BORIS user guide

v. 9.5

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1. User guide of BORIS the Behavioral Observation Research Interactive Software

BORIS is a user-friendly software designed for event logging during video/audio coding and live observations. It is a free and open-source application that can be used on GNU/Linux and Windows operating systems.

The official BORIS web site is **https://www.boris.unito.it**.

This user guide is applicable to the version **9.5** of BORIS.

A PDF version of this user guide is available.

2. User guide

2.1 Installation

BORIS can be installed following the instructions on the download section of the BORIS web site

All previous versions of BORIS are available in the Releases section of the GitHub repository.

2.1.1 Linux

BORIS can run on various Linux distributions including Ubuntu, Debian, Raspberry Pi OS, Chromebook ...).

See the BORIS for Linux page to install BORIS for Linux.

2.1.2 Microsoft-Windows

See the BORIS for Microsoft-Windows page to install BORIS for Windows.

Two versions are available: BORIS Portable and BORIS Setup

2.1.3 MacOS

As I have no access to a physical Mac computer the v.8 is not natively able to run under MacOS at the moment.

Otherwise there are various other possibilities to run BORIS v. 8 on a Mac. See BORIS on MacOS

2.2 Starting BORIS

Once BORIS is installed, it can be launched by clicking on its icon.

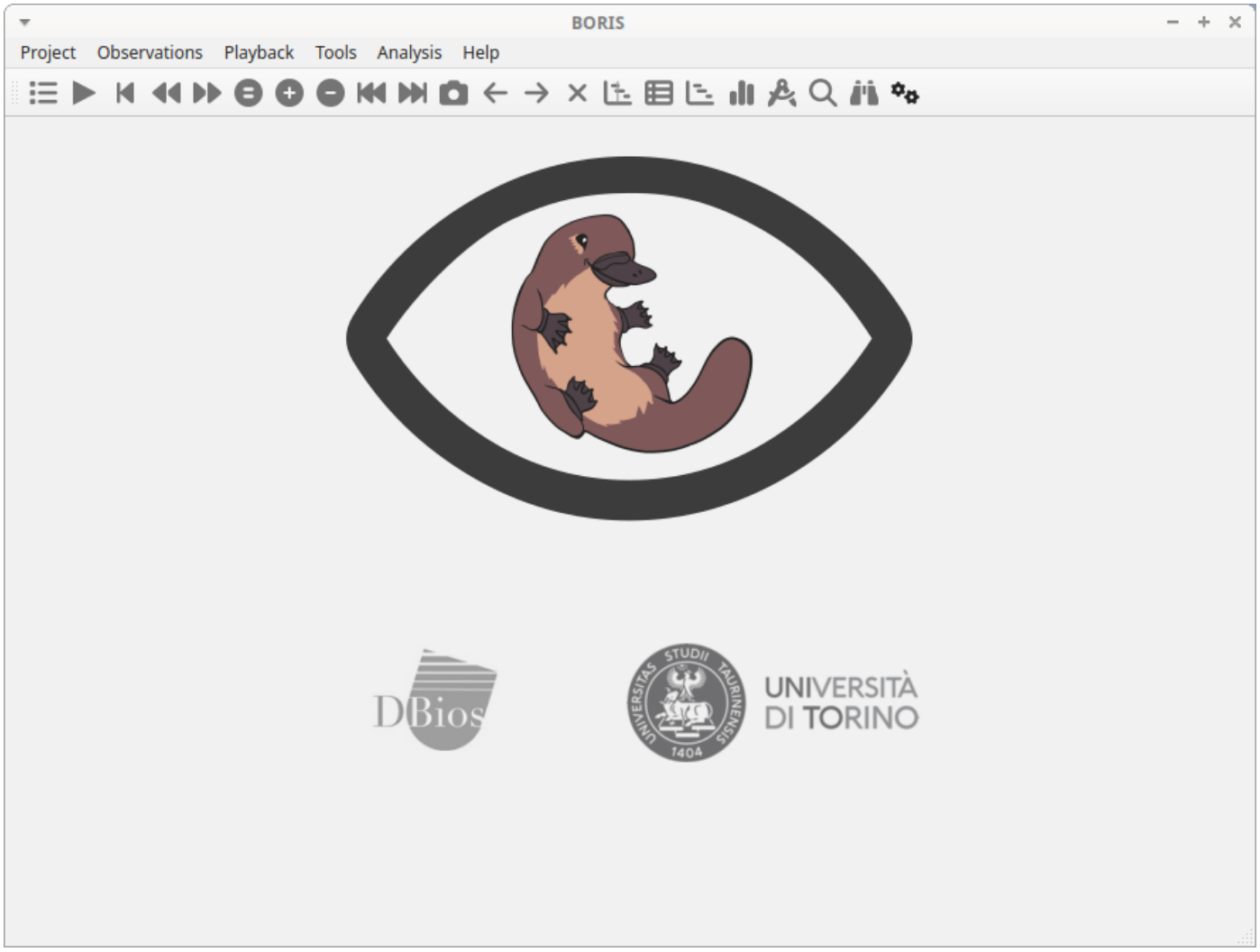
Warning for Windows users

BORIS does not yet use signed binaries which means that you will need to allow the execution of the downloaded executable. If there is no obvious way to do so, click on "More info" on the error message that shows up and then on "Run anyway".

First launch

The initial launch of BORIS may take some time to display. Please be patient!

The main window of BORIS will appear. Currently, all commands on the toolbar are disabled, except for the Preferences button.



The BORIS main window

If you want to launch BORIS from the source code, refer to the Run BORIS from source code section.

2.3 Create a project

The BORIS project file serves as a container for all project-related information, excluding media files. It encompasses the **ethogram**, **independent variables**, **subjects' definition**, **behavioral coding maps**, **converters**, and **observation** data. To save the project on your local file system, use the "**File**" > **Save Project** or **Save Project As ...** options.

Additionally, you can activate the automatic backup feature in the Preferences section.

> ⚠ **very important**
>
> It is **EXTREMELY IMPORTANT** to perform regular backups of your project files to prevent the loss of data. While software can be reinstalled, your data might be irretrievably lost. Consider using an external drive and/or a cloud service for secure backup.

BORIS allows the creation of an unlimited number of projects, but only one project can be opened at a time.

A video tutorial about creating a project is available at this link.

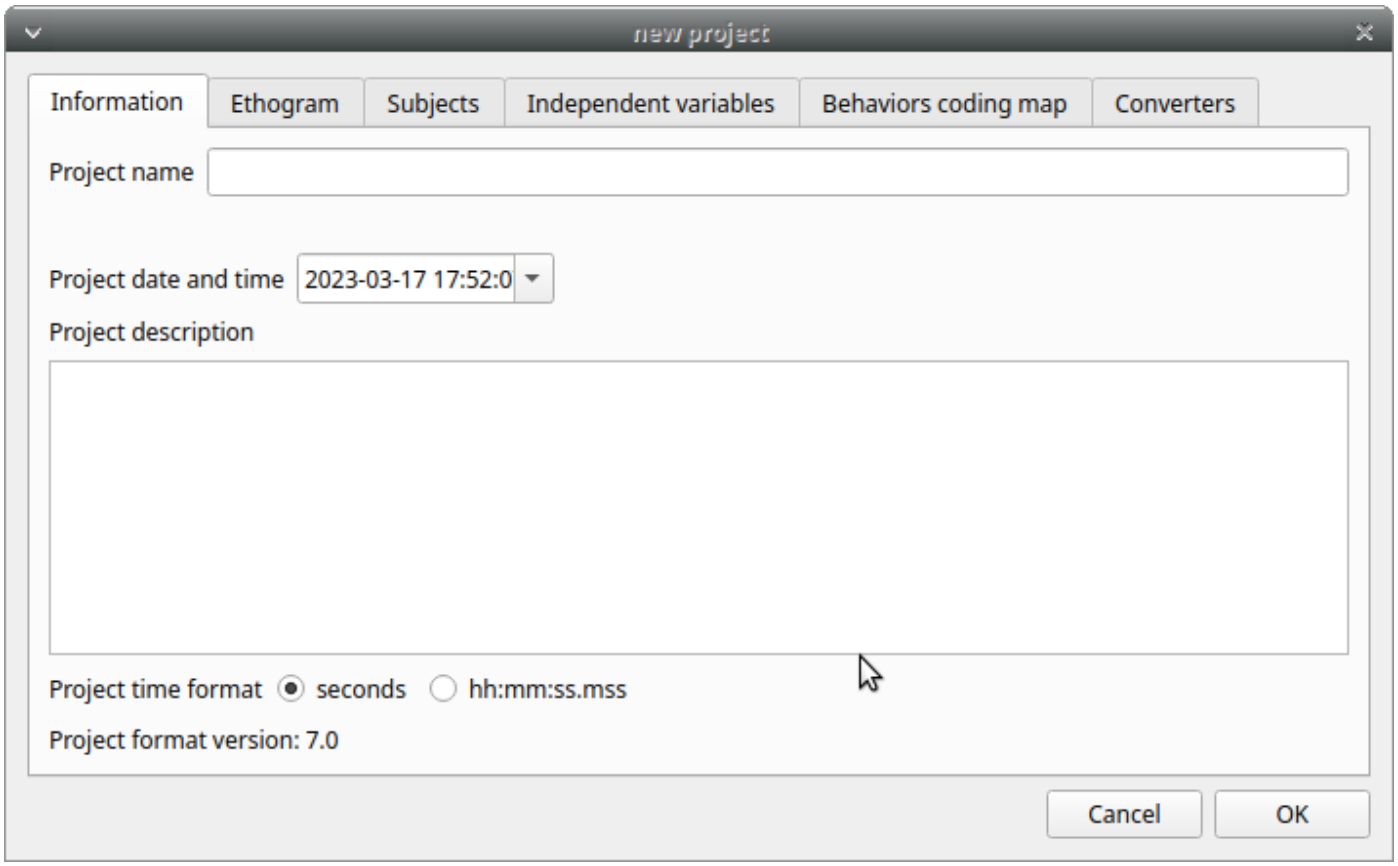
To create a new project, under the menu **File** , select **New project**.

