

BORIS user guide

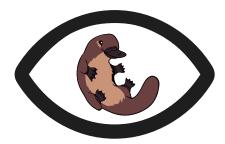
v. 9

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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 ${f 9}$ 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.

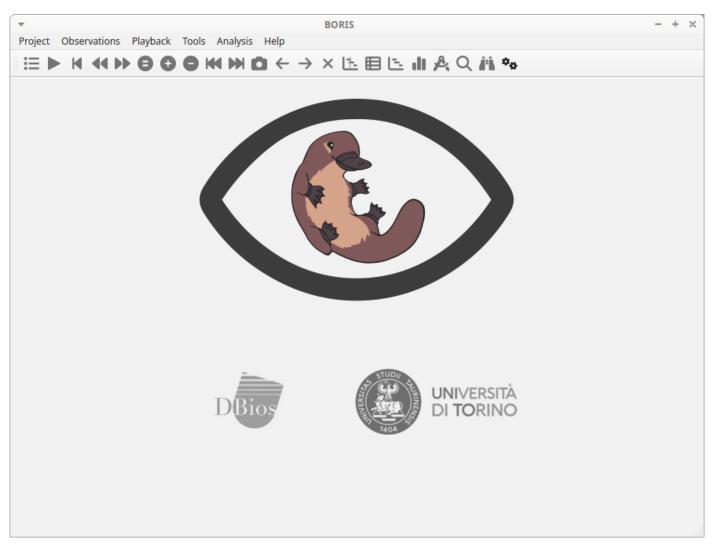
Arning for Windows users

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.

try 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 **hheass.mss**. This choice can be changed at anytime under **File** > **Preferences**.

	_	_	new project	_	_	-
Information	Ethogram	Subjects	Independent variables	Behaviors coding map	Converters	
Project name						
Project date ar Project descrip		-03-17 17:52:	0 -			
				N		
Project time fo		onds () hh:	mm:ss.mss	\$		
Project time fo Project format		onds 🔿 hh:	mm:ss.mss	2		

BORIS main window

2.3.1 Set an ethogram

See the Wikipedia ethogram definition.

Switching to the ${\bf Ethogram\ tab},$ 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)

Inf	ormation	thogram	Subjects	Independent varial	bles Behaviors coding map	Converters				
	Behavior type	e Key	Code	D	escription			Behavior		
1	State event	т	Tear	o	tter tears off vegetation			Import ethogram		
2	State event	с	Chase	o	tter chases other animals			Behavioral categories		
3	State event	I	Interact	with enrichment O	tter interacts with enrichment					
4	State event	R	Rub	o	tter rubs and rolls itself upon a	surface; may be accompanied by sniffing (Ethol, 2015)				
5	State event	с	Carry ob	ojects O	tter carries objects or food by h	rries objects or food by holding them against the cheek with one front paw while hobbling on three				
6	State event	S	Sniff	o	tter moves the nose and head n					
7	State event	L	Locomo	tion O	tter moves from place to place					
8	State event	s	Spot kee	eper O	tter spots the keeper in or out t	ne enclosure				
9	State event	A	Alert	0	tter is stationary and directs its	attention towards something or someone (Hasenjager, 2011)				
10	State event	Q	Allogroo	om O	tter licks or scratches with forep	aws or hind-paws another river otter's fur (Ethol, 2015)		Exclusion matrix		
4						N	•	Export ethogram		
						2				

-	-		_	ed	it project	_			_
Information	Ethogram	Subjects	Independent variables	Behaviors coding map	Converters				
Color	Catego	ory M	Modifiers				Exclusion		Behavior
20 #00 aaff							Vomit		Import ethogram
21 #ff007f	physio	logy	("0": {"name": "", "type": 0, "v	alues": ["Alone (1)", "In gro	up (2)"]}, "1": {"n	ame": "", "type": 0,	Alert,Allogroom,Breed,Carry		Behavioral categories
22 <mark>#ffff00</mark>	physio	logy					Alert,Allogroom,Breed,Carry		
23 #55ff00	physio	logy					Alert,Allogroom,Breed,Carry		
24 #55ffff	physio	logy					Alert,Allogroom,Breed,Carry		
25 #aaff7f	physio	logy					Alert,Allogroom,Breed,Carry		
26 #aaaaff	physio	logy					Alert,Allogroom,Breed,Carry		
27 # aaaa00	reproc	luction					Alert,Allogroom,Carry		
28	social	(("0": {"name": "", "type": 0, "v	alues": ["Nina (N)", "Himal	(H)", "Sharky (C)'	', "Nautilus (S)",	Alert,Allogroom,Breed,Carry		
29	social	4	("0": {"name": "interaction", "	type": 1, "values": ["Himal"	, "Nautilus", "Nir	na", "Sharky"]}}	Alert,Allogroom,Breed,Carry	-	Exclusion matrix
•					\$			•	Export ethogram
									Cancel OK

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 ${\bf State \ event}$ that can be coded using a ${\bf coding \ map}.$

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.

hportant

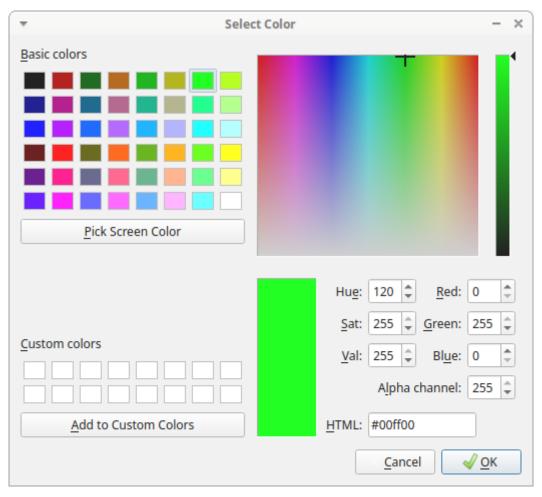
Do not use the / and * keys! They are reserved for the frame-by-frame mode.

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.



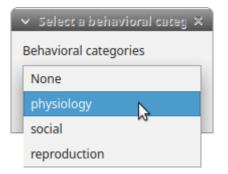
Select the color to associate to the behavior

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.

v	 Øehavioral categories 								
Be	ehavioral categories								
	Category name	Color							
1	physiology	#ffff00							
2	reproduction	#a21e97							
3	social	#23c329							
	Rename category Rem	nove category	Add category						
		Cancel	ОК						

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:

•	Set modifiers for "Alert" behavior	+	×
Modifier			
Key code	Add set of modifiers		
	Add subjects as modifier	S	
Key code is case insensit or a function key (F1, F2,			
	Cancel Of	(

Modifiers configuration

Click the Add a set of modifiers button:

▼ Set modifiers	for "Alert" behavior + ×
Modifier	Set #1
Key code	Set name
	Modifier type
Key code is case insensitive. Type one character or a function key	Single selection 👻
(F1, F2 F12)	Values
	Move modifier up Move modifier down
	Remove modifier
	Add set of modifiers Remove set of modifiers
	Move set left Move set right
	Add subjects as modifiers
	Cancel OK

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.

▼ Set modifiers for	"Carry objects" behavior + ×
Modifier	• Set #1
Stones	Set name
Key code	Type of object
1	Modifier type
Key code is case insensitive. Type one character or a function key	Single selection 🔹
(F1, F2 F12)	Values
	Move modifier up Move modifier down
	Remove modifier
	Add set of modifiers Remove set of modifiers
	Move set left Move set right
	Add subjects as modifiers
	Cancel OK

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 $\ensuremath{\textbf{Remove\ modifier}}$ button.

After adding all modifiers the window will appear like this:

▼ Set modifiers for	r "Carry objects" behavior	+ ×
Modifier	Set #1	
Key code	Type of object	
Key code is case insensitive. Type one character or a function key (F1, F2 F12)	Modifier type	
	Single selection	*
	Values	
	Stones (1) Fish (2) Branches (3) Worms (4) Kibbles (5) Leaves (6) Carrots (7)	
	Move modifier up Move modifier of	lown
	Remove modifier	
	Add set of modifiers Remove set of mod	lifiers
	Move set left Move set rig	ht
	Add subjects as modifiers	
	Cancel Of	(

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)

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

▼ Set modifiers for "PI	ay on th	e ground" behavior	+ ×			
Modifier		Set #1				
	•	Set name				
Key code	, <u> </u>	interaction				
Key code is case insensitive. Type one character or a function key (F1, F2 F12)		Modifier type				
		Multiple selection				
		Values				
		Nina (N) Himal (H) Sharky (C) Nautilus (S)				
		Move modifier up	Move modifier down			
		Remove	modifier			
		Add set of modifiers	Remove set of modifiers			
		Move set left	Move set right			
		C	ancel OK			

Modifiers configuration

Many values can be selected together.

Example of 2 sets of modifiers:

▼ Set mo	difiers for "Eat" behavior 4	×
Modifier	Set #1 Set #2	
	Set name	
Key code		
	Modifier type	
Key code is case insensitive. Type one chara or a function key (F1, F2 F12)	Single selection	*
	Values	
	Alone (1)	
	In group (2)	
	Move modifier up Move modifier dov	/n
	Remove modifier	
	Add set of modifiers Remove set of modifier	ers
	Move set left Move set right	
	Cancel OK	

Modifiers configuration

▼ Set modifier	s for "Ea	t" behavi	ior		+	×
Modifier	 → → 	Set #1 Set name	Set #2			
Key code)	Modifier	type			
Key code is case insensitive. Type one character or a function key (F1, F2 F12)		Single so Values	election			*
		Fish (3) Worms (Carrots (Kibbles ((5)			
		Move	e modifier up Remov	Move m	nodifier dow	n
		Add set	of modifiers	Remove se	et of modifie	rs
		Mo	ove set left		e set right	
				Cancel	OK	

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

✓ 5et modifie	rs for "" 🔀havior	÷×
Modifier	Set #1	
•	Variable name	
Key code	frequence	
	Modifier type	,
Key code is case sensitive. Type one character or a function key (F1,	Value from external d	lata file 👻
F2 F12)	Values	
	Move modifier up	Move modifier down
	Remov	ve modifier
	Sort	modifiers
	Add set of modifiers	Remove set of modifiers
	Move set left	Move set right
	Add subject	cts as modifiers
	Load mod	lifiers from file
	(Cancel OK

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	Manipulat	e Roll objects	Self-groor
Vocalize	✓	✓		✓		✓		V		V	✓	✓			
Yawn															
Tear		V	v	v	~	~	✓	V	V	V	\checkmark	✓	V	✓	~
Chase	\checkmark		v	v	~	~	✓	V	V	V	✓	~	V	V	~
Interact with enrichment	\checkmark	\checkmark		~	~	v	✓	✓	V	V	✓	~	V	✓	~
Rub	\checkmark	\checkmark	\checkmark		~	~	✓	V	V	V	✓	✓	V	V	~
Carry objects	\checkmark	\checkmark	\checkmark	\checkmark		V	✓	V	V	V	✓	V	V	V	~
Sniff	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark			V	V	V	\checkmark	✓	V	V	~
ocomotion	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark			V	V	V	✓	V	V	V	✓
Spot keeper	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		V	V	✓	V	V	V	~
Alert	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		V	✓	V	V	V	~
Allogroom	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		V	V	V	V	~
Dig	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		V	V	V	~
ook for food	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		V	V	~
Manipulate	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		V	✓
Roll objects	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		~
Self-groom	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	1	\checkmark	
Sleep	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	1	\checkmark	\checkmark
Stomp	\checkmark	V	V	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	√	\checkmark	V	1	\checkmark	\checkmark
Swim	\checkmark	\checkmark		\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	1		\checkmark	\checkmark	\checkmark
Eat	\checkmark	\checkmark	V	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	V	\checkmark	\checkmark	\checkmark
Defecate	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Drink	\checkmark	\checkmark	V	\checkmark	V	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	V	\checkmark	\checkmark	\checkmark
Rest	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Jrinate	\checkmark	1	V	\checkmark	V	\checkmark	1	\checkmark	\checkmark	√	\checkmark	V	1	\checkmark	1
/omit	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Breed	\checkmark	V	V	\checkmark	V	\checkmark	√	\checkmark	\checkmark	√	\checkmark	\checkmark	V	\checkmark	√
Play on the ground	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark
Play in the water	\checkmark	V	V	\checkmark	V	\checkmark	√	\checkmark	\checkmark	V	\checkmark	V	V	V	~

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 ×
Choose the ethogram to import:	
Lemur catta by Valentina Matteuc	ci
Rattus by Gaskill and Pritchett-Cor	ning 2015
	Cancel OK

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**

2.3.2 Define the subjects

Information	Ethogram	Subjects	Independent variables	Behaviors coding map	Converters						
Key	Su	ibject name	2		Descriptio	n	Subjects 🔹				
1 n	Nina		Female, adult, bor	Female, adult, born on 10/03/2013 in Ostrava biopark (Czech Republic), bright white snout							
2 h	Import subjects from a BORIS project										
2 h 3 c	Sharky		Male, juvanile, bor	ale, juvanile, born on 10/30/2015 in Zoom biopark (Italy), bright brown nose and fur							
4 s	Nautilus	utilus Male, juvanile, born on 10/30/2015 in Zoom biopark (Italy), dark brown nose and fur									
						Þ					
1							b.				
							Cancel OK				



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 doubleclick.

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

¥	BORI5	- + >	ĸ
The 2 ke Choose	ey codes many subject one:	ts.	
subject subject			
	Cancel	ОК]

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.

The subjects can also be imported from an existing BORIS project: use the Import Subjects from a BORIS project button.

Import subject from a spreadsheet

The subjects can be imported from a spreadsheet (Google spreadsheet, Microsoft-Excel, LibreOffice Calc).

The spreadsheet must contain one subject by row and have to be organized as above:

- 1st column: Subject key (One character Case sensitive Optional)
- 2nd column: Subject name (mandatory)
- 3rd column: Description of subject (optional)

Select all cells of your spreadsheet (^ ctrl + A), copy to clipboard (^ ctrl + c). Click the **Import from clipboard** button.

Note

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.

2.3.3 Define the Independent variables

	_	_	_	_	edit pr	jeci		_	_
Information	Ethogram	Subjects	Independent va	riables Be	haviors coding map	Conve	rters		
Label		Descripti	on	Туре	Predefined	value	Set of values		Add variable
1 Location	Location wh	nere observat	tions where made	text	44° 55′ 59″ N – 7				Remove variable
2 Weather	Meteorolog	ical conditior	ıs	value from s	et sun		sun,rain,clouds		Import variables
3 Temperature	ire Average temperature of the day (°C)		numeric					from a BORIS project	
4 Visitors	Visitors per day			numeric					
Label	Locat	ion							
Description	Locat	ion where ob	servations where	made					
Гуре	text		•						
Predefined valu	redefined value 44° 55′ 59″ N – 7° 25′ 18″ E							2	
									Cancel OK

Independent variables

BORIS allows adding information about the observation using **Independent variables**. This can be used to specify factors that may influence the behaviors (e.g. group composition, temperature, weather conditions) but will not change during a single observation within a project. Each independent variable can be defined by a **Label** (e.g. weather), a **Description** (e.g. weather conditions), a **Type** (*text, numeric, value from set* or *timestamp*).

The values of a set are defined in the **Set of values** column separating the available values with a comma (,). Please note that the first value of the set will be selected by default. It should be useful to define a NA value as first value of every set.

The values for the independent variables will be asked when creating a new observation. Addition, removal and sorting of the independent variables follows the same logic of the **Ethogram** table (see **Set your ethogram from scratch** for info). The independent variables can also be imported from an existing BORIS project using the **Import Variables from a BORIS project**.

_	_	_	_	edi	š proj	ject	_	_	_
Information	Ethogram	Subjects	Independent va	riables	Beha	aviors coding map	erters		
Label		Description				Predefined va	lue	Set of values	Add variable
1 Location	Location w	here observat	ions where made	text		44° 55′ 59″ N – 7° 2	5′ 18″ E		Remove variable
2 Weather	Meteorolog	value fron	n set	sun		sun,rain,clouds	Import variables		
3 Temperature	Average te	the day (°C)	numeric					from a BORIS project	
4 Visitors Visitors per day									
Label Description									
Туре	value	e from set	•						
Predefined valu									
Set of values (s	eparated by o	comma) sun,	rain,clouds						
									Cancel OK

Example of an independent variable (Weather) defined as "set of values"

The predefined value must be contained in the set of value.

2.3.4 Converters' table

Converters are used for plotting external data when the timestamp values are not expressed in seconds. Converters can be written by the user, loaded from file or loaded from the repository of the BORIS web site (http://www.boris.unito.it/static/ converters.json).

~					edit project		+ ×
Information	Ethogram	Subjects	Independent variables	Observations	Behaviors coding map	Converters	
Time converte	rs for external	data					
١	lame		Description		Code		Add new converter
							Modify converter
							Delete converter
							Load converters from file
							Load converters from BORIS repository
Name							
Description							
Python code							
Help							
							Cancel OK

Converters tab

Load converters from BORIS web site

Click Load converters from BORIS repository and select the converters to be added to your project.

-	BORIS	-	+	×							
Choos	Choose the converters to load:										
HHM	HHMMSS_2_seconds										
ISO86	601_to_seconds										
invert	_value										
	Cancel										
	ОК										
	UK										

Converters selection from repository

•				e	edit project			4	+ ×		
Information	Ethogram	Subjects	Independent variables	Observations	Behaviors coding map	Converters					
Time converter	s for external	data									
	Name			Add new converter							
1 HHMMSS_2_seconds convert HH:MM:SS in seconds since 1970-01-01								Modify converter			
2 ISO8601_to_seconds Convert ISO8601 format to seconds since 1970-01-01 Input example: "2018-01-18T12:31:402"								Delete converter			
								Load converters from file			
								Load converters from BORIS repositor	ry		
4							►				
Name											
Description									4		
Python code									er		
Help								Cancel			
								Cancel OK			

Converters tab with 2 converters defined

Writing a converter

See "Converters for external data values"

The converters loaded in your project can be then selected for converting timestamp (or other values) in external data file

See Converters

2.4 Create a new observation

A video tutorial about making an observation is available at this link.

