	Plant			
4	1	100	1			
5			2			
6			3			
7			4			
8			5			
9	2	101	1			
10			2			
11			3			
12			4			
13			5			
14	3	102	1			
15			2			



The command “multiple traits per **tray**” changes the progress to evaluate all plants in the same tray are for each trait before moving to the next tray.

	A	B	C	D	E	F
1						
2				Yellow Rust	Brown Rust	Black Rust
3	Treatment	Tray	Plant			
4	1	100	1			
5			2			
6			3			
7			4			
8			5			
9	2	101	1			
10			2			
11			3			
12			4			
13			5			
14	3	102	1			
15			2			


5.4 Saving and exiting

During the execution of a trial, values are entered in the Excel workbook by smatrix. However, these changes are **not** saved to the Excel file after every value entry, but only when smatrix closes the workbook. The following speech commands are available for saving/exiting differently from this default behavior.

- “save workbook”
The workbook is saved to the Excel file and smatrix continues executing the trial.
- “close workbook”
The workbook is saved to the Excel file and then closed. smatrix goes back to its initial state, where no trial is configured.
- “without saving close workbook”
Attention: The workbook is closed without saving. All values that have been entered (since the last save operation) will be lost! smatrix goes back to its initial state, where no trial is configured.
Note: This ‘awkward’ wording sequence is chosen to avoid inadvertent saving when saying “close workbook without saving” with a small pause between “save workbook” and “without saving”.

6 Appendix

6.1 Profiles

User-defined profiles are not supported in smatrix 1.9 and higher, because training of the recognition engine is not required anymore. Instead, a default profile stores the user settings, hidden from the UI.

Note: Different windows users automatically use different default profiles and therefor have their settings independent from other users.

6.2 Valid identifiers and how to pronounce them

During a smatrix trial, the surveyor enters data describing the characteristics (trait) of particular objects (plant, parcel, pot, ...). Each object is identified by a single or a combination of multiple identifiers, e.g.: a unique parcel number, row, and position-in-row numbers for a pot in a glasshouse.

For smatrix, a valid identifier is either:

- A **single** letter **A-Z**
- Or a sequence of characters **ending** with a **sequence of digits with an optional letter suffix**. In this case only the last 6 digits and optional suffix are meaningful for smatrix.
- Or one of the above followed by a **single space** and a subsample number.

The following table shows some identifiers and the relevant meaningful part.

Identifier	Meaningful	Comment
3546789	546789	Only last 6 digits
3546789D	546789D	Only last 6 digits + suffix
3546-789D	789D	Digit sequence starts after last non-digit
3546-A		Not valid
G	G	Single letter identifier
G 1	G 1	Single letter identifier + subsample number
X235 1009	235 1009	Digit sequence starts after last non-digit + subsample number

Identifiers can be pronounced as follows:

Identifier	Identifier Pronunciation	Subsample Pronunciation
100	one hundred	N/A
100	one zero zero	N/A
105A	one hundred and five A	N/A
105A	one zero five A	N/A
20 1	twenty	one
2452456 6	Four five two four five six	six
2452456 23	Four hundred fifty-two thousand four hundred fifty-six	twenty-three OR two three
ABC45- 5	five	N/A

Note: When pronouncing less than the meaningful digits, smatrix looks for the first object with a number ending in those digits.

6.3 Advanced “trial unit” definitions

6.3.1 Hierarchical identifiers

When multiple identifiers are mapped, the sequence of mappings represents a hierarchy.

The mapping “A (field), B (parcel in field), C (plant in parcel)” represents the concept that a field identified by a value in column A **contains** a number of parcels, each identified by a value in column B. Each parcel **contains** plants identified by values in column C.

The mapping “B (parcel), A (field in parcel), C (plant in field)” would assume that parcels contain fields which contain plants.

This hierarchical meaning has an effect on the navigation commands.

Given the first mapping, the command: “plant 5” will navigate to the plant with id-value **equal to 5 in the current** field & parcel. The command “parcel 3” will navigate to the first plant in the parcel with id-value **equal to 3** in the current field. All the other parcels with the same id-value in other fields are not considered.

The commands “next/previous plant 5” disregard the hierarchy and search **from the current sample on forwards/backwards** for one with a plant id-value **ending in ‘5’**.

6.3.2 Identifier Groups (a.k.a. PIAF id’s)

An identifier group is a single column that contains several hierarchically structured ids. Let us assume that column A contains *field-no/parcel-no/plant-no* values e.g., “123/7/10” for field 123, parcel 7, plant 10. In the id specification, one would write this a “A/3” where 3 denotes the number of parts in each id-value. The separator is always ‘/’. Each part will have to be mapped to a name. The parts are noted as “A”, “/A” and “//A” for 1st, 2nd, and 3rd part.

Column A	-	Name
Treatment,TRT		
Column /A	-	Name
Repetition		
Column //A	-	Name
Parcel		



A unique feature of identifier groups is the following:

You can say: “parcel 123 7” or “plant 123 7 10” to directly navigate to a particular parcel or plant. Note that the numbers in this command **must be** spoken as **natural numbers**! Digit-by-digit pronunciation cannot be supported as this would introduce ambiguities (e.g., “parcel 1 2 3” could be field 12, parcel 3 or field 1 parcel 23).