You can determine your project name by writing in the **Project name** field in the **Information** tab. Once the project will be saved, the **Project file path** will show the full path to your project file.

Date will automatically set on the current date and time, but you can alternatively set this info on your media date and time, or whatever you prefer.

Description can host all the relevant information about your project, can be also left empty.

Time format can be alternatively set to **seconds** or to **hh:mm:ss.mss**. This choice can be changed at anytime under **File** > **Preferences**.



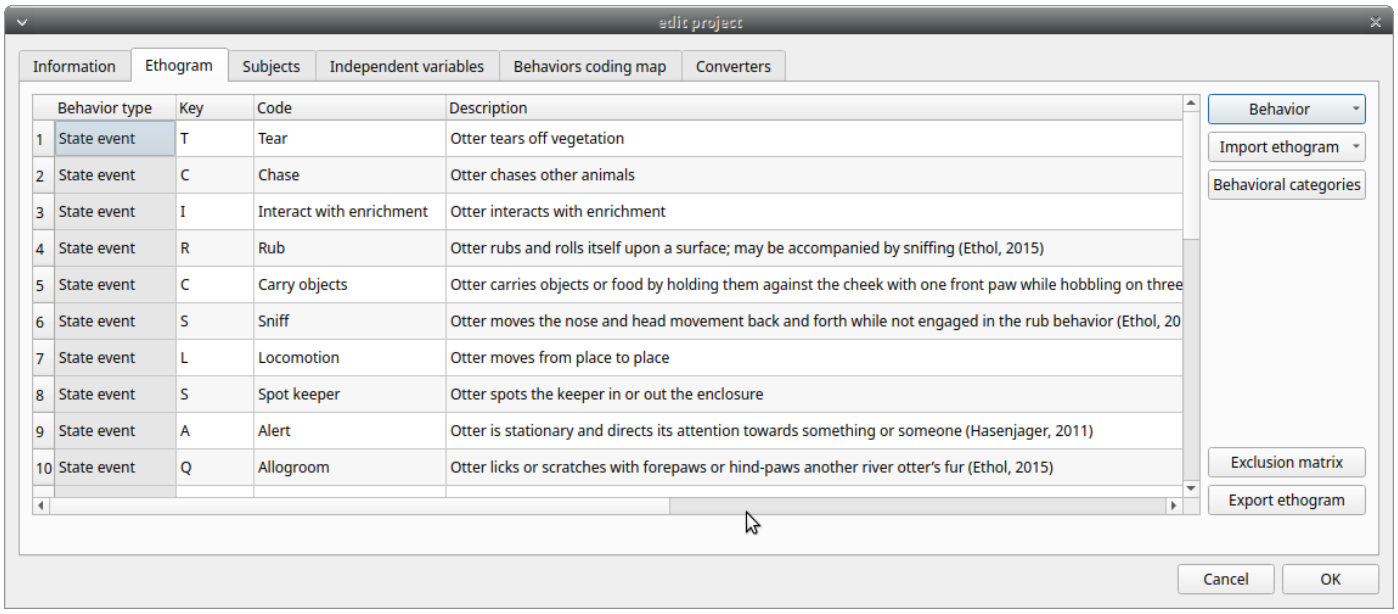
BORIS main window

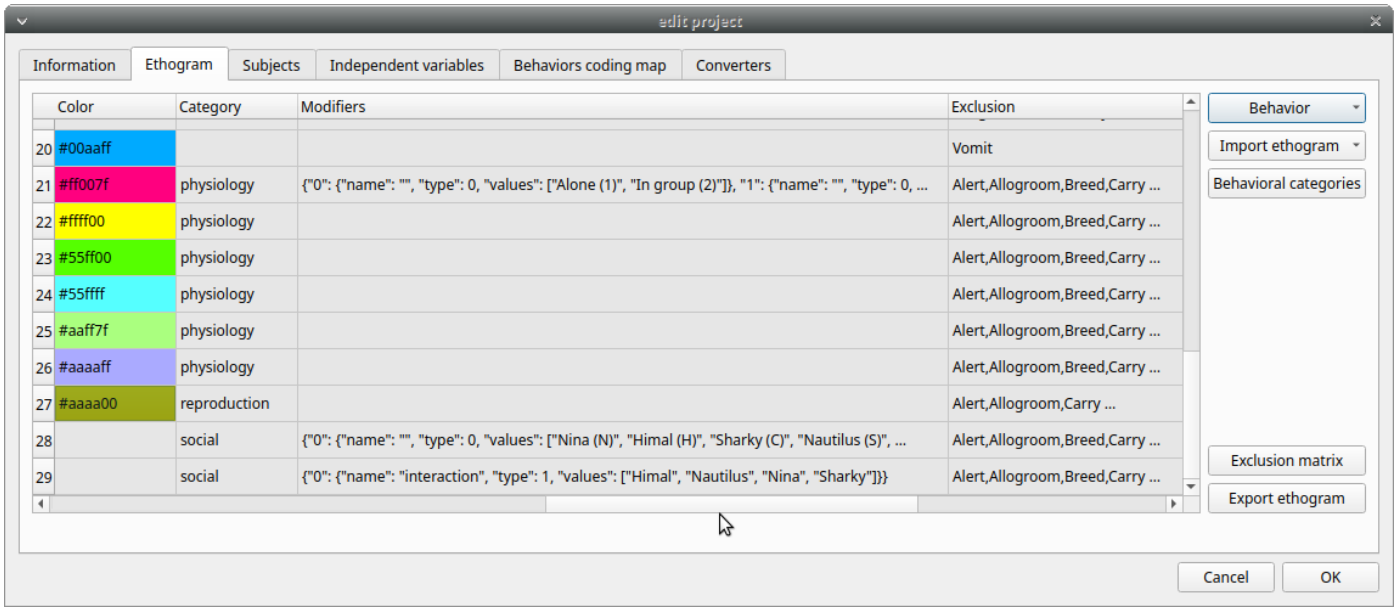
2.3.1 Set an ethogram

See the Wikipedia ethogram definition.

Switching to the **Ethogram tab**, you can alternatively:

- set your ethogram from scratch;
- import an existing ethogram from another BORIS project;
- import an ethogram from a JWatcher global definition file (.gdf).
- import an ethogram from a plain text file or a spreadsheet file (XLSX or ODS)





Set your ethogram from scratch

By clicking on the **Behavior** > **Add behavior** button, you can add a new row in the **Ethogram** table, and the behavior type will be automatically set to **Point event**.

The cells with gray background can not be directly edited. You must double-click on them and then select a value.

Behavior types

2 types of behaviors can be defined. Double-click on the cell and select the type of behavior:

- **Point event** behavior when the behavior has **no duration**.

  The behavior will be coded by pressing the defined keyboard key (see below) or by double-clicking to the corresponding row in the Ethogram table.

- **State event** behavior when the behavior has a **duration**.

  The behavior start and stop will be coded by pressing the defined keyboard key (see below) or by double-clicking to the corresponding row in the Ethogram table. These behaviors **must** have a start event and a stop event otherwise an **UNPAIRED events** warning will be reported when you will close the observation or during an analysis.