To create a new observation you must first Create a new project with BORIS or Open an existing project with BORIS.

Clicking on **Observations > New observation** will show the **New observation** window.

New observation					×
Observation id *		Date and time	2024-05-0	7 11:01:0	04.703 -
Description	Independ	dent variables			
	Variable	Type Value			
Time offset					
O Seconds hh:mm:ss Date time Time value + hour 0 mm:ss.ms 00:00.000 ⁺					
Limit observation to a time interval					
Observation type					
\odot Observation from media file(s) \odot Live observation \odot Observation from pictures					
		C	ancel	Save	Start

New observation window

This window allow adding various observation data:

- a mandatory **Observation id** (must be unique across all observations in the open project);
- Date, which will be 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, which can host all the relevant information about your observation, but can be also left empty.
- **Independent variables** (e.g. to specify factors that may influence the behaviors but will not change during the observation within a project). See the independent variables section for details.
- Time offset. BORIS allow specifying a time offset that can be added or subtracted from the media timecode.
- The Limit observation to a time interval option can be used to limit the observation to an arbitrary time interval.

You must then indicate if you want to make an observation based on **pre-recorded media (audio / video)** or a **live observation**.

2.4.1 Live observation

During the live observation BORIS will show you a timer that will be used for recording time for coded events.

Click on the Live observation radio button to create a live observation.

	×
Observation id * Date and time 2024-05-07 11:01:04.	• 60
Description Independent variables	
Variable Type Value	
Time offset	
O Seconds (a) hh:mm:ss O Date time Time value + hour (a) mm:ss.ms (00:00.000 (2)	
Limit observation to a time interval	
Observation type	
Observation from media file(s) Live observation Observation from pictures 	
Scan sampling every 0 🗘 seconds	
Start from current time	
Day time	
O Epoch time (seconds since 1970-01-01)	
Cancel Save S	art

New live observation

Start from current time

If you want that the time starts from the current time you can check the **Start from current time** checkbox.

Observation type
\odot Observation from media file(s) \odot Live observation \bigcirc Observation from pictures
Scan sampling every 0
✓ Start from current time
 Day time
○ Epoch time (seconds since 1970-01-01)

Set a live observation to start from current time

If the **Day time** option is checked the start time will be the computer current time when you will press the **Start** button.

If the **Epoch time** is checked the start time will be the number of seconds since the Jan 1st, 1970 (1970-01-01). See Unix time for details. This option is usefull for long observations (few days) or observations that start before midnight and end after.

Start the observation

Click the **Start** button to begin the live observation or **Save** to save it in the Observations list.

The main window during a live observation will look like this:

la Obsony	ations Playback	demo 2 - LEMUR CATTA example of u Tools Analysis Help	se - BORIS			
	-					
nogram	-		Events for "demo 2	" observation		
-	Code					
Кеу ç	Marking	00:00:44.537	time 1 00:00:03.937	subject Ciro	code	type
*	Licking	00.00.44.337	2 00:00:11.089	Ciro	Watering	START
z	Yawning	Focal subject: Totò	3 00:00:16.560	Ciro	Watering	STOP
v	Rasp	Total subject. Toto	4 00:00:23.000	Totò	Quadrupedal walking	START
€	Sitting		5 00:00:32.232	Totò	Quadrupedal walking	STOP
v	Shriek					
v	Click					
1. S. S.	Quadrupedal					
s	Slap					
i	Chase					
с	Watering					
4	Chew					
у	Sunning					
	Mouth face					
))					
ects		3				
Key	Name					
	No focal subject					
	Ciro					
	Totò					
	Maurice					
		Stop live observation				

The main window during a live observation

See the Live observations section to start coding.

2.4.2 Observation from media file(s)

Click on the **Observation from media file(s)** radio button to create an observation based on one or more media files.

New observation	×
Observation id *	Date and time 2024-05-07 11:01:04.703 *
Description	ndependent variables
	Variable Type Value
Time offset	
O Seconds	
Time value + hour 0 mm:ss.ms 00:00.000 1	
Limit observation to a time interval	
Observation type	
Observation from media file(s)	
Media files Data files	
Player Offset (seconds) Path Duration FPS Video Audio	
Add media * Remove selected media Use media file name as observation id	
□ Visualize the sound spectrogram for the player #1 □ Visualize the waveform for the player #1 □ Us	e the media creation date/time metadata as offset
Scan sampling every (s) 0 🗘 Image display duration (s) 1 🗘	
Stop ongoing state events between successive media files	
	Cancel Save Start

Observation from media files

The Observation from media file(s) tab contains 2 tabs: Media files and Data files.

Click the Media files tab and add one or more media files using the Add media button. You have 3 options:

- with absolute path: the whole media file path will be recorded in the project
- with relative path: the media file path will be recorded relatively to the position of the BORIS project file (the directory of the BORIS project file must be included). This option is useful if you have to have to move your BORIS project file on another computer.
- from directory with absolute path: all the media file found in the directory will be added to the playlist (the whole media file path will be recorded in the project)
- from directory with relative path: all the media file found in the directory will be added to the playlist (the relative media file path will be recorded in the project)

Information about the selected media file will be extracted and displayed in the media list: media file path, media duration, number of frames by second (FPS), the presence of a video stream, the presence of an audio stream.

Media files	Data files					
Player	Offset (seconds)	Path	Duration	FPS	Video	Audio
1 1 -	0	0016_slow.mp4	00:00:15.950	20.00	True	False
Scan samplin	ne sound spectrogram for t	Use media file name as observation id he player #1	1 🔲 Use the medi	a creation da	te/time meta	data as offset

Media files

You can choose to use the media file name as Observation id by clicking the Use media file name as observation id button.

The dropdown list in the first column allow you to choose a player (for a maximum of 8). If you want to observer more media files simultaneously you must use consecutive players (starting from 1). See example below:

M	edia f	iles Data	a files					
		Player	Offset (seconds)	Path	Duration	FPS	Video	Audio
1	1	*	0	video1.mp4	00:02:59.960	25	True	False
2	2	Ŧ	0	video2.mp4	00:02:59.960	25	True	False
3	3	*	0	video3.mp4	00:02:59.960	25	True	False

Media files tab

If you have to synchronize 2 (or more) videos you can use the **Offset column** to indicate when the 2nd player should start. For example if the video loaded in the second player starts 15 seconds after the first video you have to input **15** in the **Offset** cell. If the second video starts before the first player you can set a negative value in the **Offset** cell

If you have to play sequentially many videos you have to select the same player (#1) for all video you have loaded. This means that an event occurring at time $t \sim x \sim$ in the media file queued as second (e.g. second_video.mp4) in the playlist will be scored as happening at time $t \sim 1 \sim + t \sim x \sim$ (where $t \sim 1 \sim$ is the duration of the first media file, e.g. first_video.mp4).

The **Remove selected media** button can be used to remove all the selected media files.

All the media types that can be played by the MPV player can be played in BORIS.

The Use media file name as observation id button will set the first media file name as observation id

Spectrogram visualization

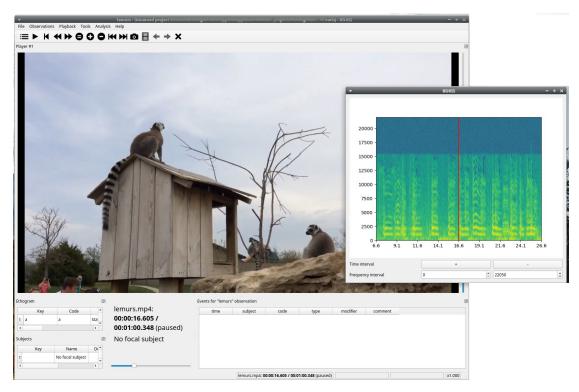
BORIS allow you to visualize the sound spectrogram during the media observation. Activate the **Visualize spectrogram** check box. BORIS will ask you to generate the spectrograms for all media files loaded in the first player.

Please note that the generation of the spectrogram can be long for long duration media files.



Spectrogram generation

The spectrogram visualization will be synchonized to the media position during the observation.



$Spectrogram\ visualization$

Stop all state events between media files

If your media files are not contiguous, you can enable the **Stop ongoing events between successive media files** option to automatically stop state events between media files. This option may be usefull in case of video coding from camera-trap systems, for instance.

Add media - Remove selected media Use media file name as observation id
\Box Visualize the sound spectrogram for the player #1 \Box Visualize the waveform for the player #1
Scan sampling every (s) 0 🗘 Image display duration (s) 1
Stop ongoing state events between successive media files

Stop state events between media files

External data files

Note	
at this time only 2 external data can be plotted with your media file	

You can select one or more external data files to be plotted synchronously with your media. Click the **Data files** tab and use the **Add data file** button to select a data file.

Media files	Data files							
Data files to	plot							
Path	Columns to plot	Plot title	Variable name	Converters	Time interval (s)	Start position (s)	Substract first value	Color
Add data fi	le Add data file w	ithout path Vie	w first rows Sho	w plot Remov	e selected data file			

External data file table

The data files must be plain text files with at least **2** columns separated by a comma or a TAB character. One column must contain a timestamp that will be used to synchronize the plot with the media. The sampling rate can be variable.

Example of a plain text data file with 5 columns separated by comma (,):

```
Display,X Pos,Y Pos,Start Time (secs),Pupil Diameter
1,864,509,549.233,0.00295773451216519
1,863,505,549.25,0.00281810853630304
1,863,503,549.266,0.00287826382555068
1,861,502,549.283,0.0030536837875843
1,858,501,549.3,0.0030626942061484
1,856,499,549.333,0.00305776367895305
[...]
```

In the above example the 4th column contains the timestamp and the 5th the value to be plotted.

Input the index of the column containing the timestamp and the index of the column containing the value to be plotted. The two indices must be separated by a comma (,). Click **OK** to close the window.

7		Data file: eye_tracker.tsv				
	1	2	3	4	5	
1	Display	X Pos	Y Pos	Start Time (secs)	Pupil Diameter	
2	1	864	509	549.233	0.00295773451216519	
3	1	863	505	549.25	0.00281810853630304	
4	1	863	503	549.266	0.00287826382555068	
5	1	861	502	549.283	0.0030536837875843	
Er	nter the column in	dices to plot (time	, value) separated	by comma (,)		
4,	.5					
		Cancel			OK	

Selection of columns (time, value)

A new row will be added in the data files table.

h (Columns to plot	Plot title	Variable name	Converters	Time interval (s)	Start position (s)	Substract first value	Col
		Tiot due	variable name	converters	Time intervar(s)	Start position (3)	Substract mist value	

Data file table

You can modify/complete the following parameters by directly typing in the table cells:

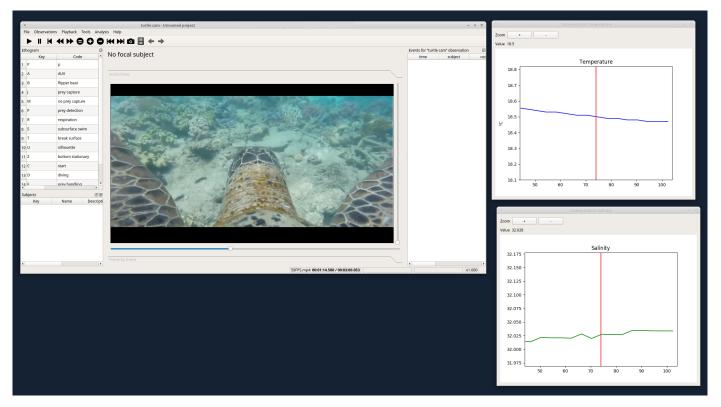
- Columns to plot
- Plot title: the title of the plot
- Variable name
- Converters: Used if the timestamp is not expressed in seconds (see below for details)
- Time interval: The time interval that will be plotted (in seconds)
- Start position: the start position of data for synchronisation with the media (in seconds)
- Substract first value: if the timestamp does not start with a 0 value you can choose to substract the first value to all timestamp values.
- Color: the color of the color

NOTE : if you want to record the value of the plotted variable in a modifier of a behavior (see Value from external data file modifier) the modifier must have the same **variable name**.

You can check if the data from file can be correctly plotted by using the **Show plot** button. If the data are compatible you will see a plot otherwise you will obtain a message with an explanation.

For now only 2 values can be plotted synchronously with your media file. The values can come from the same file or from two different files.

During the observation tha values you have selected in external data files will be plotted synchronously with your media file.



Observation with 2 values plotted from external data files: Temperature and salinity

CONVERTERS

If the values in the timestamp column are not expessed in seconds (like 12.45) but in another format (HH:MM:SS, MM:SS, ISO8601 2018-01-18T12:31:40Z ...) you must use a converter that will convert the current format in seconds.

See the Converters' table in the project configuration.

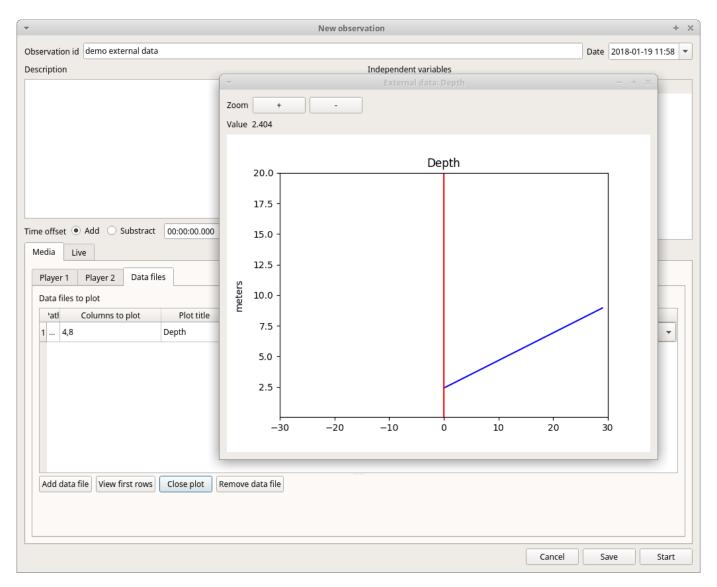
A **double-click** on the converters cell will allow you to select a converter for each column to be plotted

	onverters + ×
Assign conve	None
Column #4:	HHMMSS_2_seconds
Column #8:	ISO8601_to_seconds
	invert_value

Data files to plot

Path	Columns to plot	Plot title	Variable name	Converters	Time interval (s)	Start position (s)
1 /home/user/external_data2.csv	4,8	Depth	meters	{'4': 'HHMMSS_2_seconds'}	60	0

Use the **Show plot** button to verify if your external data can be plotted without problem. The **Close plot** button will close the plot window.



Converters can also be used to convert values that are not time value.

Example of a converter for inverting value:

OUTPUT = - float(INPUT)

Start the observation

Click the **Start** button to start coding. The **Observation** window will be closed and you'll be transferred to the main **BORIS** window. If you do not want to start the observation click the **Save** button. The observation will be saved in the observations list.

The main window during the observation of a single media file will look like this:

	servations Playback				DEMO1 - LEMUR CATTA example of use - 807						
	K 4 1 0 0	0 0 M M	© + → X	∎ ⊑ C	2						
rer #1		_						-20			
							1 1 1				
								4			
gram					0	Events for "DEMO1"	observation	4			
Key	Code	Туре	Description	-	Player paused	Time	observation	Code	Туре	Modifier	Comment
Key v	Purr	Point event	AFFILIATIVE (Macedor	ia 1993)	Player paused videoS1.mp4: 00:02:00.600 /		Subject	Code nead Hanging	Туре	Modifier	Commen
Key v	Purr Chirp	Point event Point event	AFFILIATIVE (Macedon AFFILIATIVE (Macedon	iia 1993) iia 1993)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016	Time 27 00.01.21.459	Subject	neau	Туре	Modifier Male vs male	Commen
Key v v 1	Purr Chirp Approach	Point event Point event Point event	AFFILIATIVE (Macedon AFFILIATIVE (Macedon AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1	Time 27 00:01:21:459 28 00:01:27:919	Subject Toto	Hanging	Type START		Commen
Key v v 1	Purr Chirp Approach Arm-over	Point event Point event Point event Point event	AFFILIATIVE (Macedon AFFILIATIVE (Macedon AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele Kappele	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject	Time 27 00:01:21:459 28 00:01:27:919 29 00:01:38.000	Subject Toto Maurice	Hanging Wave tale			Commen
Key v v 1 2 I	Purr Chirp Approach Arm-over Touch	Point event Point event Point event Point event Point event	AFFILIATIVE (Macedon AFFILIATIVE (Macedon AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	ia 1993) ia 1993) Kappele Kappele	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1	Z7 00:01:21:439 28 00:01:27:919 29 00:01:38.000 30 00:01:48.199	Subject Toto Maurice Toto	Hanging Wave tale Grooming	START		Commen
Key v v 1 2 I	Purr Chirp Approach Arm-over	Point event Point event Point event Point event Point event	AFFILIATIVE (Macedon AFFILIATIVE (Macedon AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject	Zime Time 28 00:01:27:919 29 00:01:38.000 30 00:01:48.199 31 00:01:50.359	Subject Toto Maurice Toto Ciro	Hanging Wave tale Grooming Grooming	START		Comment
Key V 1 2 1 i k	Purr Chirp Approach Arm-over Touch	Point event Point event Point event Point event Point event	AFFILIATIVE (Macedon AFFILIATIVE (Macedon AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 27 00.01.21.433 28 00.01127.919 29 00.01138.000 30 00.01148.199 31 00.0150.359 32 00.0153.546	Subject Toto Maurice Toto Ciro Ciro	Hanging Hanging Wave tale Grooming Grooming Grooming	START START STOP		Commen
Key V V 1 2 1 i è e	Purr Chirp Approach Arm-over Touch Licked by conspecif	Point event Point event Point event Point event Point event State event	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject	Time 2000/121433 28 0001127.919 29 0001138.000 30 0001148.199 31 0001150.359 32 0001153.546 33 000153.546	Subject Totò Maurice Totò Ciro Ciro Totò	Hanging Hanging Wave tale Grooming Grooming Grooming Grooming	START START STOP	Male vs male	Commen
Key V 1 2 1 k	Purr Chirp Approach Arm-over Touch Licked by conspecif	Point event Point event Point event Point event Point event	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 0.01/21/433 28 00.01/21/433 29 00.01/21/4319 30 00.01/48.199 31 00.01/50.359 32 00.01/53.546 33 00.01/53.546	Subject Totò Maurice Totò Ciro Ciro Ciro Totò Maurice	Hanging Hanging Wave tale Grooming Grooming Grooming Anoint tale	START START STOP	Male vs male	Commen
Key v 1 2 1 1 2 2 4 2 2 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Purr Chirp Approach Arm-over Touch Licked by conspecie	Point event Point event Point event Point event Point event Point event State event Description	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira &	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 0.01/21/433 28 00.01/21/433 29 00.01/21/4319 30 00.01/50.359 32 00.01/53.546 33 00.01/53.546 34 00.01/56.120 35 00.020.0559	Subject Totò Totò Totò Ciro Ciro Totò Maurice Ciro	nead Hanging Wave tale Grooming Grooming Grooming Grooming Anoint tale Look away	START START STOP	Male vs male	Commen
Key v 1 2 1 1 2 2 4 2 2 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5	Purr Chirp Approach Approach Arm-over Touch Licked by conspecie	Point event Point event Point event Point event Point event Point event State event Cescription Lemur catta - Male	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & University) Current state() Huddling	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 20000727433 28 0001127.919 29 0001127.919 20 0001138.000 30 0001150.359 32 0001153.546 33 0001150.359 34 0001153.546 35 000200.559 36 0002200.559	Subject Toto Maurice Toto Ciro Ciro Toto Maurice Ciro Ciro	nead Hanging Wave tale Grooming Grooming Grooming Anoint tale Look away Look away	START START STOP	Male vs male	Commen
Key V V 1 2 1 i è e	Purr Chirp Approach Approach Arm-over Touch Licked by conspecie	Point event State event Description Lemur catta - Male	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & Huddling Huddling	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 200007271433 28 00.017271433 28 00.01127.919 29 00.01138.000 30 00.01148.199 31 00.01150.359 32 00.01153.546 33 00.01561.20 35 00.0200.559 36 00.0200.559 37 00.0213.640	Subject Toto Maurice Toto Ciro Ciro Toto Maurice Ciro Ciro Toto Maurice	nead Hanging Wave tale Grooming Grooming Grooming Anoint tale Look away Look away Anoint tale	START START STOP	Male vs male Male vs male Male vs male	Commen
Key V V 1 2 1 i è e	Purr Chirp Approach Approach Arm-over Touch Licked by conspecie	Point event Point event Point event Point event Point event Point event State event Cescription Lemur catta - Male	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & Huddling Huddling	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 0001/21/839 28 0001/21/839 29 0001/21/839 29 0001/38.000 30 0001/48.199 31 0001/50.359 32 0001/50.359 34 0001/50.359 35 0002:00.559 36 0002:01.564 37 00:02:03.594 38 00:02:03.594	Subject Toto Toto Toto Ciro Ciro Ciro Ciro Ciro Ciro Toto Maurice Maurice Maurice	nead Hanging Wave tale Grooming Grooming Grooming Anoint tale Look away Look away Anoint tale Wave tale	START START STOP	Male vs male Male vs male Male vs male	Comment
Key v 1 2 1 i i i i i i i i i i i i i	Purr Chirp Approach Approach Arm-over Touch Licked by conspecie	Point event State event Description Lemur catta - Male	AFFILIATIVE (Macedoi AFFILIATIVE (Macedoi AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & AFFILIATIVE (Pereira & Huddling Huddling	iia 1993) iia 1993) Kappele Kappele t al 1988)	Player paused videoS1.mp4: 00:02:00.600 / 00:06:36.066 frame: 3016 media #1 / 1 No focal subject Observed behaviors:	Time 20001/21/839 28 0001/21/839 29 0001/21/839 29 0001/80,199 30 0001/150,3546 34 0001/55,3546 35 0000/00000000000000000000000000000000	Subject roco Totò Ciro Ciro Ciro Totò Ciro Ciro Ciro Ciro Ciro Ciro Ciro Ciro	Head Hanging Wave tale Grooming Grooming Grooming Anoint tale Look away Anoint tale Wave tale Threat	START START STOP	Male vs male Male vs male Male vs male	Comment

The main window during the observation of one video

See the media coding section to start coding.

2.4.3 Observation from pictures

Click on the **Observation from pictures** radio button to create an observation based on pictures.

V	New observation					×
Observation id *			Date an	d time 2022-	09-05 16:3	38:40 -
Description		Independent va	ariables			
		Variable	Туре	Va	alue	^
		1 Location	text	44° 55′ 59″ N	N - 7° 25′ 1	18″ E
		2 Weather	value from set	sun		-
	nh:mm:ss e seconds	3 Temperature	numeric			
Limit observation to a time interval		4 Visitors	numeric			¥
Observation type						
\odot Observation from media file(s) \odot Live observation \odot Observation	ervation from pictures					
					Add dired	tory
				R	emove dir	rectory
Use the pictures directory as observation id						
Time						
● No time ○ Use the EXIF DateTimeOriginal tag ○ Time la	pse (s) 0.000					
				Cancel	Save	Start

Observation from pictures tab

Use the **Add directory** to select a directory containing the pictures you want to code. You can select many directories, in this case the pictures will be browsed in the order of the directories were added.

The Use the pictures directory as observation id button will set the directory name as observation id

Time

You have 3 option for the coding time:

- No time: no time will be recorded. The image index (the position of image in the directory) and the image file path will be recorded.
- Use the EXIF DateTimeOriginal tag: the time will be extracted from the EXIF tag of the picture file (if any).
- Time lapse: this option will let you define the time interval between the pictures.

Start the observation

Click the **Start** button to start coding. The **Observation** window will be closed and you\'ll be transferred to the main **BORIS** window. If you do not want to start the observation click the **Save** button. The observation will be saved in the observations list.

	Events for "tim	e lapse" obse	ervation					
	time	subject	code	type	modifier	comment	image index	image path
Image index: 10 / 4499	1 20.000		Rest	START			1	/data/tmp/img/img_0001.jpg
Dise store a fels to floor a first a	2 100.000		Rest	STOP			5	/data/tmp/img/img_0005.jpg
Directory: /data/tmp/img File name: img_0010.jpg	3 200.000		Sleep	START			10	/data/tmp/img/img_0010.jpg
No focal subject								

The main window during the coding of a picture directory

See the media coding section to start coding.

2.4.4 Various options

Scan sampling (Live and media observation)

You can select a time for **Scan sampling** observation. In this case the timer will stop at every time offset you indicated and all the coded events will have the same time value.

Limit observation to a time interval (Live and media observation)

This option can be used to limit the observation to a time interval for live or media based observations.

✓ Limit of	bservati	on to	a time interval	
Media	Live		✓ Start observation at	÷×
Media	files	Data	Start observation at	
	Player		+ 0 (*): 00 (*): 00 (*) (•) hh:mm:ss (seconds
1 1		•	Cancel	ОК

2.5 Observations list

The **Observations > Observations list** will show you all the observations contained in the current BORIS project.

The following values are displayed:

- the observation id (id)
- the **description** of observation
- the coded subjects (subjects)
- the observation duration (as the difference between the last recorded event and the first one)
- the percent of **exhaustivity** of the coding (as the sum of the length of the coded events divided by the observation duration)
- the media file path, LIVE in case of live observation, the pictures directory path in case of observation from pictures
- the values of the independent variables (if defined)

id			•								
	id 🔻	date	description	subjects	observation duration	exhaustivity %	media	Location	Weather	emperatur	Visitors
	0001_a	2016-05-17 00:00:31	Vegetation	Himal, Nautilus	32.400	100.0	#1: 20160517162539.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
	0001_b	2016-05-17 00:00:31	Vegetation	Himal, Nautilus	32.400	98.5	#1: 20160517162539.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
	0002	2016-05-17 00:00:24	Vegetation	Sharky, Himal, Nautilus	34.470	89.6	#1: 20160517162540.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
	0003	2016-05-17 00:00:05	Vegetation	Sharky, Himal, Nautilus, Nina	22.500	87.1	#1: 20160517162641.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
	0004	2016-05-17 00:00:59.000	Central trunks	Sharky, Himal, Nautilus, Nina	50.697	72.9	#1: video1.mp4	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
	0005	2016-05-17 00:00:49	In the pool	Sharky, Nautilus	40.770	100.0	#1: 20160517163131.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
	0006	2016-05-17 00:00:42	In the pool	Sharky, Himal, Nautilus	61.830	73.3	#1: 20160517163231.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
	0007	2016-05-17 00:00:13	In the pool	Sharky, Himal, Nina	124.986	41.3	#1: 20160517163347.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
	0008	2016-05-17 00:00:17	In the pool	Sharky, Himal, Nautilus	64.800	85.1	#1: 20160517163743.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
0	0009	2016-05-17 00:00:10	In the pool	Sharky, Himal, Nina	46.277	84.6	#1: 20160517163927.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
1	0010	2016-05-17 00:00:57	Area near the glass window	Sharky, Himal, Nautilus	16.779	81.1	#1: 20160517164021.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
2	0011	2016-05-17 00:00:50	Area near the glass window	Sharky, Himal, Nautilus, Nina	25.101	49.1	#1: 20160517164106.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
3	0012	2016-05-17 00:00:45	Area near the glass window	Sharky, Nautilus, Nina	78.210	62.4	#1: 20160517164204.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
4	0013	2016-05-17 00:00:25	Central trunks	Sharky, Himal, Nautilus, Nina	63.631	66.2	#1: 20160517164715.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
5	0014	2016-05-17 00:00:52	In the pool	Sharky, Himal, Nautilus, Nina	242.596	53.5	#1: 20160517164927.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
6	0015	2016-05-17 00:00:18	Central trunks	Sharky, Himal, Nautilus, Nina	111.302	49.7	#1: 20160517165631.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046

The observations can be sorted by clicking in the desired column header (alphabetic order ascending or descending).

2.5.1 Checking the observations

The status of observation is displayed in the first column (**id**). If the background of this column is **red** the observations has one or more UNPAIRED state events. These UNPAIRED observations will not be analyzed. See Fix unpaired state events for details.

id		▼ contains	5 •			
	id 🔻	date	description	subjects	observation duration	exhaustivity %
1	0001_a	2016-05-17 00:00:31	Vegetation	Himal, Nautilus	32.400	100.0
2	0001_b	2016-05-17 00:00:31	Vegetation	Himal, Nautilus	32.400	98.5
3	0002	2016-05-17 00:00:24	Vegetation	Nautilus, Himal, Sharky	34.470	89.6
L.	0003	2016-05-17 00:00:05	Vegetation	Sharky, Nina, Himal, Nautilus	22.500	87.1
5	0004	2016-05-17 00:00:59	Central trunks	Sharky, Nina, Himal, Nautilus	50.697	72.9
,	0005	2016-05-17 00:00:49	In the pool	Nautilus, Sharky	40.770	100.0
	0006	2016-05-17 00:00:42	In the pool	Sharky, Himal, Nautilus	61.830	73.3
3	0007	2016-05-17 00:00:13	In the pool	Nina, Himal, Sharky	124.986	43.5
)	0008	2016-05-17 00:00:17	In the pool	Nautilus, Himal, Sharky	64.800	85.1
0	0009	2016-05-17 00:00:10	In the pool	Nina, Himal, Sharky	46.277	84.6
1	0010	2016-05-17 00:00:57	Area near the glass window	Nautilus, Himal, Sharky	16.779	81.1
2	0011	2016-05-17 00:00:50	Area near the glass window	Nina, Nautilus, Himal, Sharky	25.101	49.1
13	0012	2016-05-17 00:00:45	Area near the glass window	Nina, Nautilus, Sharky	78.210	62.4
4	0013	2016-05-17 00:00:25	Central trunks	Sharky, Nina, Himal, Nautilus	63.631	66.2
5	0014	2016-05-17 00:00:52	In the pool	Nina, Nautilus, Himal, Sharky	242.596	53.5
16	0015	2016-05-17 00:00:18	Central trunks	Sharky, Nina, Himal, Nautilus	111.302	49.7

2.5.2 Filtering the observations

The observations list can be filtered selecting a field and a condition in the drop-list boxes.

In the following example observations are filtered: only observations with **description** containing the **In the pool** subject are shown:

de	scriptior	contains		in the pool				
uc	id 🔻	date			media	Location	Weather	Tomoreture
1	0005	2016-05-17 00:00:49	description In the pool	subjects Sharky, Nautilus	#1: 20160517163131.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	Temperature
-	0006	2016-05-17 00:00:42	In the pool	Sharky, Nautilus, Himal	#1: 20160517163231.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	24
3	0007	2016-05-17 00:00:13	In the pool	Nina, Sharky, Himal	#1: 20160517163347.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	25
4	8000	2016-05-17 00:00:17	In the pool	Sharky, Nautilus, Himal	#1: 20160517163743.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
5	0009	2016-05-17 00:00:10	In the pool	Sharky, Nina, Himal	#1: 20160517163927.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	25
6	0014	2016-05-17 00:00:52	In the pool	Nina, Sharky, Nautilus, Himal	#1: 20160517164927.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
7	0185	2016-05-28 00:00:23	In the pool	Nina, Sharky, Nautilus	#1: 20160528124413.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
8	0212	2016-05-31 00:00:53	In the pool	Sharky	#1: 20160531104533.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
9	0217	2016-05-31 00:00:49	In the pool	Nina, Himal	#1: 20160531145324.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
10	0220	2016-05-31 00:00:36	In the pool	Sharky, Nina, Nautilus, Himal	#1: 20160531153747.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
11	0359	2016-06-06 00:00:54	In the pool	Nina, Sharky, Nautilus, Himal	#1: 20160606163758.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
12	0411	2016-06-07 00:00:53	In the pool	Nina, Nautilus	#1: 20160607103354.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
13	0412	2016-06-07 00:00:21	In the pool	Nautilus	#1: 20160607103630.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E		
4								•

Observations list

Observations can be filtered with **Independent variables** values.

The following example displays only the observations that do not contain "Sunny" in the Weather independent variable :

~			_	_		Observations list -	BORIS			÷
1430	observa	tions								
Wea	ther	•	does not contain	•	sun					
	id 🔻		date	description	1	subjects	media	Location	Weather	Temperature
1	8000	2016-	05-17 00:00:17	In the pool		Sharky, Nautilus, Himal	#1: 20160517163743.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
2	0010	2016-	05-17 00:00:57	Area near the glass w	indow	Sharky, Nautilus, Himal	#1: 20160517164021.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
3	0011	2016-	05-17 00:00:50	Area near the glass w	indow	Sharky, Nina, Nautilus, Himal	#1: 20160517164106.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
4	0013	2016-	05-17 00:00:25	Central trunks		Nina, Sharky, Nautilus, Himal	#1: 20160517164715.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
5	0014	2016-	05-17 00:00:52	In the pool		Nina, Sharky, Nautilus, Himal	#1: 20160517164927.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
6	0015	2016-	05-17 00:00:18	Central trunks		Nina, Sharky, Nautilus, Himal	#1: 20160517165631.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
7	0016	2016-	05-17 00:00:58	Central trunks		Nina, Sharky, Nautilus, Himal	#1: 20160517165923.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
8	0017	2016-	05-17 00:00:37	Suspended trunks		Nina, Sharky, Nautilus, Himal	#1: 20160517170018.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
9	0018	2016-	05-17 00:00:18	Central trunks		Nina, Himal	#1: 20160517170259.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
10	0019	2016-	05-17 00:00:23	Central trunks		Sharky, Nina, Nautilus, Himal	#1: 20160517170519.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
11	0020	2016-	05-25 00:00:24	Indoor entrance		Nina, Himal	#1: 20160525145403.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
12	0021	2016-	05-25 00:00:47	Indoor entrance		Sharky, Himal	#1: 20160525145814.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
13	0022	2016-	05-25 00:00:30	Indoor entrance		Nina, Himal	#1: 20160525150240.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E		
4										•
								Cancel Start	View	Edit

Observations list

Observations with a value of **Temperature** independent variable between 18 and 22:

100	bservat	tions						
Ten	nperatu	ure 👻 between (us	e and to separate terms) 🔻	24 and 26				
	id 🔻	date	description	subjects	media	Location	Weather	Temperature
1 (0001_a	2016-05-17 00:00:31	Vegetation	Nautilus, Himal	#1: 20160517162539.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25
2 (0001_b	2016-05-17 00:00:31	Vegetation	Nautilus, Himal	#1: 20160517162539.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	26
3 (0002	2016-05-17 00:00:24	Vegetation	Sharky, Nautilus, Himal	#1: 20160517162540.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	24
1 (0003	2016-05-17 00:00:05	Vegetation	Nina, Sharky, Nautilus, Himal	#1: 20160517162641.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	25
5 (0004	2016-05-17 00:00:59	Central trunks	Sharky, Nina, Nautilus, Himal	#1: 20160517162952.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	26
5 (0005	2016-05-17 00:00:49	In the pool	Sharky, Nautilus	#1: 20160517163131.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	24
7 (0006	2016-05-17 00:00:42	In the pool	Sharky, Nautilus, Himal	#1: 20160517163231.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	24
в	0007	2016-05-17 00:00:13	In the pool	Nina, Sharky, Himal	#1: 20160517163347.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	25
9 (0009	2016-05-17 00:00:10	In the pool	Sharky, Nina, Himal	#1: 20160517163927.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	25
10 (0012	2016-05-17 00:00:45	Area near the glass win	dow Sharky, Nina, Nautilus	#1: 20160517164204.m2ts	44° 55′ 59″ N – 7° 25′ 18″ E	sun	26
4								

Observations list

Observations with a value of $\ensuremath{\textit{Visitors}}$ independent variable greater than 1000:

× .			_	_	Observations list - 80	RI5	_	_	_	_	$\dot{\mathbf{v}}$
825	observations										
Vis	itors 👻	>	v	1000							
	id	date	de	scription	subjects	1edi ▼	Location	Weather	Temperature	Visitors	
4	0003	2016-05-17 00:00:05	Vegetation		Nina, Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046	
5	0004	2016-05-17 00:00:59	Central trun	ks	Sharky, Nina, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046	
6	0005	2016-05-17 00:00:49	In the pool		Sharky, Nautilus	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046	
7	0006	2016-05-17 00:00:42	In the pool		Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046	
8	0007	2016-05-17 00:00:13	In the pool		Nina, Sharky, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046	
9	0008	2016-05-17 00:00:17	In the pool		Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	
10	0009	2016-05-17 00:00:10	In the pool		Sharky, Nina, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046	_
11	0010	2016-05-17 00:00:57	Area near th	e glass window	Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	
12	0011	2016-05-17 00:00:50	Area near th	e glass window	Sharky, Nina, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	
13	0012	2016-05-17 00:00:45	Area near th	e glass window	Sharky, Nina, Nautilus	#1:	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046	
14	0013	2016-05-17 00:00:25	Central trun	ks	Nina, Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	
15	0014	2016-05-17 00:00:52	In the pool		Nina, Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	
16	0015	2016-05-17 00:00:18	Central trun	ks	Nina, Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	
17	0016	2016-05-17 00:00:58	Central trun	ks	Nina, Sharky, Nautilus, Himal	#1:	44° 55′ 59″ N - 7° 25′ 18″ E			1046	

Observations list

2.5.3 Delete observations

The observations can be deleted from the project using the following procedure: **File > Edit project > Observations**

Select all the observations you want to remove.