- **Point event with a coding map**

  a **Point event** that can be coded uusing a **coding map**.

- **State event with a coding map**

  a **State event** that can be coded using a **coding map**.

You can switch between the types of behavior at your convenience with a double-click on the **Behavior type** cell. You can also add a **Coding map** to either a **State event** (**State event with coding map**) or a **Point event** (**Point event with coding map**). See the **Coding map** section for details.

An existing behavior can be duplicated using the **Clone behavior** button. Its code have then to be changed. On a selected behavior, click on the **Remove behavior** button to remove. The **Remove all behaviors** button will clear the **Ethogram** table. Both the above-mentioned operations must be confirmed when prompted.

The behavior can be sorted by clicking on the Ethogram table header. They cannot be sorted manually.

Set keys and codes

For each behavior you have to set a keyboard key (**Key** column) that will be then used to code the behavioral events. You can choose whether you want to set a unique key for each behavior or use the same key for more than one behavior. In the case you set the same key for more than a behavior, BORIS will pause your coding and ask which of the behavior you want to record. The keys are **case-sensitive**.

If your project was created with an old version of BORIS (< v.7) you can use the **Convert keys to lower case** to convert all keys to lower case otherwise you will have to code your observation using upper case key.

If you open a project file created with a version older than v.7 BORIS will ask you to convert the upper case behavior and subject keys to lower case.

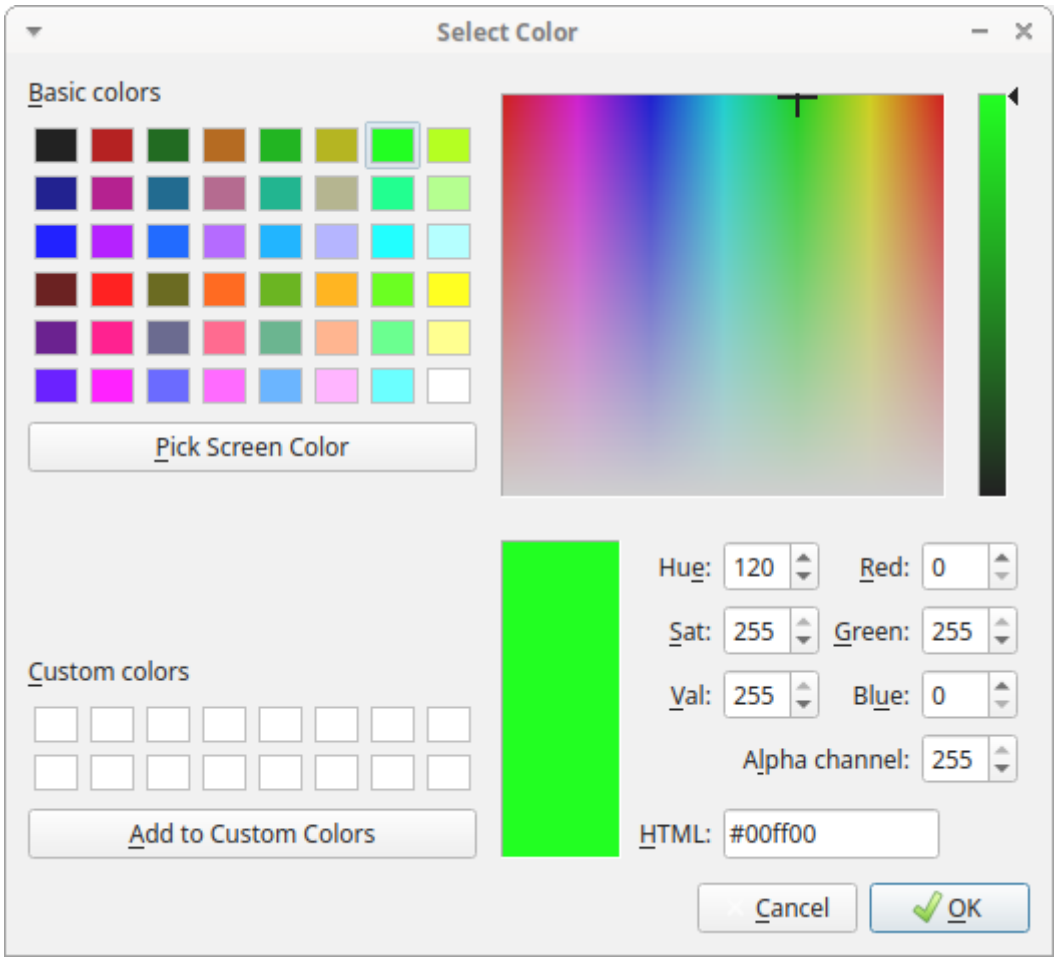
> **Important**
>
> **Do not use the / and * keys! They are reserved for the frame-by-frame mode.**

In the **Code** column, you have to add a unique code for each behavior. Duplicated codes are not accepted and BORIS will warn in red about duplicates on the bottom left of the **Ethogram** tab. The code can be an alphanumeric string (which must not include the pipe character |).

The **Description** of your behavior is optional. The **Description** column can be useful to add information about a specific behavior, its characteristics (e.g. to standardise observation between different users) or to refer to external information (e.g. reference to a previous ethogram).

The columns with a grey background (**Behavior type**, **Color**, **Category**, **Modifiers**, **Exclusion**, **Modifiers coding map**) cannot be edited directly.

The **Color** column allow to select a color for the behavior. This color will be used for plotting events. Double-click on the cell and select the color you want to associate to the behavior.



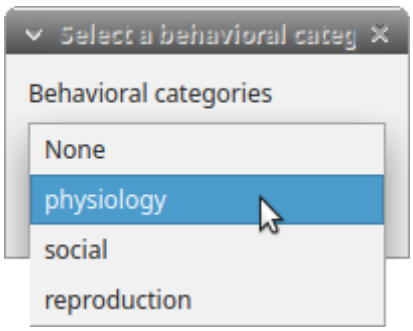
Select the color to associate to the behavior

CATEGORIES OF BEHAVIORS

Defining categories of behaviors can be usefull for the analysis of coded events (for example the time budget analysis).

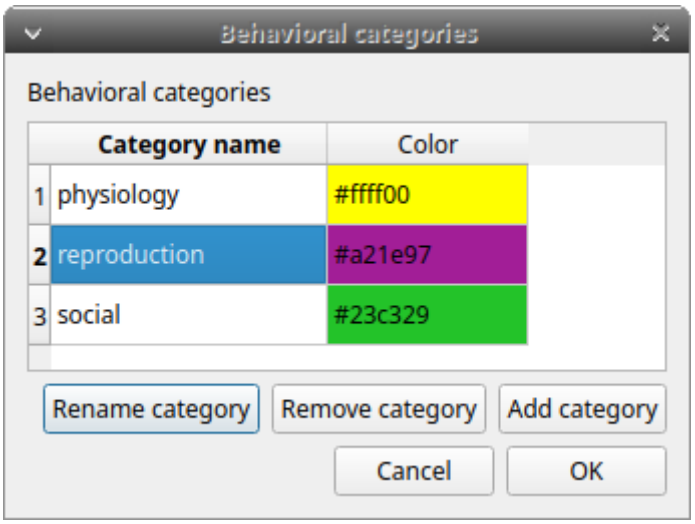
The **Category** column allow you to include the behavior to a predefined behavioral category.

Double-click on the cell and select the behavioral category for the behavior.



Choose a behavioral category for the behavior

To add, remove or rename a behavioral category, click the **Behavioral categories** button. A color can also be associated to a behavioral category.



Behavioral categories manager

Set the modifiers

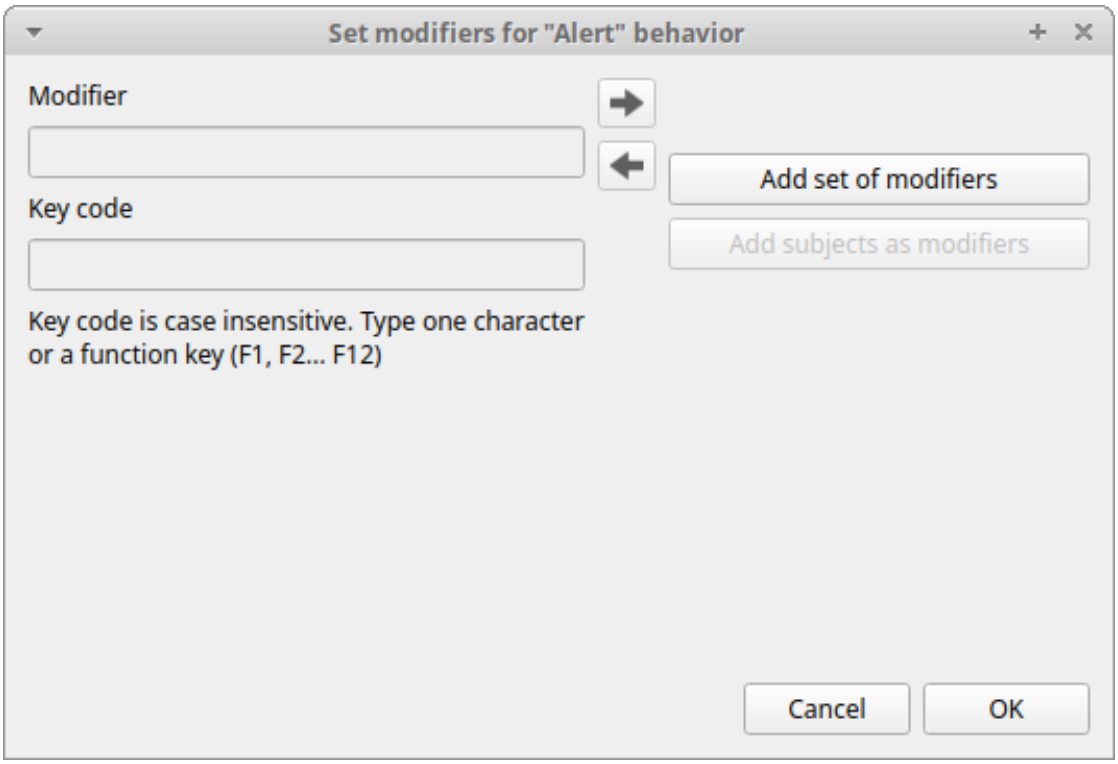
Modifiers can be used to add attributes to a behavior. A single behavior can have two or more modifiers attached (e.g. the behavior **play** may have **solitary** or **social** as modifiers). The use of modifiers can be convenient to significantly reduce the number of keys and simplify the behavioral coding.

4 types of modifiers are available: **Single selection**, **Multiple selection**, **Numeric** and **Value from external data file**:

- the **Single selection** type will allow the observer to select only **one** modifier for the current behavior.
- the **Multiple selection** type will allow the observer to select one or more modifiers for the current behavior.
- the **Numeric** type will allow the observer to input a number. For example a distance of interaction.
- the **Value from external data file** type will save the value of a variable from an external data file.

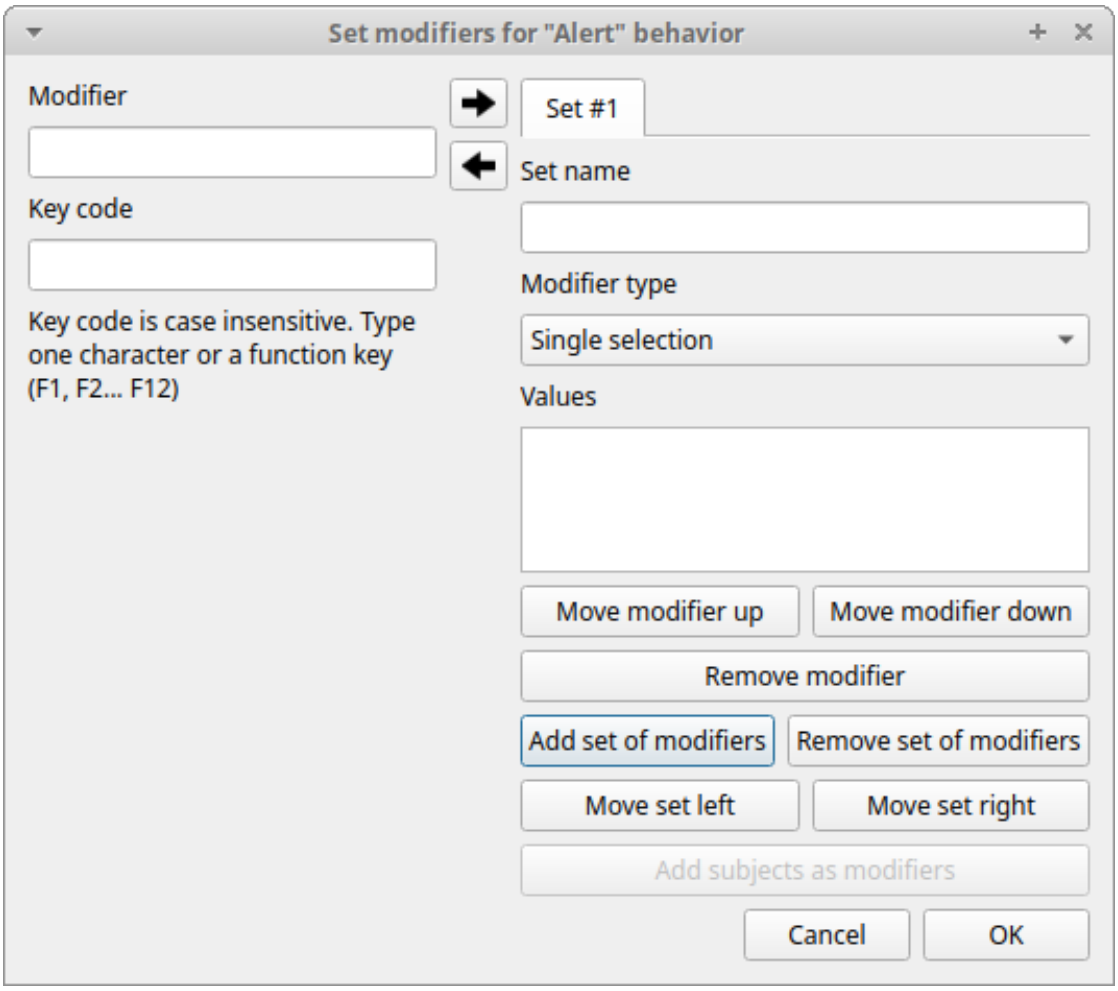
In BORIS modifiers can also be added in different modifier sets (e.g. **play social** may have a modifier set (#1) for **brothers** and another (#2) for **sisters**). In the case of using sets of modifiers, you can select one/more modifier for each set.

To add modifiers to a behavior, you need to double-click the **Modifiers** cell corresponding to the behavior you want to add the modifiers to. The following window will show up:



Modifiers configuration

Click the **Add a set of modifiers** button:



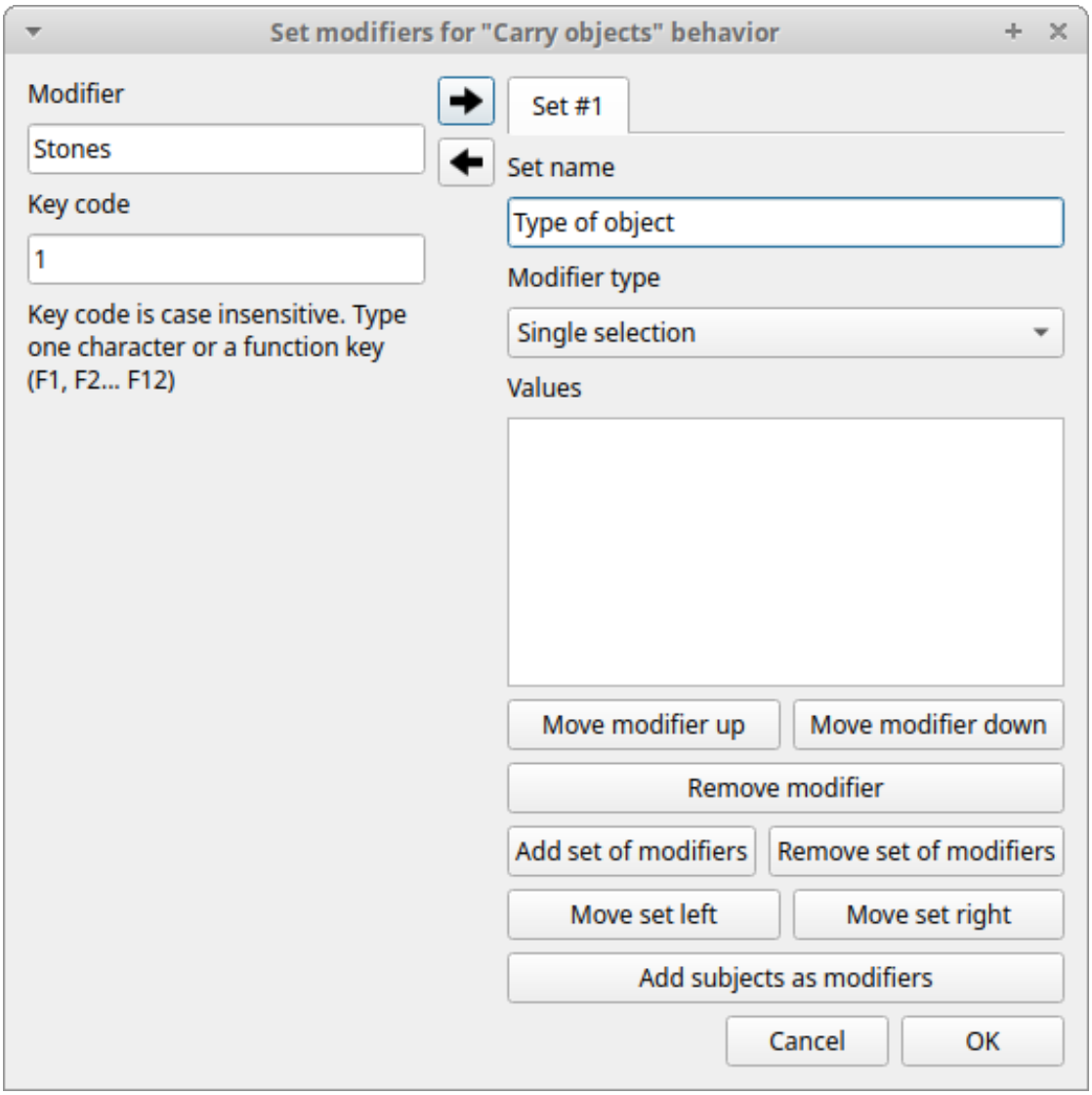
Modifiers configuration

Select the modifier type using the **Modifier type** combo box. You have to choose between **Single selection**, **Multiple selection Numeric** and **Value from external data file**.

SINGLE SELECTION AND MULTIPLE SELECTION MODIFIERS

Set a name for the new modifiers set by typing it in the **Set name** edit box. Setting a modifiers\' set name is not mandatory.

Within a set of modifiers, you can add a modifier by writing the modifier in the **Modifier** edit box. You can choose a shortcut (one character - case sensitive) to this modifier (optional). Then press the **right-arrow** button to add the new modifiers to the set.

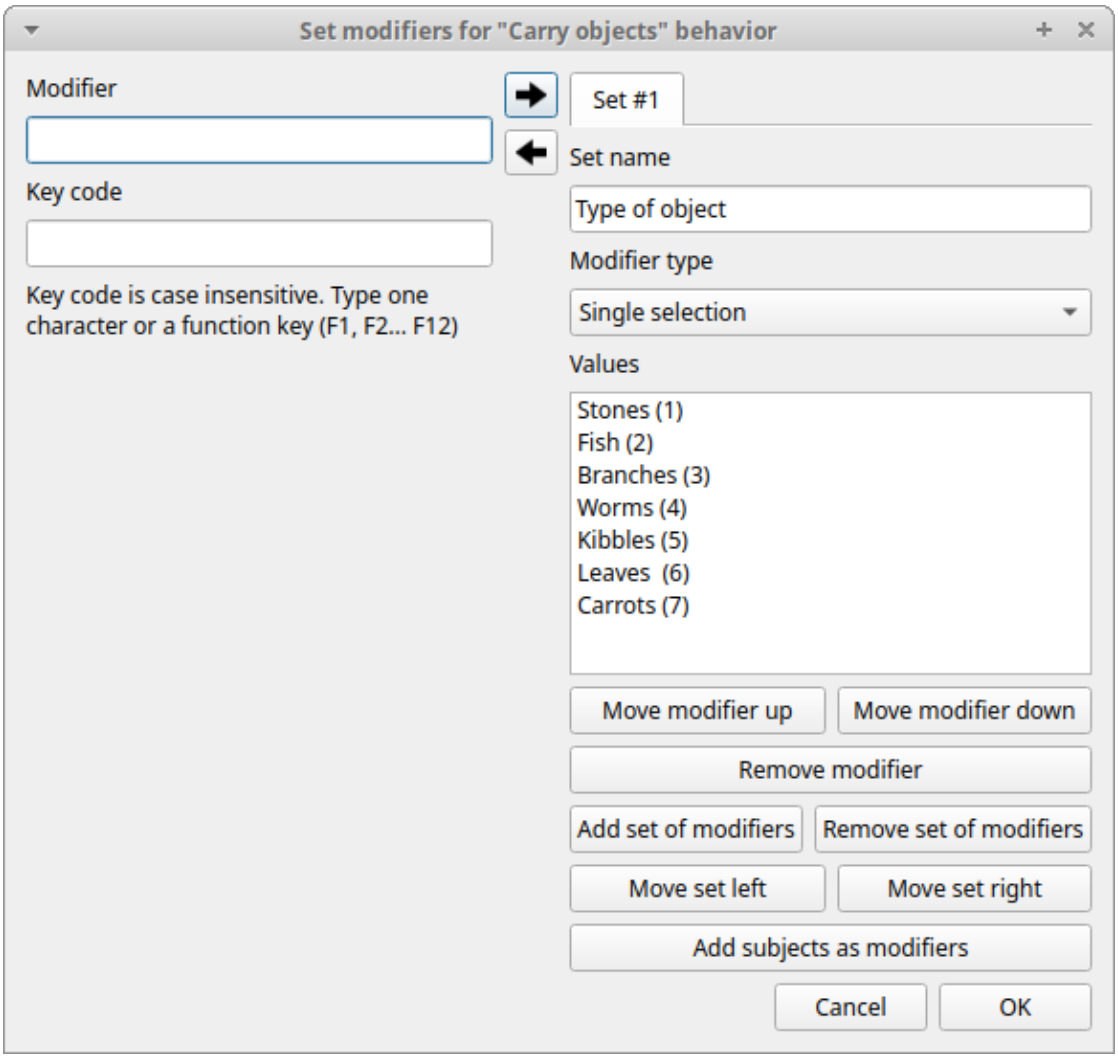


Modifiers configuration

To modify a modifier, select it and press the **left-arrow** button, edit the modifier and press the **right-arrow** button.

A modifier can be removed by pressing the **Remove modifier** button.

After adding all modifiers the window will appear like this:



Modifiers configuration

All defined subjects can be added as modifiers using the **Add subjects as modifiers** button. This can help in case of coding the interactions between subjects for example.

The modifiers can be loaded from a plain text file Use the **Load modifiers from file** button.

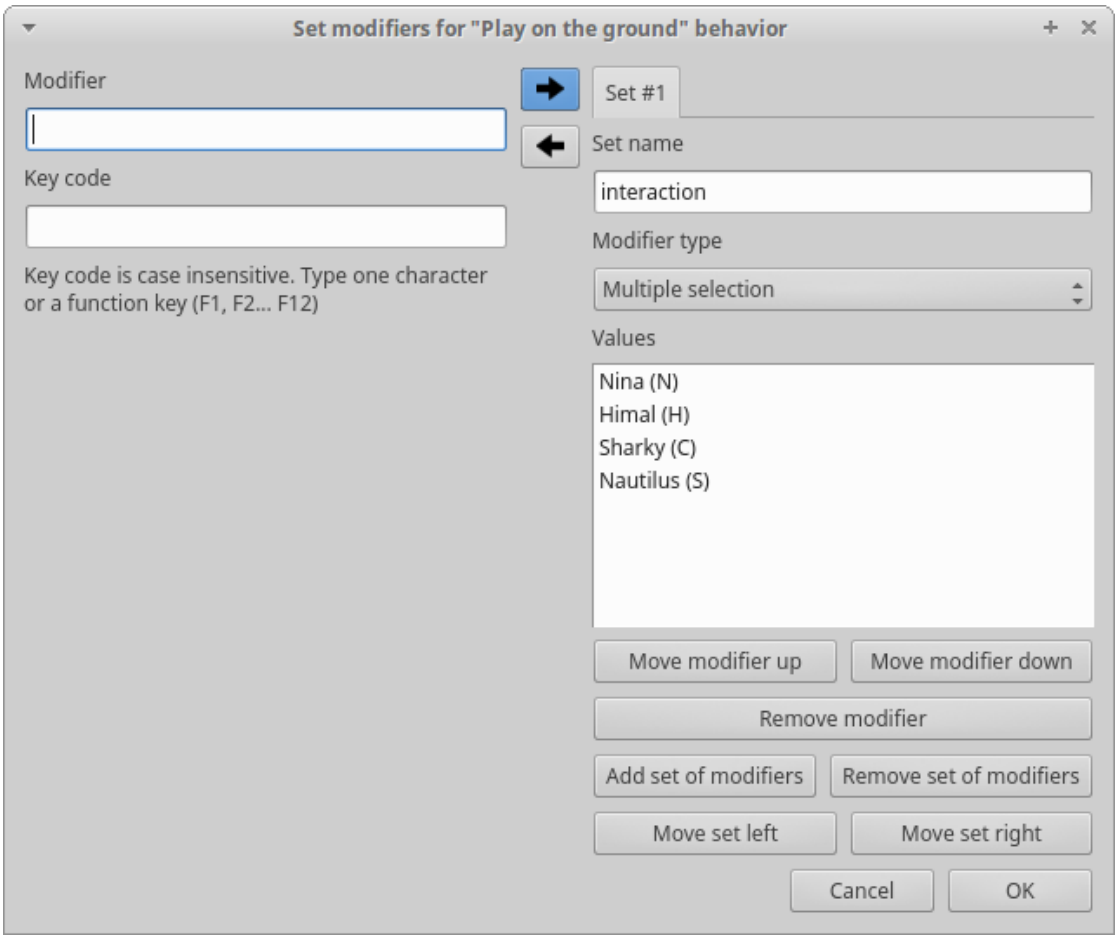
The modifier position into the modifiers\' set can be manually set using the **Move modifier up** and **Move modifier down** buttons. The modifiers can be sorted alphabetically (use the **Sort modifiers** button).