Click the **Remove selected observations** button and confirm the deletion.

Please note that the deletion is irreversible, the deleted observations can not be restored.

2.5.4 Import observations

The **Observations** > **Import observations** option allows to import observations. Two formats are available for importing observations:

From a BORIS project file

Choose the BORIS project file and then the observations to import. BORIS will check if observations with same id are already existing in the current project. BORIS will also check if behaviors and/or subjects used in the imported observations are not defined in the current project.

From a spreadsheet file

Observations can be imported from: - OpenDocument (ODS) - Microsoft-Excel (XLSX)

Choose the spreadsheet file

2.6 Coding

When looking at the BORIS main window, the window title bar shows the **Observation id** - **Project name** - **BORIS**. The media (the first in the queue) will be loaded in the media player and paused.

2.6.1 Media based coding

The toolbar



The toolbar can be resized using the **Preferences > Interface** option.

The media can also be controlled by special keyboard keys:

Page Up Switch to the next media
Page Down switch to the previous media
Up Jump forward in the current media
Down Jump backward in the current media
Thome Increase the playback speed (See general preferences to set the step value)
End Decrease the playback speed (See general preferences to set the step value)
Backspace Set the playback speed to 1x

← Left Go to the previous frame

 \rightarrow Right Go to the next frame

2.6.2 Live observations

During a live observation the media control toolbar is disabled.

Press the **Start live observation** button to start your observation. If some events are already coded BORIS will ask you for deleting them.

A timer will be displayed. The events will be recorded in the events widget.

*		ol	No. do e olo se	Table Archai	11-1-	live observation - Test project* - BORIS							- +	×
		Observations F	Playback	Tools Analysis										
			80			∃ Ŀ ılı & Q #i ↔								-
Etho	ogram				0		EV	ents for "live o						Ø
-			Code	Туре	Description ^		-	Time	-			Modifier	Comme	nt
1		Tear		State event	Otter tears off	00.00.25 002	1	00:00:00.000			START			
2	C	Chas		State event	Otter chases	00:00:35.893	-	2 00:00:08.387			STOP			
3	I	Inter	act with	State event	Otter interacts		3	3 00:00:13.859	Himal	Chase	START	None		
4	R	Rub		State event	Otter rubs and									
5	C	Carry	objects	State event	Otter carries									
6	S	Sniff		State event	Otter moves t									
7	L	Loco	motion	State event	Otter moves									
8	s	Spot	keeper	State event	Otter spots th 👻									
4					•									
Sub	jects				۵									
	Key	Name		Description	Current state(s)									
1		No focal subject												
2	N	Nina	Female, a	dult, born on										
3	Н	Himal	Male, adu	ılt, born on	Chase (None)									
4	С	Sharky	Male, juva	anile, born on										
5	S	Nautilus	Male, juva	anile, born on		Focal subject: Himal								
						Observed behaviors: Chase (None)								
						Stop live observation								

2.6.3 Ethogram table in the main window

	Key	Code	Type	Description	Color	Category	Modifiers	Excluded
1	т	Tear	State event	Otter tears off vegetation			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
2	C	Chase	State event	Otter chases other animals			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
3	I	Interact with	State event	Otter interacts with enrichment			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
4	R	Rub	State event	Otter rubs and rolls itself upon a surface; may be			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
5	С	Carry objects	State event	Otter carries objects or food by holding them			{'0': {'name': '', 'type': 0,	Alert, Allogroom, Breed, Chase, Defecate, Dig, Drink, Eat, In
6	s	Sniff	State event	Otter moves the nose and head movement back			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
7	L	Locomotion	State event	Otter moves from place to place			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
8	s	Spot keeper	State event	Otter spots the keeper in or out the enclosure			{'0': {'name': '', 'type': 0,	Alert,Allogroom,Breed,Carry
9	A	Alert	State event	Otter is stationary and directs its attention toward				Allogroom,Breed,Carry
10	Q	Allogroom	State event	Otter licks or scratches with forepaws or hind-paw				Alert,Breed,Carry
11	D	Dig	State event	Otter uses front legs to move sand, stones on the				Alert,Allogroom,Breed,Carry

The **Ethogram** table provide the user with the list of behaviors defined in the **Ethogram**. It can be used to record an event by double clicking on the corresponding row. The **Key** column indicates the keyboard key assigned to each behavior (if any). Pressing a key will record the corresponding behavior (that will appear in the **Events** table).

The behaviors shown in the ethogram widget can be filtered:

Right-click on ethogram widget > Filter behaviors

Check/Uncheck single behaviors or double-click on the behavioral category.

 Select the behaviors to show in the ethogram table 	×
Behaviors to show in ethogram list	
Select all Unselect all Reverse selection	
physiology	
✓ Eat	
✓ Defecate	
✓ Drink	
✓ Rest	
✓ Urinate	
✓ Vomit	
social	
✓ Play on the ground	
✓ Play in the water	
reproduction	
✓ Breed	
No category	
✓ Tear	
✓ Chase	
 Interact with enrichment 	
✓ Rub	
✓ Carry objects	
✓ Sniff	
✓ Locomotion	
✓ Spot keeper	
✓ Alert	
✓ Allogroom	
✓ Dig	
✓ Look for food	
✓ Manipulate	-
Pollobiacts	
Cancel OK	

2.6.4 **Subjects** table in the main window

Subjects

	Key	Name	Description	Current state(s)
1		No focal subject		
2 1	N	Nina	Female, adult, born on 10/03/2013 in Ostrava biopark (Czech Republic), bright white snout	
3 I	н	Himal	Male, adult, born on 04/30/2014 in Amneville biopark (France), larger tale, bigger than the others	
4 (С	Sharky	Male, juvanile, born on 10/30/2015 in Zoom biopark (Italy), bright brown nose and fur	
5 5	s	Nautilus	Male, juvanile, born on 10/30/2015 in Zoom biopark (Italy), dark brown nose and fur	

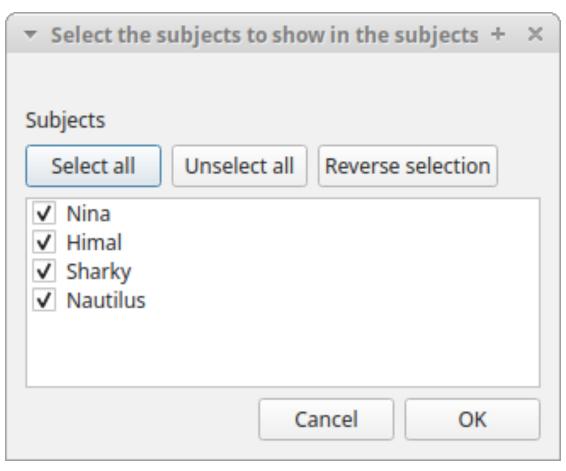
The subjects table in main window

The **Subjects** widget provide the user with the list of subjects defined in the **Subject** tab in the **Project** window. It can be used to add information about the focal subject on the recorded behaviors by double clicking on the corresponding row. When a subject is selected his/her name appears above the media player. The **Key** column indicates the keyboard key assigned to each subject (if any).

The subjects shown in the subjects widget can be filtered:

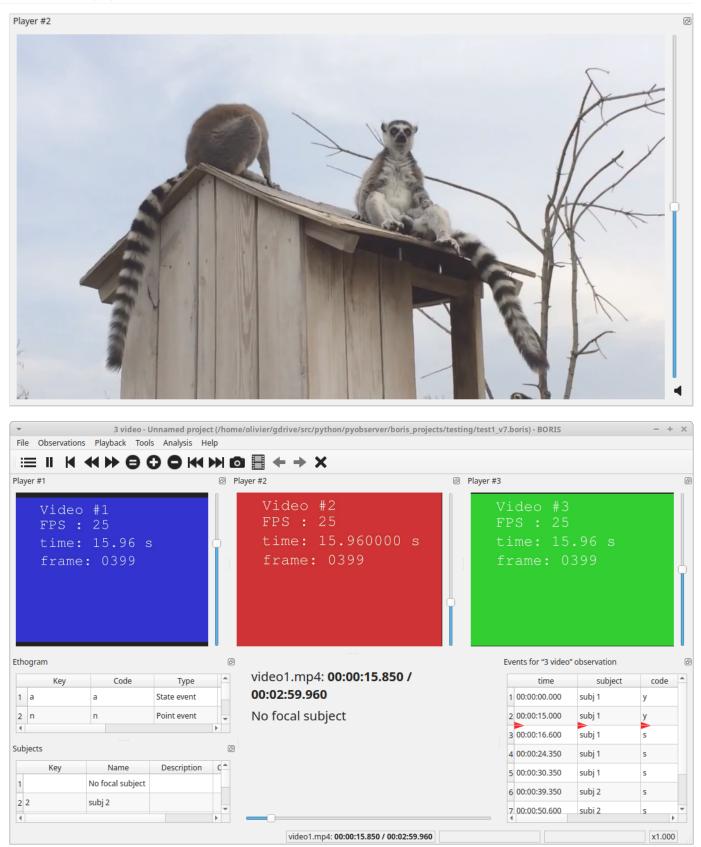
Right-click on subjects widget > Filter subjects

Check/Uncheck the subjects to show/hide them on the subjects' table.



Filter subjects in subjects table

2.6.5 The media player



You can adjust the media position with the horizontal slider. Each media player is equipped with its own audio volume control, which can be adjusted using the vertical slider located on the right side of the player and a mute/unmute button for easy sound management.

- 50/127 -

The arrangement of different widgets can be personalized to suit your preferences. In the screenshot provided, all widgets are detached from the main program window. This feature is particularly useful when using a multi-monitor setup.

and the second se	and the second			Provide la								17
		Unnamed projec							+	×		33
	100 C	vations Playbac						P	ayer #3		Ø	ANT
	■ = ►	₩ ₩ ₩	80	● 🖛 🍽	•		- → × -				9780	A.
Player #1 © Video #1 FPS: 25 time: 30.64 s frame: 0766	1000	video1.mp4: 00:00:30.600 / 00:02:59.960 (paused) No focal subject							Video #3 FPS : 25 time: 30.64 s frame: 0766			
Liame. 0700												
	1	video1.mp4: 00	:00:30.600 / (00:02:59.960 (pa	aused)	A REAL PROPERTY.						
			and the second			ç	ubjects		0	15.18 Mar		100
	Et	hogram			0	X	Key	Name	Description	Events for "3 video		Ø
	Server & The Party	Key	Code	Type	-		1	No focal subject		time	subject	^
Player #2	Ø	1 a	a	State event		Carlos Sala	2 2	subj 2		1 00:00:00.000	subj 1	У
Video #2		2 n	n	Point event		E.	3 1	subj 1	di la	2 00:00:15.000	subj 1	У
FPS : 25	Distance -	3 p	p	Point event		76	4 z	z	10	3 00:00:16.600	subj 1	s
time: 30.640000 s	100 C	4 s	r e	State event				-		4 00:00:24.350	subj 1	s
frame: 0766		5 x	3		- 1	A.S.				5 00:00:30.350	subj 1	s
fildne. 0700			x	Point event	- 18		4			6 00:00:39.350	subj 2	s 🕶
		6 X	x	Point event			20th	mint	1 Parts	1		•
						A. 1.			X			
		Ver	0.00	A CONTRACT	True !	2	all and	Prost	maning	1 P 100	the match	R. Sails

2.6.6 The events table

The **events table** shows all the recorded behaviors (events).

The displayed parameters (organized in columns) depend of the type of the observation:

Observation from media file

Events for "0004" observation

	Time	Frame index	Subject	Code	Туре	Modifier	Comment
1	00:00:08.253	207	Himal	Locomotion	START	Run	
2	00:00:08.329	209	Nautilus	Locomotion	START	Run	
3	00:00:10.400	260	Sharky	Swim	START		
4	00:00:11.779	295	Himal	Locomotion	STOP	Run	
5	00:00:12.778	320	Nina	Alert	START		
6	00:00:13.789	345	Nautilus	Locomotion	STOP	Run	
7	00:00:13.790	345	Nautilus	Locomotion	START	Walk	
8	00:00:14.348	359	Himal	Locomotion	START	Jump	
9	00:00:14.660	367	Nina	Alert	STOP		
10	00:00:14.865	372	Nautilus	Locomotion	STOP	Walk	
11	00:00:14.866	372	Nautilus	Locomotion	START	Jump	
12	00:00:15.001	375	Nina	Rest	START		
13	00:00:16.467	412	Himal	Locomotion	STOP	Jump	

The following paramters are displayed:

- Time, the time at which the event occurred;
- Frame index the frame index corresponding to the event;
- **Subject**, the focal subject (if any);
- Code, the behavior code;
- Type, in case of a state event indicates whether the time corresponds to the start or to the stop. Empty for a point event;
- Modifier, indicates the modifier(s) that was(ere) selected (if any);
- **Comment**, is an open field where the user can add notes.

A tracking cursor (red triangle) will visualize the current event. This cursor can be positioned above the current event, see tracking cursor position option in **Preferences** window.

A double-click on a row will reposition the media player to the moment of the corresponding event. See Time offset for media reposition in **Preferences** window to customize the time offset for media repositioning.

Live observation

_	Time	Subject	Code	Туре	Modifier	Comment
1	00:00:01.248	Nina	Alert	START		
2	00:00:15.664	Himal	Manipulate	START		vegetables
3	00:00:22.857	Himal	Manipulate	STOP		
4	00:00:24.841	Himal	Roll objects	START		
5	00:00:29.985	Himal	Roll objects	STOP		
6	00:00:38.009	Nina	Alert	STOP		
7	00:00:41.577	Sharky	Stomp	START		
8	00:00:49.105	Sharky	Stomp	STOP		

The following paramters are displayed:

- Time, the time at which the event occurred;
- Subject, the focal subject (if any);
- Code, the behavior code;
- Type, in case of a state event indicates whether the time corresponds to the start or to the stop. Empty for a point event;
- Modifier, indicates the modifier(s) that was(ere) selected (if any);
- **Comment**, is an open field where the user can add notes.

Observation from pictures Events for "cometro trap" observation

	Time	Subject	Code	Туре	Modifier	Comment	Image index	Image path
1	NA		Coleoptera		None Bostrichoidea Cerambycidae Lagriinae Anthaxia None Cetonia aurata None None None		1	/data//08010001.JPG
2	NA		Diptera		Brachycera None Conopidae Eristalinae Chrysotoxum None Cheilosia impressa None None None		2	/data/ /08010002.JPG
3	NA		Hymenoptera		None Apoidea Cephidae Arginae Anthidiellum Bombus s.s. Bombus distinguendus None None None		3	/data/ /08010003.JPG
4	NA		Lepidoptera		Macroheterocera None Geometridae Dismorphiinae Albulina None Anarta melanopa None None None		4	/data/ /08010004.JPG
5	NA		Others		flower_on		5	/data/ /08010005.JPG
6	NA		Hymenoptera		None Cephoidea Argidae Cephinae Andrena Ashtonipsithyrus Bombus bohemicus None None None		6	/data/ /08010006.JPG

The following paramters are displayed:

- Time, the time at which the event occurred;
- Subject, the focal subject (if any);
- Code, the behavior code;
- Type, in case of a state event indicates whether the time corresponds to the start or to the stop. Empty for a point event;
- Modifier, indicates the modifier(s) that was(ere) selected (if any);
- Comment, is an open field where the user can add notes;
- Image index, the image index (in the directory) corresponding to the event,
- Image path, the path of the image corresponding to the event (can be relative or absolute).

To simplify the events table the relevant behaviors and subjects can be filtered see Filter events

2.6.7 Events

Recording an event

An event is a unique combination of a time, a subject and a behavior. If the subject is not set it will be No focal subject.

Once ready to begin your coding, you can start the media player using the **Play** button or the **Space bar**.

An **event** can be recorded by:

- pressing the predefined **key** of the keyboard corresponding to the behavior to record.
- double-clicking to the corresponding row in the **Ethogram** table.
- using the **Coding pad** (See coding pad).

The **focal subject** can be selected by:

- pressing the predefined key of the keyboard corresponding to the subject to select.
- double-clicking to the corresponding row in the **Subects** table.
- using the Subject pad (See subject pad).