You can add and/or remove sets using the buttons **Add set of modifiers** and **Remove set of modifiers**.

The position of a modifiers\' set can be customized (using the **Move set left** and **Move set right** buttons)

Modifiers can not contain the following characters: **(|),`\~!**

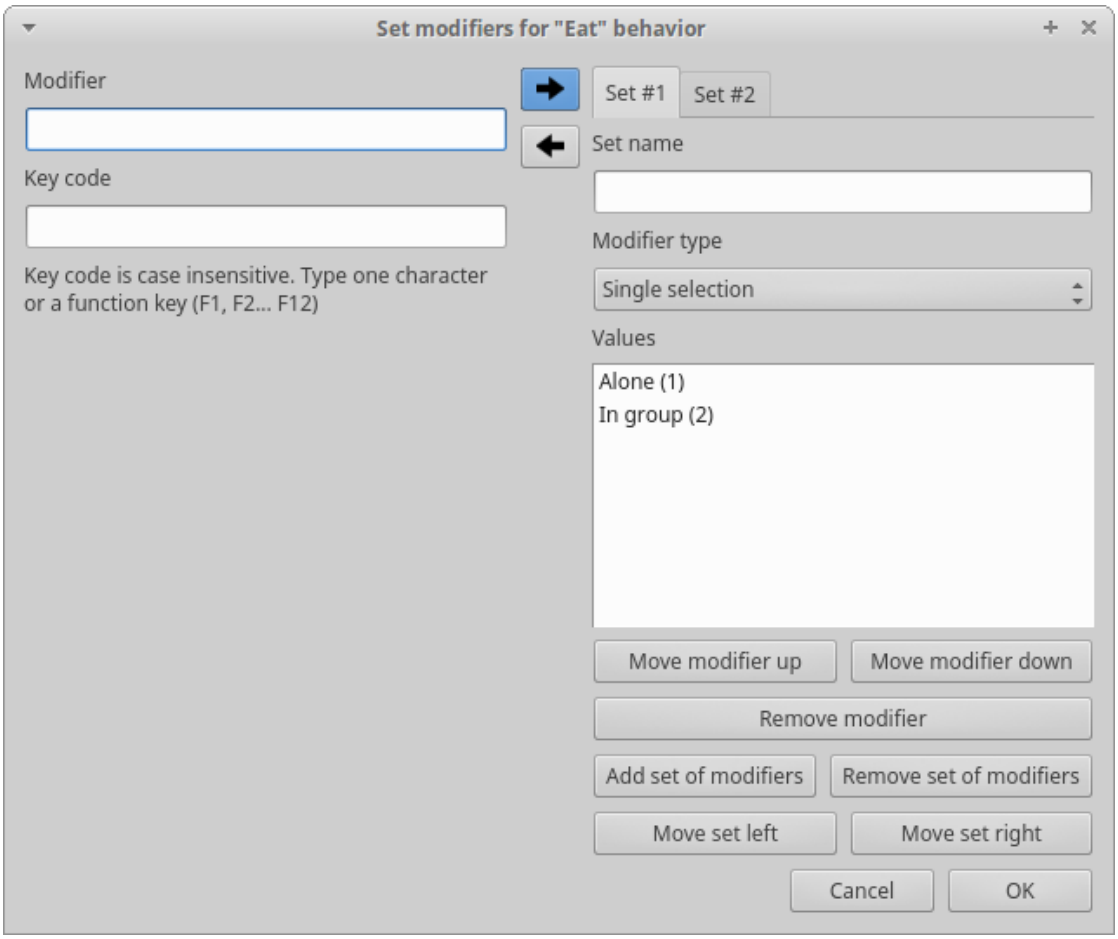
Example of a **multiple selection** modifiers set:



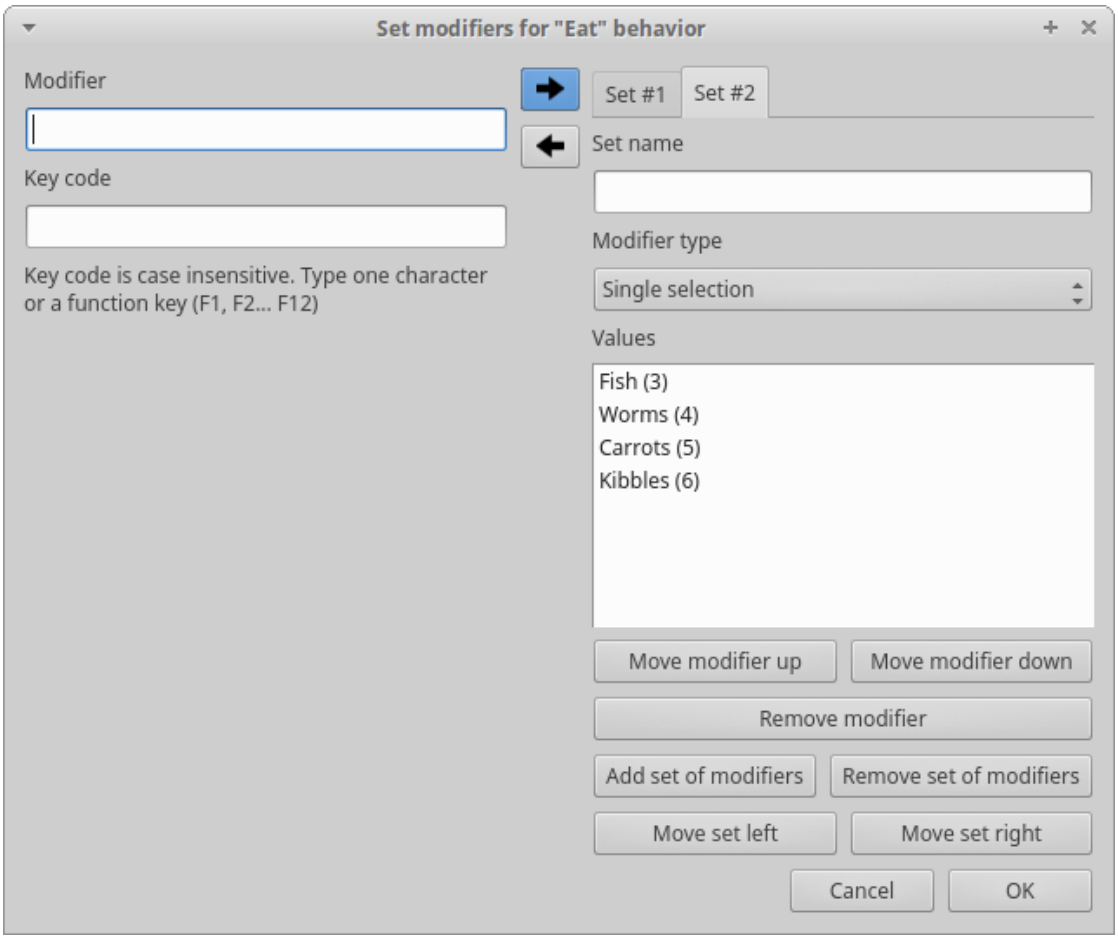
Modifiers configuration

Many values can be selected together.

Example of 2 sets of modifiers:



Modifiers configuration



Modifiers configuration

NUMERIC MODIFIER

Set a name for the new set by typing it in the **Set name** edit box. Setting a modifiers' set name is not mandatory.

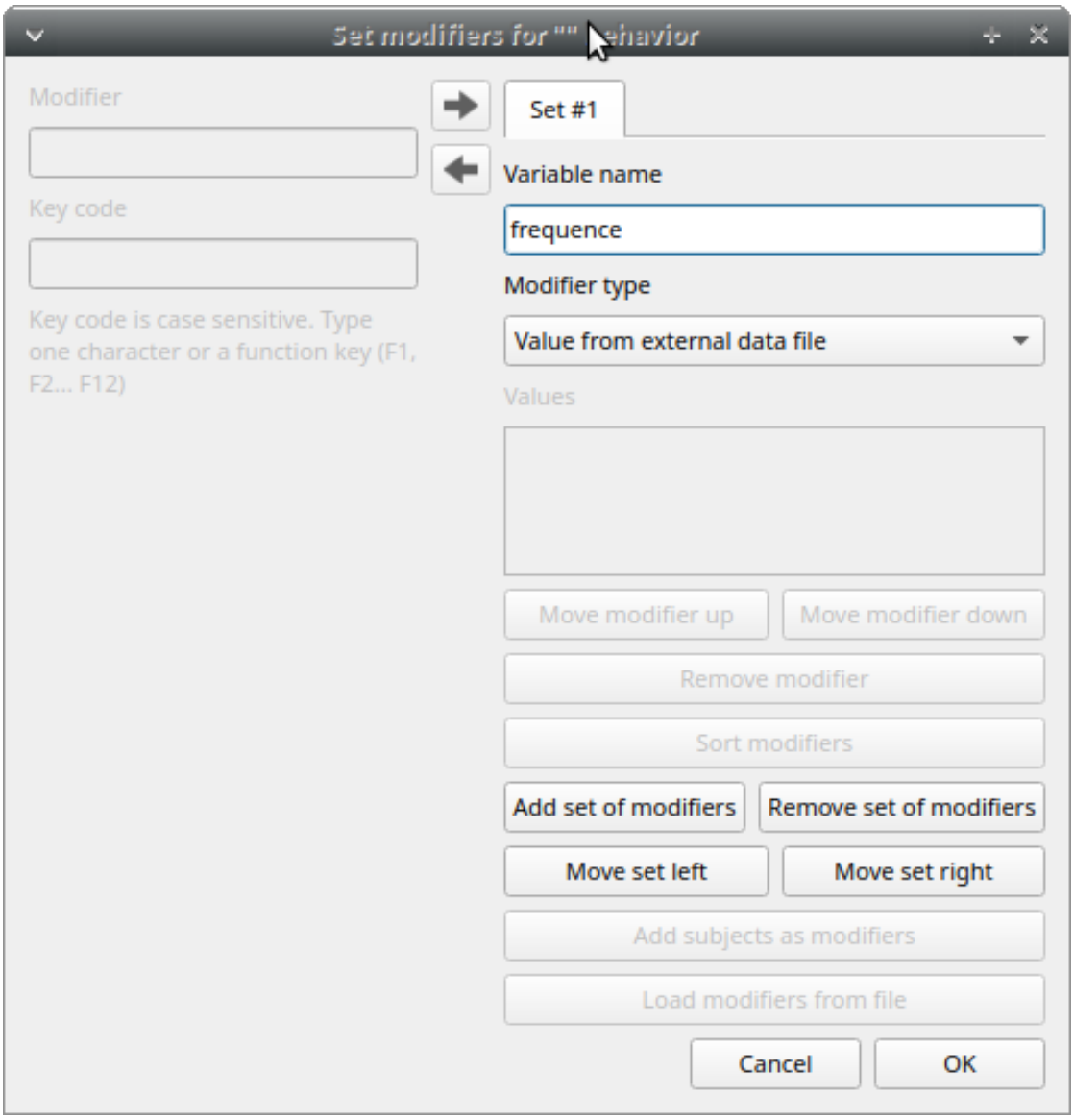
When a **Numeric** modifier will trigger, BORIS will ask the observer for a numeric value.

VALUE FROM EXTERNAL DATA FILE MODIFIER

This modifier can be used to record the value of a variable coming from an external data file (defined during the creation of the observation).

You have to define the variable name in the **Variable name** edit box. This is mandatory and the name of the variable **must** be the same than the variable defined in the observation.

See External data files



modifier value from external data file

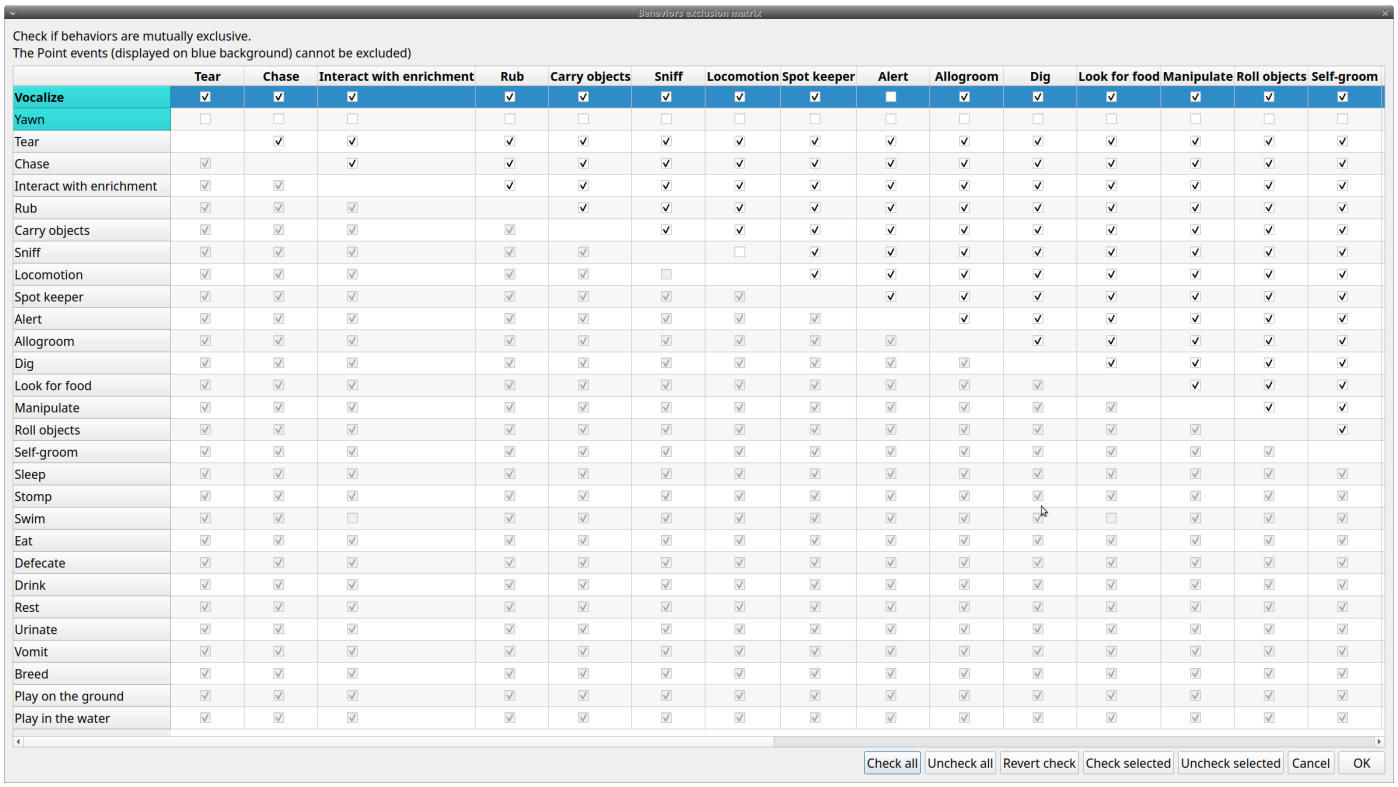
Click **OK** to save modifiers in the **Ethogram** table.

Set the exclusion matrix

The occurrence of an event (State or Point) can exclude the occurrence of a state event. This can be set using the **Exclusion matrix** window, which can be opened clicking on the **Exclusion matrix** button. BORIS will ask for including **Point events** or not and a new **Exclusion matrix** window will open.

Exclusive behavior may be selected by checking on the corresponding checkbox in the automatically-generated matrix. We suggest to work on the **Exclusion matrix** when all the behaviors have been added to your ethogram.