Project Observations Playback Tools Analysis Help

	Key	Code	Туре	Description	Color	Category	Modifiers	Excluded	f
1 t		Tear	State event	Otter tears off vegetation			{'0': {'name': ",	Alert,Allogroom,Breed,Carry	
2 C		Chase	State event	Otter chases other animals			{'0': {'name': ",	Alert,Allogroom,Breed,Carry	
3 i		Interact with	State event	Otter interacts with enrichment			{'0': {'name': ",	Alert,Allogroom,Breed,Carry	
4 r		Rub	State event	Otter rubs and rolls itself upon			{'0': {'name': ",	Alert,Allogroom,Breed,Carry	
5 C		Carry objects	State event	Otter carries objects or food b			{'0': {'name': '',	Alert,Allogroom,Breed,Chase,Defecate,Dig	
6 S		Sniff	State event	Otter moves the nose and hea			{'0': {'name': '',	Alert,Allogroom,Breed,Carry	
7 I		Locomotion	State event	Otter moves from place to place			{'0': {'name': '',	Alert,Allogroom,Breed,Carry	
8 S		Spot keeper	State event	Otter spots the keeper in or o			{'0': {'name': '',	Alert,Allogroom,Breed,Carry	
9 a		Alert	State event	Otter is stationary and directs				Allogroom,Breed,Carry	
10 q		Allogroom	State event	Otter licks or scratches with				Alert,Breed,Carry	
11 d		Dig	State event	Otter uses front legs to move				Alert,Allogroom,Breed,Carry	
12 f		Look for food	State event	Otter looks for food in the				Alert,Allogroom,Breed,Carry	

Subjects

Key	Name	Description	Current state(s)
	No focal subject		
2 n	Nina	Female, adult, born on 10/03/2013 in Ostrava biopark (Czech Republic), bright white snout	
3 h	Himal	Male, adult, born on 04/30/2014 in Amneville biopark (France), larger tale, bigger than the others	
4 c	Sharky	Male, juvanile, born on 10/30/2015 in Zoom biopark (Italy), bright brown nose and fur	
5 s	Nautilus	Male, juvanile, born on 10/30/2015 in Zoom biopark (Italy), dark brown nose and fur	

Ethogram and subjects widgets

If the pressed key defines a single event, the corresponding event will be recorded directly in the **Events** table. In the case you have specified the same key for two (or more) events (e.g. key **d** in the figure below), BORIS will prompt you for the desired behavior.

ര

*	BORIS	- + ×
	y codes more behavio he correct one:	rs.
Defecat	e - Otter eliminates fe	cal matter (Etho
_	ter uses front legs to r Otter consumes water	
		P
	Cancel	
	ОК	

Ask for a behavior

In the case you have specified modifiers (one or more sets), BORIS will prompt you for the desired modifier(s) if any (e.g. **ball** or **opponent** in the figure below). You can select the modifiers using the mouse or the keyboard (1, 2, 3, 4, 5 or 6 key)

▼ [ORIS - + ×						
Choose the modifiers for Eat behavior							
Modifier	Modifier						
None Alone (1) In group (2)	None Fish (3) Worms (4) Carrots (5) Kibbles (6)						
	Cancel OK						

Ask for modifiers

If no keys are defined for the modifier selection, you can type the first character of the modifier and use the **Up arrow** and **Down arrow** keyboard keys to select the correct modifier.

In the case your behavior type is a **Point event with coding map** or a **State event with coding map**, BORIS will show the **Coding map** window and will allow selecting the desired area(s). In case you click a part of the map in which two (or more) areas overlap, the corresponding codes will be recorded.

A recorded event can be edited (once selected) using the **Observations** > **Edit event** menu option. The resulting *Edit event parameters* allows modifying every parameter (e.g. time, subject, code, modifiers, and comment).

The **Observations > Add event** menu option allows adding a new event by specifying its time and the other parameters.

The Events table context menu

Some functions are available in the Events table context menu. Righ-click on the Events table and the menu will pop-up.

Add event	Ctrl+A
Edit selected event(s)	
Shift time of selected event(s)	
Copy events	
Paste events	
Find in events	
Find/replace in events	
Filter events	
Show all events	
Check state events	
Fix unpaired events	Ctrl+U
Add frame indexes	
Run external program with selected event(s)	
Delete selected events	

The various functions available in the menu are described below. The same functions and others are available in the **Observations** menu.

Undo an even recording

A wrong event can be removed from the events list using the **Undo** function $(\underline{\ ctrl} + \underline{z})$. You can go back till 25 events recorded events.

Add event

This option allows adding a new event by specifying its time and the other parameters.

*	Add a new event	×
O Seconds	s O hh:mm:ss O Date time	Set to current time
Subject 🗨 Code Alert	•	
Comment		
	Cano	cel ОК

Add a new event

Select a time format and imput the time value.

Select the ${\bf subject}$ from the drop-down menu or leave empty for ${\bf No}\ {\bf focal}\ {\bf subject}.$

Select the ${\bf behavior}$ from the drop-down menu.

Edit selected event(s)

This option allows to edit the selected event(s). When many events are selected you have to choose the field to edit between **Subject**, **Behavior** and **Comment**. In this case the new value will apply to all selected events.

time	subject	code	type	modifier	comment						
1 0.000	Himal	Tear	START	Branches							
2 0.000	Nautilus	autilus Tear START		Branches							
3 30.199	Himal	Tear	STOP	Branches							
4 30.200	Himal	Locomotion	START	Walk							
5 32.400	Himal	Locomotion	STOP	Walk							
6 32.400 Nautilus Tedit selected events + X											
		 Subject Behavior New value Nina Himal Sharky Nautilus Comment New comment Cancel 		OK							

Edit time of selected event(s)

This option allows to add or subtract a time value (in seconds) to all selected events. For subtracting a value use a negative value.

	time	subject	code	type	modifier	comment
1	0.000	Himal	Tear	START	Branches	
2	0.000	Nautilus	Tear	START	Branches	
3	30.199	Himal	Tear	STOP	Branches	
4	30.200	Himal	nal Locomotion START Wa		Walk	
5	32.400	Himal	Himal Locomotion STOP		Walk	
6	32.400	Nautilus	Tear	STOP	Branches	
	Value to a -10.200	Time value add or subtract (us <u>× C</u> ancel	\$			

Copy events

This option allows to copy the selected events in the clipboard. The clipboard will contain the values of the selected events (except the **type** field) separated by a **<TAB>** character. The copied values are: **Time**, **Subject**, **Behavior**, **Modifier(s)**, **Frame index**

Example of clipboard content:

8.253 Himal Locomotion Run 207 8.329 Nautilus Locomotion Run 209 10.400 Sharky Swim 260 11.778 Himal Locomotion Run 295 320 12.778 Nina Alert 12.//78 Nina Alert 320 13.788 Nautilus Locomotion Run 13.789 Nautilus Locomotion Walk 14.348 Himal Locomotion Jump 14.660 Nina Alert 367 345 345 359 14.865 Nautilus Locomotion Walk 14.865 Nautilus Locomotion Jump 372 372 15.000 Nina Rest 375 16.466 Himal Locomotion Jump 16.467 Himal Alert 412 412 23.600 Nautilus Locomotion Jump 23.600 Nautilus Rest 590 24.228 Nautilus Rest 606 590 24.407 Himal Alert 6 24.917 Himal Locomotion Walk 611 623 39.682 Nautilus Locomotion Run 992 40.549 Nina Rest 1014 42.313 Nautilus Locomotion Run 42.314 Nautilus Rest 1058 1058 44.759 Himal Locomotion Walk 44.761 Himal Allogroom 1119 1119 48.219 Nautilus Rest 48.363 Himal Allogroom 1206 1209 48.365 Himal Locomotion Walk 1209 49.274 Himal Locomotion Walk 1232 49.274 Himal Drink 1232 50.408 Himal 50.408 Himal Drink 1261 1261 Swim 58.851 Sharky Swim 1472 58.950 Himal Swim 1474

Paste events

This option allows to paste the clipboard content into the events table. The clipboard must respect the format described in the previous section: 5 columns separated by a $\langle TAB \rangle$ character.

Find in events

This option allows to search for a string in the various field of events. Select the fields to be searched. The find/replace operation can be restricted to the selected events.

	time	subject	code	ty	/pe	modifier	comment			
1	0.000	Himal	Tear	START		Branches				
2	0.000	Nautilus	Tear	START		Branches				
3	30.199	Himal	Tear	STOP		Branches				
4	30.200	Himal	Locomotion	START	⊤ Fi		+ ×			
5	32.400	Himal	Locomotion	STOP	V Sub	Subject				
6	32.400	Nautilus	STOP	✓ Behavior						
					Find Locom	nment				

Find/Replace in events

	time	subject	code	type	modifier	comment
1	0.000	Himal	Tear START Branches			
2	0.000	Nautilus	Tear	START	Branches	
3	30.199	Himal	Tear	STOP	Branches	
4	30.200	Himal	Locomotion			
5	32.400	Himal	Fi Fi			* ×]
6	32.400	Nautilus	· ✔ Subject			
			Behavior			
			Comment			
			Find			
			Himal			
			Replace			
			Сосо			
			Find/Replac	e in selected even	ts	
			Cancel	Find and replace	Find and replace	e all

This option allows to search for a string and replace it by a new value in the various field of events. Select the fields to be searched. The find operation can be restricted to the selected events.

Filter events

This option allows to filter the events by field value (Subject and Behavior).

▼ Sele	ct subjects an	d behaviors	+	×
Subjects				
Select all	Unselect all	Reverse se	lection	
 ✓ No focal su ✓ Nina ✓ Himal ✓ Sharky ✓ Nautilus 	bject			
Behaviors				
Select all	Unselect all	Reverse se	lection	
 physiology ✓ Defecate ✓ Drink ✓ Eat ✓ Rest ✓ Vrinate ✓ Vomit social ✓ Play in the ✓ Play on the reproduction ✓ Breed 	e ground			•
		Cancel	ОК	

Show all events

This option reverts the previous one and allows to visualize all coded events.

Check state events

This option allows to check if the **state events** are **PAIRED**, if they have a **START** and a **STOP** occurences.

Delete selected events

This option allows to delete the selected events. This operation is irreversible!

Delete all events

This option is not present in the context menu but only in the main menu (Observations > Delete all events).

This option allows to delete all then events in the current observation. This operation is irreversible!

Fix unpaired state

You can use the **Fix unpaired events** function to fix the **state events** without a STOP event.

Observations > Fix unpaired events (keyboard shortcut: ^ Ctrl + U)

The program will ask for a time at which insert the STOP events for all unpaired state events

This function can be run on a set of selected observations (when no observation is open). In this case the STOP events will be inserted at the end of observation.

Add frame indexes

This function can be used for the observations from a video. The frame index corresponding to the coded events will be added in the events table.

Run external program with selected events

This function is not yet implemented.

Explore project

You can search information in various fields in all observations in the current project (Observations > Explore project).

The searchable fields are: subject, behavior, modifier and comment.

If more than one field is searched a logic \boldsymbol{AND} will apply.

👻 Explore project 🕂 🗙
Subject
Himal
Behaviors
Swim
Modifier
Comment
Case sensitive
Cancel Find

The events that were found are listed in a table. By double-clicking on the row the corresponding observation will be opened and the visualization will be scrolled to the row corresponding to the event.

Normal Participant Normal				ervation	ts for "0004" ob	Ever
No Allogroom State ev 2 Q Allogroom State ev 3 B Breed V BORIS - 4 × X 4 C Carry object 148 results Tow index 17 0:00:23.600 Nautilus Rest 570 5 C Chase 1 0:004 32 0:00:23.600 Nautilus Rest 500 6 D Defecate 2 0:004 34 3006 7 34 0:005:24.07 Himal Alert 500 9 E Dirink 3 0:006 7 34 0:006 9 300 0:00:42.313 Nautilus Locomotion 570 10 Interact with 5 0:006 12 0:00:42.314 Nautilus Rest 570 11 Locomotion 5 0:006 12 0:00:042.314 Nautilus Rest 570 12 F Lockofrofrof 8	type	type	code	subject	time	
No No<	т	START	Alert	Himal	00:00:16.468	14
A C Carry object 148 results 10 0000:24.228 Nautilus Rest STO 5 C Chase 1 0004 32 18 00:00:24.228 Nautilus Rest STO 6 D Defecate 1 0004 32 2 0004 34 19 00:00:24.217 Himal Alert STO 9 E D Dig 3 0006 7 12 00:00:42.313 Nautilus Locomotion STA 9 E Eat 3 0006 7 12 00:00:42.313 Nautilus Locomotion STA 10 I Interact with 5 0006 12 00:00:42.314 Nautilus Rest STA 13 M Mainpulate 6 0007 11 10 0007 18 00:00:48.219 Nautilus Rest STO 14 P Play in they 10 0007	(STOP	Locomotion	Nautilus	00:00:23.600	15
Image: Construction in the constructin the constructin the construction in the construction in the cons	г	START	Rest	Nautilus	00:00:23.601	16
6 D Defecate 1 0004 32 7 D Dig 34 3 0006 7 8 D Drink 3 0006 7 20 00:00:24.917 Himal Locomotion STAF 9 E Eat 3 0006 7 20 00:00:42.313 Nautilus Locomotion STAF 10 I Interact with 5 0006 12 00:00:42.314 Nautilus Locomotion STAF 12 F Lock for for 6 0007 11 9 0007 8 0007 11 Allogroom STAF 14 P Play in the with 9 0007 18 0007 9 0007 18 00007.48.364 Himal Allogroom STAF 10 0007 19 10 0007 19 20 00:00:48.364 Himal Locomotion STAF 11 0007 19 10 0007 19 20 00:00:48.364 Himal Locomotion <td></td> <td>STOP</td> <td>Rest</td> <td>Nautilus</td> <td>00:00:24.228</td> <td>17</td>		STOP	Rest	Nautilus	00:00:24.228	17
6 D Defecate Image: Comparison of Comp		STOP	Alert	Himal	00:00:24.407	18
7 D Dig Dig </td <td>т</td> <td>START</td> <td>Locomotion</td> <td>Himal</td> <td>00:00:24.917</td> <td>19</td>	т	START	Locomotion	Himal	00:00:24.917	19
a D Drink Image: Construction of the construction	т	START	Locomotion	Nautilus	00:00:39.683	20
E Eat Interact with 5 0006 12 1 Locomotion 5 0006 15 2 F Look for for 6 0007 8 3 M Manipulate 9 0007 11 9 0007 18 10 0007 19 11 0007 19 10 0007 19 11 0007 20 00:00:48.365 Himal Locomotion STO 28 00:00:48.365 Himal Locomotion STO 29 00:00:49.275 Himal Locomotion STO		STOP	Rest	Nina	00:00:40.550	21
10 Interact with Interact with Interact with Nautilus Rest STAF 11 L Locomotion 6 0006 15 12 F Look for foo 7 0007 8 13 M Manipulate 9 0007 11 14 P Play in the with 9 0007 18 10 0007 19 10 0007 19 11 0007 20 000:00:48.365 Himal Locomotion STAF 28 00:00:48.365 Himal Locomotion STAF 29 00:00:48.365 Himal Locomotion STAF 20 00:00:48.365 Himal <td></td> <td>STOP</td> <td>Locomotion</td> <td>Nautilus</td> <td>00:00:42.313</td> <td>22</td>		STOP	Locomotion	Nautilus	00:00:42.313	22
11 L Locomotion F Locomotion STO 11 L Locomotion F Cocomotion STO 12 F Look for foo 7 0007 8 13 M Manipulate 9 0007 11 9 0007 18 10 0007 19 14 P Play on there 10 0007 19 11 0007 20 000048.365 Himal Locomotion STO 10 0007 19 10 000744.760 Himal Locomotion STO 10 0007 19 10 000744.365 Himal Locomotion STO 11 0007 20 000049.275 Himal Locomotion STO 10 0007 19 10 00007 19 10 000049.275 Himal Locomotion STO 10 0007 20 000049.275 Himal Locomotion STO 10 0007 20 000049.275	т	START	Rest	Nautilus	00:00:42.314	23
12 F Look for for or Image: Constraint of the second		STOP	Locomotion	Himal	00:00:44.760	24
13 Manipulate 8 0007 11 14 P Play in the width 9 0007 18 14 P Play on the width 10 0007 19 14 P Play on the width 10 0007 19 11 0007 20 000048.365 Himal Locomotion STAR 28 00:00:49.275 Himal Locomotion STAR 20 00:00:49.275 Himal Drink STAR	т	START	Allogroom	Himal	00:00:44.761	25
9 0007 18 14 P Play in the width 15 P Play on the width 10 0007 19 11 0007 19 11 0007 20 11 0007 20 11 0007 20 11 0007 20 11 0007 20 11 0007 20 11 0007 20 11 0007 10 11 0007 10 12 00:00:48.365 Himal Locomotion STAP 20 00:00:49.275 Himal Drink STAP	,	STOP	-	Nautilus	00:00:48.219	26
10 0007 19 11 0007 20 11 0007 20 10 0007 19 10 00		STOP	Allogroom	Himal		
In 0007 20 I		START	-			
ubjects		STOP				
Key Name OK 50 00.0049.275 Hinter Drink State		START				-
		STOP				
No tocal subject						-
2 N Nina Female, a Swim STAF		START	Swim	Himal		_

Frame-by-frame mode

You can switch between the media player and the frame-by-frame mode using the **arrow buttons** in the toolbar:

In frame-by-frame mode the video will stop playing and the user will visualize the video frame by frame.

Note

Some video files should be re-encoded to be used in frame-by-frame mode. Otherwise the extracted frames are not reliable or it will not be possible to move backward.

You can move between frames by using the arrow keys in the toolbar (on the right) or by using keyboard special keys:

← Left] Go to the **previous frame**

 \rightarrow Right Go to the **next frame**

* Page Up Switch to the **next media**

* Page Up Switch to the **previous media**

↑ Up **Jump forward** in the current media

↓ Down Jump backward in the current media

If you have a numeric keypad you can use the following keys in alternative:

- The key / will allow you to view the previous frame
- \bullet The key * will allow you to view the next frame

To return in the media player mode press the **Play** button in the toolbar.

2.7 Export events

The coded events can be exported in various formats.

2.7.1 Export events in tabular format

Observations > **Export** events > **Tabular** events

This function exports the events of selected observations in one or many files. Various formats are available:

- Plain text in tabular format
- Tab Separated Values (TSV)
- Comma Separated Values (CSV)
- Hyper Text Markup language (HTML)
- Spreadsheet files
- OpenDocument (ODS)
- Microsoft Excel (XLSX, XLS)
- Pandas dataframe (to be loaded in Python with the pickle module)
- R dataframe (to be loaded in R with readRDS function)

If many observations are selected BORIS will ask for a directory to save the various files. For the spreadsheet format (XLSX and ODS) the events can be exported on various worksheet in a single workbook. All these formats are suitable for further analysis.

Select the subjects, the behaviors and the time interval.

Set the time interval to the **Observed events**

~	Select subjects and behaviors	×
Subjects		
Select all	Unselect all Reverse selection	
 ✓ Nina ✓ Himal ✓ Sharky ✓ Nautilus 		
Behaviors		
Select all	Unselect all Reverse selection	
physiology Eat Defecate ✓ Drink ✓ Rest Urinate Vomit		*
Time interval	l d events O User defined O Media file(s) duration Cancel OK	

Select a User defined time interval.

V.	Select subjects and behaviors	×
Subjects		
Select all	Unselect all Reverse selection	
✓ Nina ✓ Himal		
✓ Sharky		
✓ Nautilus		
Behaviors		
Select all	Unselect all Reverse selection	
physiology Eat		•
Defecate		
✓ Drink		Ŧ
Time interval		
Observed	l events	
Start time	+ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
End time	+ 0 0 : 50 : 000 + 0000 + 0000 + 000 + 000 + 000 + 000 + 000 + 000 + 000 + 000 + 000	
	Cancel OK	
xample of output	t of tabular events	

Observation id	Observation date	Description	Observation duration	Observation type	Source	Media duration (s)	FPS	Location	Weather	Temperature	Visitors
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts	36.000	25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts	36.000	25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24	Vegetation	34.47	Media file(s)	player #1:20160517162540.m2ts		25.000	4° 55′ 59″ N - 7° 25′ 18″	sun	24	1046
0002	2016-05-17 00:00:24 2016-05-17 00:00:24	Vegetation Vegetation	34.47 34.47	Media file(s) Media file(s)	player #1:20160517162540.m2ts player #1:20160517162540.m2ts		25.000 25.000	4° 55′ 59″ N - 7° 25′ 18″ 4° 55′ 59″ N - 7° 25′ 18″	sun	24 24	1046 1046
Subject	Behavior	Behavioral catego	ory Modifier #1	Behavior ty	pe Time	Media file name	Image ir	ndex Image	file path	Com	ment
Himal	Tear		Branches	START	0.000	20160517162540.m2ts	NA	-	NA		
Sharky	Tear		Branches	START	0.000	20160517162540.m2ts	NA		NA		
Nautilus	Tear		Branches	START	1.359	20160517162540.m2ts	NA		NA		
Nautilus	Tear		Branches	STOP	25.776	20160517162540.m2ts	NA		NA		
Nautilus	Carry objects		Branches	START	25.777	20160517162540.m2ts	NA		NA		
Nautilus	Carry objects		Branches	STOP	27.732	20160517162540.m2ts	NA		NA		
Sharky	Tear		Branches	STOP	30.688	20160517162540.m2ts	NA		NA		
Sharky	Locomotion		Walk	START	30.689	20160517162540.m2ts	NA		NA		
Sharky	Locomotion		Walk	STOP	31.819	20160517162540.m2ts	NA		NA		
Himal	Tear		Branches	STOP	33.898	20160517162540.m2ts	NA		NA		
Himal	Locomotion			START	33.899	20160517162540.m2ts	NA		NA		
Himal	Locomotion			STOP	34.470	20160517162540.m2ts	NA		NA		

2.7.2 Export aggregated events

Observations > **Export events Aggregated events**

This function will export the events corresponding to the selected subjects and the selected behaviors of the selected observations.

Various formats are available:

- Plain text in tabular format
- Tab Separated Values (TSV)
- Comma Separated Values (CSV)
- Hyper Text Markup language (HTML)
- Spreadsheet files
- OpenDocument (ODS)
- Microsoft Excel (XLSX, XLS)
- SQL format for populating a SQL database
- SDIS format for analysis with the GSEQ program available at http://www2.gsu.edu/~psyrab/gseq
- Pandas dataframe (to be loaded in Python with the pickle module)
- R dataframe (to be loaded in R with readRDS function)

If two or more observations are selected you can choose to group all results in one file. If you do not want to group results BORIS will ask for a directory to save the various files (the observation id will be used as file name).

The **State events** are paired and in this case the event duration is available.

An arbitrary time interval can be selected (check the **Limit to time interval** option). In this case the ongoing events will be started at start time and stopped at end time in the export file.

The following fields are available in the output:

- Observation id
- Observation date and time
- Observation description
- Observation type (Media file / Live / Pictures)
- Source (for media file and pictures)
- Total duration (in seconds, the duration of observation in base of the selected time interval)
- Media duration(s) (in seconds, for media file observation)
- FPS (frame/s, for video file, number of images per second)
- Independent variables (one column by variable9)
- Subject name
- Observation duration by subject
- Behavior
- Behavioral category (if any)
- Modifier(s) of behavior (one column by madifier)
- Behavior type (STATE / POINT)
- Start (seconds)
- Stop (seconds)
- Duration (seconds, duration of the event for STATE events)
- Media file name (for media file observation, media in which the event occurs)
- Image index start (for observations from pictures, index of the image where the event starts)
- Image index stop (for observations from pictures, index of the image where the event stops)
- Image file path start (for observations from pictures, path of the image where the event stops)
- Image file path stop (for observations from pictures, path of the image where the event stops)
- Comment start
- Comment stop

Example of table export of aggregated events (TSV, CSV, XLSX, ODS, HTML)

Observation id	Observation date	Description	Observation type	Source	Total duration	Media duration (s) FP	S (frame/s)	Location	Weather	Temperature	Visitors
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0004	2016-05-17 00:00:59	Central trunks	Media file	player #1:20160517162952.m2ts	50.697	59.040	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
0005	2016-05-17 00:00:49	In the pool	Media file	player #1:20160517163131.m2ts	40.770	40.800	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
0005	2016-05-17 00:00:49	In the pool	Media file	player #1:20160517163131.m2ts	40.770	40.800	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
0006	2016-05-17 00:00:42	In the pool	Media file	player #1:20160517163231.m2ts	61.830	61.920	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
0006	2016-05-17 00:00:42	In the pool	Media file	player #1:20160517163231.m2ts	61.830	61.920	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
0006	2016-05-17 00:00:42	In the pool	Media file	player #1:20160517163231.m2ts	61.830	61.920	25.000	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046

Subject	Observation duration by subject by observation	Behavior	Rehavioral category	Modifier #1	Behavior type	Start (s)	Stop (s)	Duration (s)	Media file name	Image index sta	rt Image index stop Image file path	start Image file path stop Corr	ment start Comment sto
Himal		Locomotion		Run	STATE	8.253	11.779	3.526	20160517162952.m2ts	NA	NA		
Nautilus	24.431	Locomotion		Run	STATE	8.329	13,789	5.460	20160517162952.m2ts	NA	NA		
Sharky	48.452	Swim	Not defined		STATE	10.400	58.852	48,452	20160517162952.m2ts	NA	NA		
Nina	27.431	Alert	Not defined		STATE	12.778	14.660	1.882	20160517162952.m2ts	NA	NA		
Nautilus		Locomotion		Walk	STATE	13,790	14.865	1.075	20160517162952.m2ts	NA	NA		
Himal	47.613	Locomotion		Jump	STATE	14.348	16.467	2.119	20160517162952.m2ts	NA	NA		
Nautilus	24.431	Locomotion		Jump	STATE	14.866	23,600	8.734	20160517162952.m2ts	NA	NA		
Nina	27.431	Rest	physiology		STATE	15.001	40,550	25,549	20160517162952.m2ts	NA	NA		
Himal	47.613	Alert	Not defined		STATE	16.468	24,407	7.939	20160517162952.m2ts	NA	NA		
Nautilus	24.431	Rest	physiology		STATE	23.601	24,228	0.627	20160517162952.m2ts	NA	NA		
Himal	47.613	Locomotion	Not defined	Walk	STATE	24.917	44.760	19.843	20160517162952.m2ts	NA	NA		
Nautilus	24.431	Locomotion	Not defined	Run	STATE	39.683	42.313	2.630	20160517162952.m2ts	NA	NA		
Nautilus	24.431	Rest	physiology		STATE	42.314	48.219	5.905	20160517162952.m2ts	NA	NA		
Himal	47.613	Allogroom	Not defined		STATE	44.761	48.364	3.603	20160517162952.m2ts	NA	NA		
Himal	47.613	Locomotion	Not defined	Walk	STATE	48.365	49.274	0.909	20160517162952.m2ts	NA	NA		
Himal	47.613	Drink	physiology		STATE	49.275	50.408	1.133	20160517162952.m2ts	NA	NA		
Himal	47.613	Swim	Not defined		STATE	50.409	58.950	8.541	20160517162952.m2ts	NA	NA		
Sharky	40.77		Manipulate	Not defined	STATE	0.000	40.770	40.770	20160517163131.m2ts	NA	NA		
Nautilus	40.77		Manipulate	Not defined	STATE	0.000	40.770	40.770	20160517163131.m2ts	NA	NA		
Himal	44.368	Manipulate	Not defined		STATE	0.000	40.760	40.760	20160517163231.m2ts	NA	NA		
Nautilus	45.037	Manipulate	Not defined		STATE	0.000	17.448	17.448	20160517163231.m2ts	NA	NA		
Sharky	46.537	Manipulate	Not defined		STATE	1.824	48.361	46.537	20160517163231.m2ts	NA	NA		

Example of SQL export of aggregated events:

CREATE TABLE aggregated_events (id INTEGER PRIMARY KEY ASC, observation TEXT, subject TEXT, behavior TEXT, type TEXT, modifiers TEXT, start FLOAT, stop FLOAT, comment TEXT, comment_stop TEXT, image_index_stor INTEGER, image_path_start TEXT, image_index_stop TEXT); INSERT INTO "aggregated_events" VALUES(1,'0001_a','Himai','Tear','STATE','Branches',0.0,30.199,',',''NA','NA', NULL,NULL); INSERT INTO "aggregated_events" VALUES(3,'0001_a','Himai','Iear','STATE','Branches',0.0,32.4,'',''NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(4,'0001_b','Himai','Tear','STATE','Branches',0.0,30.199,','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(4,'0001_b','Himai','Tear','STATE','Branches',0.0,30.199,','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(4,'0001_b','Himai','Tear','STATE','Branches',0.0,30.199,','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(6,'0001_b','Himai','Locomotion','STATE','Branches',0.0,30.389,','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(7,'0002','Himai','Tear','STATE','Branches',0.0,33.899,34.47,'','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(8,'0002','Himai','Locomotion','STATE','Branches',0.0,33.889,'','',NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(8,'0002','Sharky','Tear','STATE','Branches',0.0,33.889,'','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(10,'0002','Sharky','Tear','STATE','Branches',0.0,33.889,'','','NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(11,'0002','Natrky','Locomotion', 'STATE','Branches',1.359,25.776,'','',NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(12,'0002','Natrky','Carry objects','STATE','Branches',2.5.777,27.732,'',''NA','NA',NULL,NULL); INSERT INTO "aggregated_events" VALUES(13,'0003','Nina','Locomotion','STATE','Branches',2.5.777,27.732,'',''NA','NA',NULL,NULL); INSERT INTO "aggregated_events' VALUES(14,'0003','Nina','Locomotion','STATE','Branches',2.5.77',''NA','NA',NUL,NULL); INSERT INTO "aggregated_events' VAL

2.7.3 Export events as behavioral sequences

Observations > Export events as behavioral sequences

Behavioral strings can be used with the **Behatrix** program: Behatrix

Example:

observation id: demo#1
observation description:
Media file name: video1.mp4, video2.mp4

Subject #1: eat|jump|eat|jump

Subject #2: eat|rest|jump|eat|jump

2.7.4 Export events as Praat TextGrid

Observations > Export events as Praat TextGrid

Example:

```
File type = "ooTextFile"
Object class = "TextGrid"
xmin = 4.3
xmax = 113.988
tiers? <exists>
size = 2
item []:
    item [1]:
       class = "IntervalTier"
       name = "Subject #1"
        xmin = 4.3
        xmax = 10.0
        intervals: size = 1
        intervals [1]:
           xmin = 4.3
            xmax = 10.0
            text = "eat"
    item [2]:
        class = "IntervalTier"
        name = "Subject #2"
        xmin = 26.6
        xmax = 113.988
```

intervals: size = 1
intervals [1]:
 xmin = 26.6
 xmax = 113.988
 text = "eat"

2.7.5 Export events for analysis with JWatcher

Observations > Export events for analysis with JWatcher

JWatcher is a powerful tool for the quantitative analysis of behavior.

The events coded with BORIS can be exported to be analyzed with JWatcher.

Click **Observations > Export events > for analysis with JWatcher** to export the coded events.

BORIS will ask for selecting a directory. After this, for each combination of selected observation and selected subject the following files will be created:

- the Focal Data File (.dat)
- the Focal Analysis Master File (.faf)
- the Focal Master File (.fmf)

These files can be used to analyze your observations with JWatcher.

2.7.6 Export events as Behaviors Binary Table

Observations > Export events as Behaviors Binary Table

A time interval will be asked to the user (in seconds). The observation will be checked every n seconds and the presence (1, absence: 0) of the selected behaviors will be exported in a table for each selected subjects.

Example for a time interval of 1 second:

time	Alert	Drink	Locomotion	Swim
0.0	0	1	0	0
1.0	0	1	0	0
2.0	0	1	0	0
3.0	0	1	0	0
4.0	0	1	0	0
5.0	0	1	0	0
6.0	0	1	0	0
7.0	0	1	0	0
8.0	0	1	0	0
9.0	1	0	0	0
10.0	1	0	0	0
11.0	0	0	1	0
12.0	1	0	0	0
13.0	1	0	0	0
14.0	1	0	0	0
15.0	1	0	0	0
16.0	1	0	0	0
17.0	1	0	0	0
18.0	0	0	1	0
19.0	0	0	1	0
20.0	0	0	1	0
21.0	0	0	1	0
22.0	1	0	0	0
23.0	0	0	0	0
24.0	0	0	0	0
25.0	0	0	0	0
26.0	0	0	0	0
27.0	0	0	0	0
28.0	0	0	0	0
29.0	0	0	0	0
30.0	0	0	0	0
31.0	0	0	0	0
32.0	0	0	0	0
33.0	0	0	0	1
34.0	0	0	0	1
35.0	0	0	0	1
36.0	0	0	0	1
37.0	0	0	0	1
38.0	0	0	0	1
39.0	0	0	0	1
40.0	0	0	0	1
41.0	0	0	0	1
42.0	0	0	0	1

43.0	0	0	0	1
44.0	0	0	0	1
45.0	0	0	0	1
46.0	0	0	0	1
47.0	0	0	0	1
48.0	0	0	0	1
49.0	0	0	0	1

2.7.7 Extract sub-sequences from media files corresponding to coded events

Sequences of media file corresponding to coded events can be extracted from media files:

1. Click on **Observations > Extract events from media files** option.

- 2. Choose the observation(s).
- 3. Select the events to be extracted.
- 4. Select a destination directory that will contain the extracted sequences.
- 5. Select a time offset (in seconds, the default value is 0).

The time offset will be substracted from the starting time of event and added to the stopping time. All the extracted sequences will be saved in the selected directory followind the file name format:

{observation id}_{player}_{subject}_{behavior}_{start time}-{stop time}

2.7.8 Extract frames corresponding to coded events

The frames corresponding to coded events can be extracted and saved as images.

1. Click on **Observations > Extract frames from media files** option.

- 2. Choose the observation(s).
- 3. Select the events to be extracted.
- 4. Select a destination directory that will contain the extracted sequences.
- 5. Select a time offset (in seconds, the default value is 0).

2.7.9 Export transitions matrix

3 transitions matrix outputs are available: The matrix of frequencies of transitions, the matrix of frequencies of transition after each behavior and the matrix of number of transitions.

Matrix of frequencies of transitions

This matrix contains the frequencies of total transitions. The sum of all frequencies must be 1.

Example of frequencies of transitions matrix:

eat sleep walk eat 0.0 0.286 0.143 sleep 0.143 0.0 0.143 walk 0.286 0.0 0.0

In this matrix you can see that the **eat** behavior precedes the **sleep** behavior with a frequency of **0.286** of the total number of transitions.

Matrix of frequencies of transitions after behavior

This matrix contains the frequencies of transitions after each behavior. The sum of each row must be 1.

Example:

eat	sleep	walk	
eat	0.0	0.667	0.333
sleep	0.5	0.0	0.5
walk	1.0	0.0	0.0

In this example you can see that **sleep** follows **eat** with a frequency of **0.667** and **walk** follows with a frequency of **0.333**.

Matrix of number of transitions

This matrix contains the number of transitions after each behavior.

Example:

eat sleep walk eat 0 2 1 sleep 1 0 1 walk 2 0 0

2.8 Playback menu

2.8.1 Jump

Jump forward

Allow to jump forward in the current media file. See **File > Preferences** for setting the jump value.

Jump backward

Allow to jump backward in the current media file. See **File > Preferences** for setting the jump value.

Jump to specific time

Allow to go to a specific time in the current media file.