All behaviors can be excluded by a particular behavior by selecting the corresponding entire row (click on the row header of the behavior) and by clicking on the **Check selected** button. You can also uncheck all behaviors by selecting the **Uncheck selected** button.



	Tear	Chase	Interact with enrichment	Rub	Carry objects	Sniff	Locomotion	Spot keeper	Alert	Allogroom	Dig	Look for food	Manipulate	Roll objects	Self-groom
Vocalize	☑	☑	☑	☑	☑	☑	☑	☑	☐	☑	☑	☑	☑	☑	☑
Yawn	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Tear		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Chase	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Interact with enrichment	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Rub	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Carry objects	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Sniff	☑	☑	☑	☑	☑		☐	☑	☑	☑	☑	☑	☑	☑	☑
Locomotion	☑	☑	☑	☑	☑	☐		☑	☑	☑	☑	☑	☑	☑	☑
Spot keeper	☑	☑	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑	☑
Alert	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑	☑
Allogroom	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑	☑	☑	☑
Dig	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑	☑	☑
Look for food	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑	☑
Manipulate	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑	☑
Roll objects	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑		☑
Self-groom	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Sleep	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Stomp	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Swim	☑	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☐	☑	☑	☑
Eat	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Defecate	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Drink	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Rest	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Urinate	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Vomit	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Breed	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Play on the ground	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Play in the water	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Example of an exclusion matrix

For example in the previous figure, the **Alert** behavior will exclude the following behaviors: **Allogroom**, **Breed**, **Carry objects**, **Chase** ...

During the observation, the excluding event will stop all the current excluded state events one millisecond before the occurence of the event.

Set the Modifiers coding map

If the behavior is defined as a **Point event with coding map** or a **State event with codinf map** you can associate a **Modifiers coding map** to select the modifiers from a map.

Import an ethogram from an existing project

Behaviors within an ethogram can be imported from an existing BORIS project (.boris) using the **Import ethogram** > **from a BORIS project** button. BORIS will ask to select a BORIS project file and whether imported behaviors should replace or be appended to the **Ethogram** table. Imported behaviors will retain all the previously defined behavior parameters (namely Behavior type, Key, Code, Description, Modifiers and Exclusion information).

Import an ethogram from a spreadsheet file

Behaviors can be imported from a spreadsheet file using the **Import ethogram** > **from spreadsheet file (XLSX/ODS)** button.

The first row of your spreadsheet (header) must contain the following labels. The order is not mandatory:

- Behavior code
- Behavior type
- Description
- Key
- Behavioral category
- Excluded behaviors

Behavior code is mandatory, the others fields can be empty.

Optional fields can be added:

- Color
- Modifiers (JSON)

BORIS will ask to select a spreadsheet file (by default: *.xlsx or* .ods) and whether imported behaviors should replace or be appended to the **Ethogram** table. The missing information for the imported behaviours have to be redefined.

Import an ethogram from a plain text file

Behaviors can be imported from a plain text file using the **Import ethogram** > **from text file** button. The fields must be separated by TAB, comma (,) or semicolomn (;). All rows must contain the same number of fields.

The first row of your plain text file must contain the following labels. The order is not mandatory but respect the case:

- Behavior code
- Behavior type
- Description
- Key
- Behavioral category
- Excluded behaviors

Behavior code is mandatory, the others fields can be empty.

Example of a plain text ethogram definition:

```
Behavior type,Behavior code,Key,Behavioral category,Description,Excluded behaviors
state event,Play,p,,Play on the garden,s
point event,Sleep,s,,Subject is sleeping,p
```

BORIS will ask to select a plain text file (by default: *.txt *.csv *.tsv) and whether imported behaviors should replace or be appended to the **Ethogram** table. The missing information for the behaviours imported from text file have to be redefined.

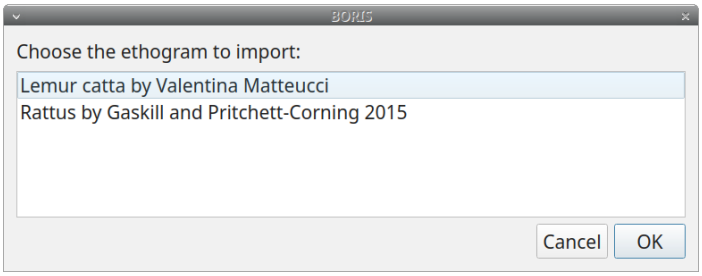
Import an ethogram from a JWatcher global definition file (.gdf)

Behaviors can be imported from a JWatcher global definition file (.gdf) using the **Import ethogram** > **from JWatcher** button. BORIS will ask to select a JWatcher file (.gdf) and whether imported behaviors should replace or be appended to the **Ethogram** table. Behavior type and exclusion information for the behaviours imported from JWatcher have to be redefined.

Access to the BORIS ethogram repository

This function can be activated by clicking the **Import ethogram** > **from the BORIS repository** button.

A list of available ethograms will open and an ethogram can be loaded in the current project.

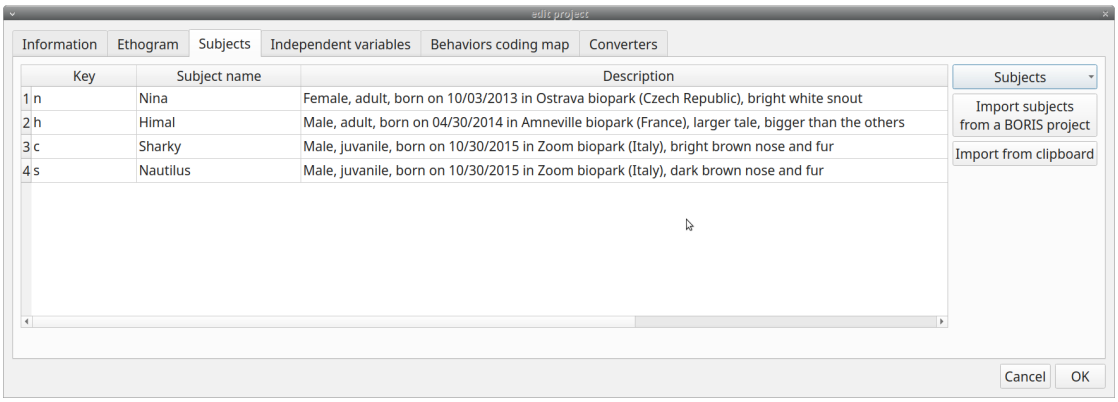


BORIS ethogram repository

Export the ethogram

The entire ethogram can be exported in various formats (TSV, CSV, XLSX, ODS, HTML). See **File** > **Edit project** > **Ethogram tab** > **Export ethogram**

2.3.2 Define the subjects



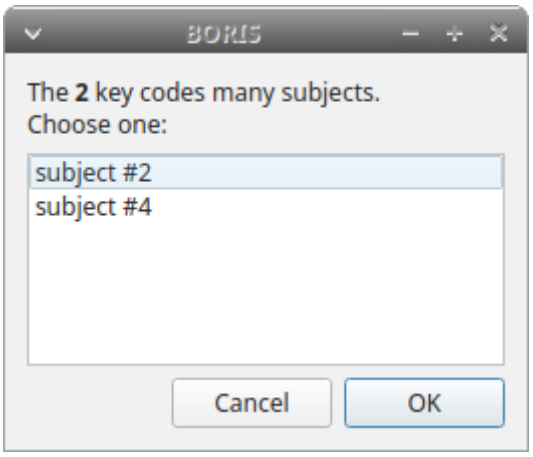
Subjects definition

BORIS allows coding behaviors for different subjects within a single observation. The **Subject** table allows the specification of subjects using a **Key** (e.g., the **k** on your keyboard), **Subject name** (e.g., **Kanzi**), and **Description** (e.g., male, born on October 28, 1980).

With the subjects defined in the previous figure, pressing **n** will set **Nina** as the focal subject for behavioral coding. Pressing **n** again will deselect **Nina** and set the focal subject to **No focal subject**.

The key definition is not mandatory. In this case, you will have to select the current subject from the subjects list with a double-click.

The keys are **case-sensitive** and the same key can be used to select more than one subject. In this case a dialog will show up and will allow to select



Choose a subject

The definition of one or more subjects is not mandatory. Addition, removal and sorting of the subjects follows the same logic of the **Ethogram** table (see Set your ethogram from scratch for info).

Note

If your project was created with a previous version of BORIS (< v.7) you can use the **Convert keys to lower case** to convert all keys to lower case otherwise you will have to code your observation using upper case key.