The time selection widget will pop-up:

*	Jump to specific time	×
Set the time		
Second	ls 🔘 hh:mm:ss 🔘 Date time	
+	seconds	
	Cancel OK	

3 formats are available to select the time:

• Decimal seconds:

▼ Jump to specific time	×
Set the time	
Seconds	
+ 3.14 seconds	
Cancel	ОК

• HH:MM:SS:ZZZ format (ZZZ indicates the milliseconds):

▼ Jump to specific time	×
Set the time	
○ Seconds ● hh:mm:ss ○ Date time	
+ hour 3 mm:ss.ms 14:15.926	
Cancel	к

• A date-time format (YYYY-MM-DD hh:mm:ss.zzz):

*	Jump to specific time	×
Set the	e time	
	○ Seconds ○ hh:mm:ss ④ Date time	
+	2000-01-01 03:14:15:926	
	Cancel OK	

2.8.2 Zoom level

Click the media player you want to set the zoom level.

Using the keyboard

Zoom in (Ctrl) + (+) or (Ctrl) + Mouse wheel up

Zoom out ^ Ctrl + - or ^ Ctrl + Mouse wheel down

Reset zoom level \land Ctrl + 0 or by clicking the mouse right button on the video.

Using the mouse

Zoom in Double click on left mouse button

 ${\bf Zoom\ out}$ Double click on right mouse button

2.8.3 Pan video

Click the media player you want to pan.

Using the keyboard

Pan Left $\land Ctrl + \leftarrow Left$ Pan Right $\land Ctrl + \rightarrow Right$ Pan Down $\land Ctrl + \uparrow Up$ Pan Up $\land Ctrl + \downarrow Down$

Using the mouse

Pan Up: Mouse Wheel up (the video moves down)

Pan Down: Mouse Wheel down (the video moves up)

Pan Left: (shift) + Mouse Wheel Up (the video moves to the right)

Pan Right: 1 shift + Mouse Wheel Down (the video moves to the left)

Reset Pan and zoom: (1) Shift) + Left mouse button

The zoom level can also be set using the menu Playback > Zoom level

2.8.4 Rotate video

Select the video rotation angle for each player using the menu **Playback** > **Rotate video**. The available rotation angles are: 0, 90, 180 and 270.

👻 Video rotation angle 🙁
Select the rotation angle
Player #1
90 💌
Cancel OK

2.8.5 Display subtitles

Select to display or hide the subtitles using the menu **Playback** > **Display subtitles**. The subtitles file must have exactly the same name of the video file except for the extension and be placed in the same directory.

~	BO	RI5		×
Display	subtitle	es		
✓ Play	/er #1			
Car	ncel		ОК	

2.8.6 Image overlay on video

Select an image overlay to be displayed on the video **Playback** > **Image overlay on video** > **Add**. If the selected image does not have a transparent background the transparency can be set from 0 (full transparency) to 255 (no transparency).

The image must be in PNG format, if the image is smaller than the video resolution the image position can be set from the topleft corner (x: horizontally, y: vertically).

 во 	eris ×
Player #1	•
Image file	
	Browse
Position: x,y	
Transparency %	90
Cancel	ОК

Select > **Playback** > **Image overlay on video** > **Remove** to remove the image overlay.

2.8.7 Video equalizer

Playback > Video equalizer

Using this function the **brightness**, the **contrast**, the **saturation**, the **gamma** and the **Hue** can be set for each player.

e Observations Playback Tools Analysis	project (/home/olivier/g Help	drive/src/python/py	observer/boris_	projects/testing/	/test1_v7.boris) - Bl	ORIS	-	+ 3
≡ ► K ↔ ₩ ₩ ₩ ₩ ₩	< + • • •	X 🗌 🖻 C	2					
ver #1	Player #2			ØF	Player #3			
video1.mp4 FPS : 25 time: 0.040000 s frame: 0001	FI t:	ideo2.mp PS : 25 ime: 0.0 rame: 00	40000 s	s - ***	FPS : time:	03.mp4 : 25 : 0.0400 e: 0001	000 s	
Video equalizer Video equalizer Player 1 Piather	×	Events for "3 video'	observation					
Video equalizer Player 1 Brightness		Events for "3 video		code	type	modifier	comment	
Video equalizer Player 1			observation subject subj 1	code y	type START	modifier	comment	
Video equalizer Player 1 Brightness Contrast Saturation Gamma	× 25 0	time	subject subj 1	У		modifier	comment	
Video equalizer Player 1 Brightness Contrast a Saturation	× 25 0	time 1 00:00:00.000 2 00:00:15.000	subject subj 1 subj 1	y y	START	modifier	comment	
Video equalizer Player 1 Brightness Contrast a Saturation Gamma Hue	25 0 0 0	time 1 00:00:00.000 2 00:00:15.000 3 00:00:16.600	subject subj 1 subj 1 subj 1 subj 1	y y s	START STOP START	modifier	comment	
Video equalizer Player 1 Sightness Contrast Gamma Hue	25 0 0 0 0 0	time 1 00:00:0000 2 00:00:15.000 3 00:00:16.600 4 00:00:24.350	subject subj 1 subj 1 subj 1 subj 1 subj 1	y y s s	START STOP START STOP	modifier	comment	
Video equalizer Player 1 Sightness Contrast Gamma Hue	25 0 0 0 0 0	time 1 00:00:00.000 2 00:00:15.000 3 00:00:16.600	subject subj 1 subj 1 subj 1 subj 1	y y s	START STOP START	modifier	comment	

2.9 Tools

2.9.1 Plot events in real-time

This function can be activated with **Tools > Plot event in real time**.

				-		E	vents plot	
÷		videori - cest 5 -	30H2	s1 ·	- b -			
	vations Playback Tools Ar	nalysis Help ▶ 🖸 ← → X 🗍 🖻 Q		s2 ·	- b -			
		video1.mp4 FPS : 25 time: 16.8 frame: 042	30000 s	s1 -	- a -			
				Time ii	-10	0 10 +	20	30 40
Ethogram	Ø	Player paused	Events for "vio	leo1" observa				Ø
Key	Code Type		time	subject	code	type	modifier	con
1 p	p Point event	video1.mp4: 16.840 / 179.960 frame: 422	1 12.440	s1	a	START	Mone	con
-	51	video1.mp4: 16.840 / 179.960	1 12.440 2 21.640	s1 s2	a b	START START	None >	con
1 p 2 a	p Point event a State event	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200	s1 s2 s1	a b a	START START STOP		com
1 p 2 a 4 Subjects	p Point event a State event	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200 4 28.200	s1 s2 s1 s1	a b a b	START START STOP START	None >	
1 p 2 a ∢ Subjects Key	p Point event a State event	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200 4 28.200 5 35.200	s1 s2 s1 s1 s1 s1	a b a b b	START START STOP START STOP	None	con
1 p 2 a 4 Subjects Key 1	p Point event a State event Name No focal subject	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200 4 28.200 5 35.200 6 36.440	s1 s2 s1 s1 s1 s1 s1 s1	a b a b b a	START START STOP START STOP START	None >	con
1 p 2 a ∢ Subjects Key	p Point event a State event	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200 4 28.200 5 35.200	s1 s2 s1 s1 s1 s1	a b a b b	START START STOP START STOP	None	
1 p 2 a 4 Subjects Key 1 2 1	p Point event a State event Name No focal subject s1	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200 4 28.200 5 35.200 6 36.440 7 50.280	s1 s2 s1 s1 s1 s1 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2	a b a b b a b	START START STOP START STOP START STOP	None None None	con
1 p 2 a 4 Subjects Key 1 2 1	p Point event a State event Name No focal subject s1	video1.mp4: 16.840 / 179.960 frame: 422 media #1 / 1	1 12.440 2 21.640 3 28.200 4 28.200 5 35.200 6 36.440 7 50.280	s1 s2 s1 s1 s1 s1 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2 s2	a b a b b a b	START START STOP START STOP START STOP	None None None	con

2.9.2 . Geometric measurements

Some geometric measurements can be done: distances, areas and angles can be measured and point positions recorded.

Click on **Tools > Geometric measurements** to activate the measurements.

*		Geometric mea	surements		×		
O Point (left click	<)						
O Polyline (left click for vertices, right click to finish)							
O Polygon (left click for Polygon vertices, right click to close the polygon)							
O Angle (vertex:	left click, segments	: right click)					
Oriented angl	e (vertex: left click, s	egments: right	click)				
✓ Measurement	s are persistent	hoose color of r	marks				
Scale							
Reference		P	ixels				
1		1					
Player	media file name	Time	Frame index	pe of measureme	x		
•					Þ		
Clear mea	asurements Save of	urrent picture	Save all pictures	Save results	Close		

 $The \ geometric \ measurements \ window$

Mark color

Use the **Choose color of marks** button to select a color. All marks will be drawn with the selected color. The color transparency can be set using the **Alpha channel** vale (0 for 100% transparent, 255 for a solid color).

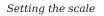
▼ Se	lect Color	- ×
Basic colors		
Custom colors	Hue: 120 ↓ Red: 0 Sat: 255 ↓ Green: 255 Val: 255 ↓ Blue: 0 Alpha channel: 255 HTML: #00ff00 Cancel ✓ Off	•

The color selection window

Setting the scale

For distance and area measurements you can set a scale in order to have results of measurements in a real unit (like centimeters, meters etc).

Scale	
Reference	Pixels
1	1



- 1. measure a reference object (that have a known size) on the frame (with the distance tool. See next chapter for details) and set the pixel distance in the **Pixel** text box.
- 2. Set the real size of the reference object in the **Reference** text box (must be a number without unit).

Point

Select the **Point** radio button. Click the left mouse button on the video/image to record the position of the clicked pixel.

·				Geometric m	neasuremen	nts				
• Point	(left click)									
) Polyli	ne (left click for ver	tices, right	click to finish)							
) Polyg	on (left click for Po	lygon vertic	es, right click to	close the polygon)						
Angle	e (vertex: left click, s	segments: ri	ight click)							
Orien	ited angle (vertex: l	eft click, seg	gments: right cli	ick)						
/ Measi	urements are persi	stent Cho	oose color of ma	arks						
cale										
eference	e				Pixels					
I					1					
Player	media file name	Time	Frame index	Type of measurement	x	у	Distance	Area	Angle	Coordinates
1	video1.mp4	0.000	0	Point	193	303	NA	NA	NA	[(193, 303)]
									NA	
	video1.mp4	0.000	0	Point	324	296	NA	NA	NA	[(324, 296)]
	video1.mp4 video1.mp4	0.000	0	Point Point	324 442	296 265	NA	NA	NA	[(324, 296)]
1	video1.mp4	0.000	0	Point	442	265	NA	NA	NA	[(442, 265)]
1 1 1 1 1	video1.mp4 video1.mp4	0.000	0	Point Point	442 447	265 376	NA	NA NA	NA	[(442, 265)] [(447, 376)]
1 1 1 1	video1.mp4 video1.mp4 video1.mp4	0.000 0.000 0.000	0 0 0	Point Point Point	442 447 262	265 376 395	NA NA NA	NA NA NA	NA NA NA	[(442, 265)] [(447, 376)] [(262, 395)]

Distance measurements

Select the **Distance** radio button. Click the left mouse button on the frame bitmap to set the start of the segment that will be measured. A circle with a cross will be drawn. Click the right mouse button to set the end. A red circle with a cross will be drawn. The distance between the two selected points will be available in the text area of the **Measurements window**.

				Geo	ometri	c me	easurements				×
O Po	nt (left click)										
• Po	yline (left click for ve	rtices, right	click to finish)								
O Po	ygon (left click for Po	olygon vertic	es, right click to	close the polygon)							
🔿 An	gle (vertex: left click,	segments: r	ight click)								
🔿 Or	ented angle (vertex:	left click, seg	gments: right cli	ick)							
✓ Me	asurements are pers	istent Ch	oose color of ma	arks							
Scale											
Refere	nce						Pixels				
1							1				
Play	er media file name	Time	Frame index	Type of measurement		x	у	Distance	Area	Angle	Coordinates
1	video1.mp4	0.240	6	Polyline	NA		NA	417.3	NA	NA	[(56, 328), (472, 295)]
1	video1.mp4	0.240	6	Polyline	NA		NA	414.7	NA	NA	[(83, 392), (496, 430)]
1	video1.mp4	0.240	6	Polyline	NA		NA	101.2	NA	NA	[(531, 196), (451, 258)]
						Clea	ar measuremen	save cur	rent picture	Save all p	ictures Save results Close

Area measurements

Select the **Area** radio button. Click the left mouse button on the frame bitmap to set the area vertices. Circles with a cross will be drawn. Click the right mouse button to close the area. The area of the drawn polygon will be available in the text area of the **Measurements window**.

Angle measurements

Select the **Angle** radio button. Click the left mouse button on the frame bitmap to set the angle vertex. A red circle with a cross will be drawn. Click the right mouse button to set the two segments. Circles with a cross will be drawn. The angle between the two drawn segments will be available in the text area of the **Measurements window**.

Persistent measurements

If the **Measurements are persistent** checkbox is checked the measurement schemes will be available on all frames otherwise they will be deleted between frames.

The marks selected on other frames will be drawn in red.

2.9.3 Coding pad

During observation a coding pad with the available behaviors can be displayed (**Tools** > **Coding pad**). This **Coding pad** allows the user to code using a touch-screen or by clicking on the buttons. When the **Coding pad** is displayed you can continue to code using the keyboard or the ethogram.

Choose an option to configure *		Coding pad			
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
Vocalize	Yawn	Eat	Defecate	Drink	Rest
Urinate	Vomit	Breed	Play on the ground	Play in the water	

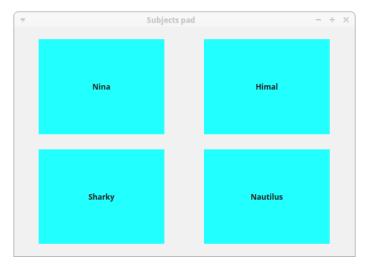
The button size can be increased or decreased.

The button color can be set for every behavior, for every behavioral category or to no color.

See the drop-down list in the upper-left corner of the Coding pad window.

2.9.4 Subjects pad

A pad with all defined subjects (or filtered subjects) can be displayed during the observation (**Tools** > **Subjects pad**). This **Subjects pad** allows the user to select the focal subject using a touch-screen or by clicking on the buttons. When the **Subjects pad** is displayed you can continue to select the focal subject using the keyboard or the subjects list.



2.9.5 Converters for external data values

Converters can be written using the Python 3 programming language.

The **INPUT** variable will be loaded with the original value of the external data file (for example 01:22:32).

The **OUPUT** variable must contain the converted value in seconds (the dot must be used for decimal separator).

Example of a code to convert HH.MM:SS format in seconds:

```
h, m, s = INPUT.split(':')
OUTPUT = int(h) * 3600 + int(m) * 60 + int(s)
```

The Python function **strptime()** from the **datetime** module can be useful for converting time values: https://docs.python.org/3/library/datetime.html#strftime-strptime-behavior

Example of a code to a date in ISO8601 format in seconds using the strptime() function:

import datetime epoch = datetime.datetime.utcfromtimestamp(0) datetime_format = "%Y-%m-%dT%H:%M:%SZ"

OUTPUT = (datetime.datetime.strptime(INPUT, datetime_format) - epoch).total_seconds()

File > Edit project > Converters

					(edit project						+
Information	Ethogra	m Subjects	Independent vari	iables	Observations	Behaviors coding ma	Conv	/erters				
Time converte	rs for exte	rnal data										
Nam	ne			De	scription				Code		Add new c	onverter
1 convert_time_ecg convert '%d/%m/%Y %H:%M:%S.%f' in seconds					ds from epoch				ort datetime		Modify co	nverter
2 hhmmss_2_		convert HH:MM:							, s = INPUT.s		Delete co	nverter
3 invert_value		invert the value							PUT = -float(.oad converte	ers from file
4 ISO8601_to		Convert ISO8601	l format to seconds		70-01-01 Input e	example: "2018-01-18T12			t datetime@	Load co	overters from	n BORIS repository
lame	IS	O8601_to_secon	ıds									
Name	IS	O8601_to_secon	Ids									
Description	C	onvert ISO8601 f	•	ince 197(0-01-01 Input ex	ample: "2018-01-18T12:3	1:40Z"					
Description Python code	Co import epoch =	onvert ISO8601 f datetime datetime.da	format to seconds si	imestam	•	ample: "2018-01-18T12:3	1:40Z"					Save converter
Description	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)							Save converter Cancel
Description Python code	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)	ample:"2018-01-18T12: format) - epoch).to		nds()				
Description Python code	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)			nds ()				
Description Python code	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)			nds ()				
escription ython code	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)			nds ()				
escription ython code	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)			nds()				
escription ython code	import epoch = datetim	onvertISO8601 f datetime datetime.da e_format = "S	format to seconds si tetime.utcfromti %Y-%m-%dT%H:%M:%	imestam %SZ"	p(0)			nds ()				

2.9.6 Transitions flow diagram

BORIS can generate DOT scripts and flow diagrams from the transitions matrices (See Observations > Create transition matrix for obtaining the transitions matrices).

DOT script (Graphviz language)

Tools > Transitions flow diagram > Create transitions DOT script

Choose one ore more transitions matrix files and BORIS will create the relative DOT script file(s).

The DOT script files can then be used with Graphviz (Graph Visualization Software) or WebGraphviz (Graphviz in the Browser) to generate flow diagram of transitions.

See DOT (graph description language) for details.

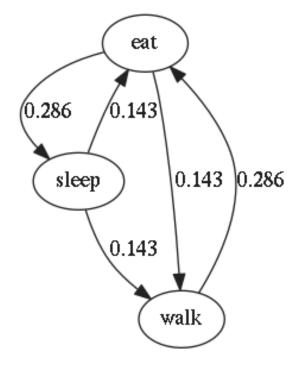
Flow diagram

If Graphviz (Graph Visualization Software) is installed on your system (and the **dot** program available in the path) BORIS can generate flow diagram (PNG format) from a transitions matrix file.

Tools > Transitions flow diagram > Create transitions flow diagram

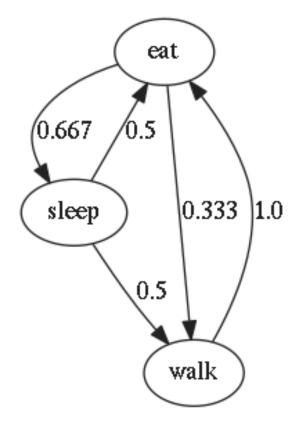
Choose one ore more transition matrix files and BORIS will create the relative flow diagram.

Flow diagram of frequencies of transitions



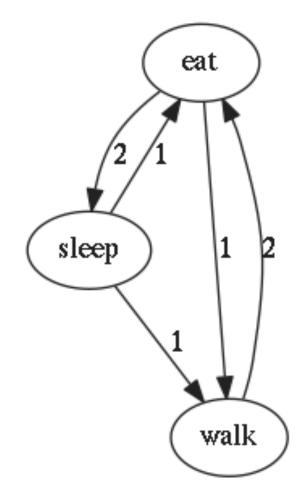
Frequencies of total transitions (the frequencies are plotted on the edges)

Flow diagram of frequencies of transitions after behavior



Frequencies of transitions after behavior (the frequencies are plotted on the edges)

Flow diagram of number of transitions



Number of transitions (the frequencies are plotted on the edges)

Re-encoding and resizing a video file

BORIS can re-encode and resize your video files in order to reduce the size of the files and have a smooth coding (specially with two video files playing together). The re-encoding and resizing operations are done with the embedded ffmpeg program with high quality parameters (bitrate 2000k).

Select the files you want re-encode and resize and select the horizontal resolution in pixels (the default is 1024). The aspect ratio will be maintained.

You can continue to use BORIS during the re-encoding/resizing operation.

The re-encoded/resized video files are renamed by adding the re-encoded.avi extension to the original files.

Rotating a video file

BORIS can rotate your video files in order to code them using the right view. The rotating operation is done with the embedded ffmpeg program using the same quality parameters then the original video.

Select the files you want rotate and select the rotation angle between: Rotate 90 clockwise, Rotate 90 counter clockwise and Rotate 180.

The aspect ratio will be maintained.

You can continue to use BORIS during the rotation operation.

The rotated video files are renamed by adding the ${\bf rotated} \verb+<\!ANGLE>$ to the original file name.

2.10 Coding map

A coding map is a bitmap image with user-defined clickable areas that will help to code for behaviors or modifiers for a behavior.

- 2 types of coding maps are available:
- Behaviors coding map
- Modifiers coding map
- 2.10.1 The Behaviors coding map

BORIS allows creating a **Behaviors coding map** using the **Map creator** tool (**Tools > Create a coding map > for behaviors**).

A Behaviors coding map can be created only if you have defined behaviors in your ethogram.

Creating a Behaviors coding map

To create a new Behaviors coding map launch the Behaviors coding map creator

Tools > Create a coding map > for behaviors).

A new window will open

▼	BORIS - Behaviors coding map creator	-	÷	×
<u>F</u> ile				
Defined area				

File > New behaviors coding map

Enter a name for the new **Behaviors coding map**

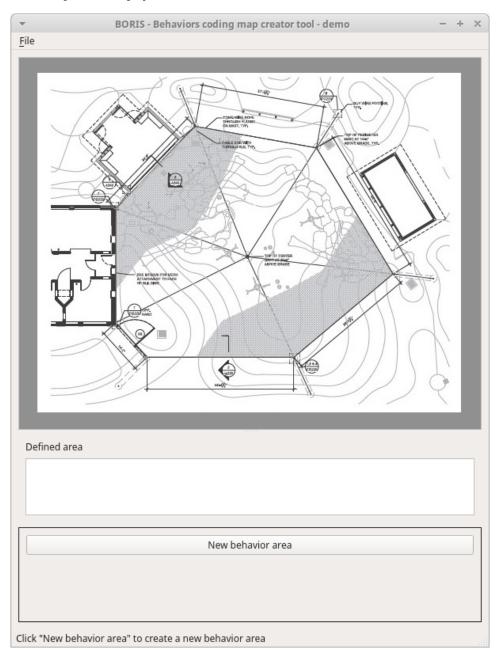


Loading a bitmap for a behaviors coding map

Click the Load bitmap button in the bottom of the window and select a bitmap image (PNG and JPEG formats are accepted).

If the size of your bitmap image is bigger than $640 \ge 640$ pixels BORIS will resize it to $640 \ge 640$ pixels keeping the aspect ratio and store the resized version in the coding map file.

The bitmap will be displayed



Adding areas corresponding the behaviors

Click the **New behavior area** button in the bottom of the window and select a behavior by clicking on the **Select behavior** button.

Defined area	▼ Select a behavior + ×		-
	Available behaviors	-	
	North zone 💦		
	East zone		
	South zone		
Save th	e b	Cancel	
Behavior	Select behavio	r Opacity: 50 %	

The available behaviors are taken from the ethogram of the current project.

Click on the bitmap to define the vertex on the area that will code the selected behavior. Close the area by clicking again on the first point.

The color of the new area can be changed using the **Opacity** button. The opacity can be changed (from 0 to 100%) using the slider.

Save the behavior area by clicking on the Save the behavior area button

The area will be added to the **Defined area** list

You can add more area and also add more than one area for a same behavior. Two or more areas can overlap. In this case all corresponding behaviors will be triggered.

 BORIS - Behaviors codi 	ing map creator - location - + ×
<u>F</u> ile	
north #1 west #2 south #3 east #4	×
New behavior area	Delete selected behavior area
Behavior north Selec	t behavior Opacity: 46 %

Add the Behaviors coding map to the current project

File > Add coding map to project

The coding map will be added to the current project

You can add a **Behaviors coding map** to the current project from a file containing the coding map:

(File > Edit project > Behaviors coding map > Add a behaviors coding map)

Saving the Behaviors coding map

Saving the **Behaviors coding map** will create a file containing the **Behaviors coding map** including the bitmap image.

File > Save the current Behaviors coding map

The file containing the **Behaviors coding map** can be then reloaded in the **Behaviors coding map creator** or added to a BORIS project (**File > Edit project > Behaviors coding map > Add a behaviors coding map**)

2.10.2 The Modifiers coding map

BORIS allows creating a modifiers coding map using the **Modifiers Map creator** tool (**Tools > Create a coding map > for modifiers**.) Clickable areas may correspond to specific modifiers that can be meaningful for the behavioral coding. Facial expression is the case we thought to when developing this function.

Creating a modifiers coding map

Loading a bitmap for a modifiers coding map

To create a new **Modifiers coding map**, launch the **Modifiers Map creator** tool (**Tools** > **Create a coding map** > **for modifiers**). The BORIS main window will be replaced by the **Modifiers Map creator** window. Click on **Modifiers Map creator** > **New Modifiers map** and enter a name for the new map in the edit box. You have to load a bitmap image (JPEG or PNG) using the **Load bitmap** button. The loaded image will be displayed.



If the size of your bitmap image is bigger than $640 \ge 640$ pixels BORIS will resize it to $640 \ge 640$ pixels keeping the aspect ratio and store the resized version in the coding map file.

Adding areas corresponding to the modifiers

To create clickable areas on a coding map, you have to click on the **New area** button and enter an **Area code** in the edit box. The new area can now be defined by clicking on the image. The drawing tool allows defining a irregular polygon (a plane shape with straight sides, which does not have all sides equal and all angles equal) by clicking to determine subsequent vertices. It can be convex or concave. Straight sides must not cross each other. Once selected an area can be deleted using the **Delete area** button.

When an area is closed and its name has been defined in the **Area code** field, it can be saved by using the **Save area** button. The areas can partially overlap each other. See the **Using a Coding map** section for more details. Once all areas are added the entire map can be saved using the **Save map** option menu (**Map creator > Save map**). The map is now saved in its own file (.boris_map) which is NOT part of the BORIS project. A map can be edited at anytime by opening the map file from the **Open map** menu option (**Map creator > Open map**).

Adding a modifiers coding map to your project

Creating a Coding map is not automatically adding the map to your project. The Coding map have to be added to your project by selecting the corresponding **Behavior type** (**Point event with coding map**, **State event with coding map**). BORIS will ask to select the file name containing the coding map (.boris_map) and load the coding map in the project. The coding map name will appear in the **Coding map** column and will be saved in the BORIS project file.

If you later modify your coding map you must reload the new version in your BORIS project.

2.11 Analysis and plot

2.11.1 Time budget analysis

The **Time budget analysis** can be done by behavior (including or not the modifiers) or by category of behaviors. Choose the option from the **Analysis** menu.

The **Time budget analysis** can be done on one or more observations. If you select more than one observation you must then choose for a global time budget analysis that will contain all selected observations or a time budget analysis for every single observation.



Choose Yes to group all observations in one time budget analysis

The **Analysis** > **Time budget** menu option shows the time budget for the events of the selected observations. Select the subjects and behaviors you want to include in the time budget analysis:

~	Select sub	jects and behavio	15	×
Subjects				
Select all	Unselect all	Reverse selection		
 ✓ Nina ✓ Himal ✓ Sharky ✓ Nautilus 				
Behaviors Select all	Unselect all	Reverse selection		
	Unselect all	Reverse selection		
 physiology ✓ Eat ✓ Defecate ✓ Drink ✓ Rest ✓ Urinate ✓ Vomit 				^
social ✓ Play on the Play in the reproduction Breed				
No category ✓ Tear				-
	difiers 🗌 Excl	lude behaviors with	out events	
Time interval Observed		er defined 🔵 Me	dia file(s) duratio	n
		Cano	el ОК	

All behaviors can be selected or unselected by clicking on the Category (bold).

You can choose to include or not the behavior modifiers in the Time budget analysis and to exclude behaviors without coded events.

The Time budget analysis can be restricted to a part of the observation:

- Full observation(s): the analysis will be made on the full observation length.
- Limit to time interval: use the **Start time** and **End time** boxes to select starting time and ending time.
- Limit to observed events: the analysis will be made from the first observed event to the last observed event.

The last dialog window will allow you to subtract the duration of one or more behaviors from the total duration of the observation. This can help you if you have defined a "out-of-sight" code in your ethogram for example:

•	Select behaviors to exclude	+	×
The duration of the selected b	ehaviors will be subtracted from the total time		
Select all Unselect all	Reverse selection		
social Play in the water Play on the ground reproduction Breed No category Alert Allogroom Carry objects Chase Dig Interact with enrichment Locomotion Look for food Manipulate Roll objects Rub Self-groom Sleep Sniff Spot keeper Stomp Swim Tear Vocalize Yawn			
✓ Out-of-sight			*
	Cancel OK	[

The results contain for each subject and behavior the **total nuber of occurrences**, the **total duration** (for the behaviors defined as state events), The **duration mean** (for the behaviors defined as state events), the **standard deviation of duration**, the **inter-events intervals duration mean**, th **standard deviation of the inter-events intervals duration** and the **percent of total duration of observation(s)**. All duration times are expressed in seconds (s).

/	_	_	_	_	_	Time budget	_			-
ele	ected observations									
)3)4)5									
ota	al observation lengt					-				
30	Subject Nina	Behavior Locomotion	Modifiers	otal number of occurence	Total duration (s) 5725.161	Duration mean (s) 2.329	Duration std dev 15.832	inter-event intervals mean (s) 12.350	inter-event intervals std dev 19.784	% of total length 6.6
31	Nina	Swim			921.317		7.632	14.566	22.372	1.1
32	Nina	Eat		242	3232.485	13.357	22.646	8.847	17.604	3.7
33	Nina	Defecate		77	485.087	6.300	1.880	8.778	12.055	0.6
34	Nina	Drink		21	71.319	3.396	2.897	4.176	6.215	0.1
35	Nina	Rest		484	2645.019	5.465	7.789	12.899	16.952	3.1
36	Nina	Urinate		91	528.810	5.811	2.397	4.485	6.334	0.6
37	Nina	Vomit		0	0.000	NA	NA	NA	NA	0.0
38	Nina	Breed		27	2367.218	87.675	174.943	7.380	2.951	2.7
39	Nina	Play on the ground		111	1808.718	16.295	19.517	3.882	6.464	2.1
40	Nina	Play in the water		42	407.223	9.696	9.037	5.925	5.593	0.5
41	Nina	Tear		11	79.060	7.187	5.410	29.728	38.196	0.1

Results of the time budget analysis

The time budget results can be saved in various formats for further analysis:

- Plain text in tabular format
- Tab Separated Values (TSV)
- Comma Separated Values (CSV)
- Hyper Text Markup language (HTML)
- Spreadsheet files
- OpenDocument (ODS)
- Microsoft Excel (XLSX, XLS)
- Pandas dataframe (to be loaded in Python with the pickle module)
- R dataframe (to be loaded in R with readRDS function)

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If a STATE behavior has an odd number of coded events, BORIS will report **UNPAIRED** instead of results.

2.11.2 Time budget by behavioral category

The **Time budget by behavioral category** is similar to the **Time budget analysis** except that the behaviors are grouped into **behavioral categories**.

ele	ected observations			
	01_a			
00	01_b			
00				
00				
00				
IOU	al observation leng		Total number	Tatal duration (a)
1	Subject Nina	Category Locomotion	2623	Total duration (s) 6646.478
-				
2	Nina	physiology	915	6962.720
3	Nina	reproduction	27	2367.218
4	Nina	social	153	2215.941
5	Himal	Locomotion	74	394.873
6	Himal	physiology	1063	6949.869
7	Himal	reproduction	27	2365.562
8	Himal	social	126	1675.827
9	Sharky	Locomotion	2666	6666.277
10	Sharky	physiology	523	4156.620
11	Sharky	social	262	3164.631
12	Nautilus	Locomotion	2542	6001.868
13	Nautilus	physiology	457	3200.887
	Nautilus	social	189	2476.637

Results of a time budget by behavioral category analysis

2.11.3 Synthetic time budget

The synthetic time budget is similar to time budget but with fewer parameters and a different organization of results. Results of all selected observations are organized in columns on a single page. Two parameters are provided for now: **number of occurrences** and **total duration** (for the behaviors defined as state events)

	A	В	C	D	E	F	G	н	I	J	
1		1	Nina	Nina	Nina	Nina	Nina	Nina	Nina	Nina	Nina
2			Alert	Alert	Allogroom	Allogroom	Breed	Breed	Carry objects	Carry objects	Chas
3		Total length (s)	Total duration	Number of occurrences	Total duration	Number of occurrent	Total duration	Number of or	Total duration	Number of od	Total
40	0037	32.160									
41	0038	86.880	1.675	1							
42	0039	96.960	13.471	2							
43	0040	335.520	86.615	12	15.84	2					
44	0041	130.560	9.069	2	5.85	1					
45	0042	36.960	24.298	3							
46	0043	107.040	42.928	5							
47	0044	109.920	11.769	4	12.471	2					
48	0045	102.240	72.857	6							
49	0046	84.960	44.459	6							
50	0047	77.280	68.929	2							
51	0048	23.520	3.1	1	10.797	1					
52	0049	34.080	9.897	2	8.431	1					
53	0050	23.040									
54	0051	44.160	1.079	1							
55	0052	18.240									
56	0053	39.840									
57	0054	35.040									
58	0055	256.800	61.321	15	19.73	1					
59	0056	26.400	15.241	5							
60	0057	45.120	6.887	3	10.984	2					
61	0058	45.120	2.647	1							
62	0059	41.760									
63	0060	292.800	1.543	2							
64	0061	25.920									

All duration times are expressed in seconds (s).

The time budget results can be saved in various formats for further analysis:

- Plain text in tabular format
- Tab Separated Values (TSV)
- Comma Separated Values (CSV)
- Hyper Text Markup language (HTML)
- Spreadsheet files
- OpenDocument (ODS)
- Microsoft Excel (XLSX, XLS)

2.11.4 Synthetic time budget with time bin

The synthetic time budget with time bin is similar to the Synthetic time budget but the results are divised in time bin.

Analysis > Synthetic time budget with time bin

Choose a time bin size (in seconds)

 Select subjects and behaviors 	×
Subjects	
Select all Unselect all Reverse selection	
 ✓ Nina ✓ Himal ✓ Sharky ✓ Nautilus 	
Behaviors	
Select all Unselect all Reverse selection	
Locomotion ✓ Locomotion ✓ Swim physiology Eat	
 □ Defecate ✓ Drink ✓ Rest □ Urinate □ Vomit 	
reproduction	Ŧ
Include modifiers	
Time bin size (s) 10 🗘 🧲 💳	
Time interval	
• Observed events O User defined O Media file(s) duration	
Cancel	

Time bin size of 10 seconds

Synthedic time budget by time bin X										
				+						
	Subjects:		·	No focal subject						
	Behaviors:		Alert	Alert	Alert	Alert	Alert			
	Total length (s)			+ Number of occurrences			Proportion of time			
0001_a	32.400	0.000-10.000	0.0	0.0	NA	NA	0.0			
0001_a	32.400	10.000-20.000	0.0	0.0	NA	NA	0.0			
0001_a	32.400	20.000-30.000	0.0	0.0	NA	NA	0.0			
0001_a	32.400	30.000-32.400	0.0	0.0	NA	NA	0.0			
0001_b	31.400	0.000-10.000	0.0	0.0	NA	NA	0.0			
0001_b	31.400	10.000-20.000	0.0	0.0	NA	NA	0.0			
0001 b	 31.400	+ 20.000-30.000	0.0	+ 0.0	+ NA	+ NA	+ 0.0			

Results of a Synthetic time budget with time bin of 10 seconds

The **time budget with time bin** results can be saved in various formats for further analysis:

- Plain text in tabular format
- Tab Separated Values (TSV)
- Comma Separated Values (CSV)
- Hyper Text Markup language (HTML)
- Spreadsheet files
- OpenDocument (ODS)
- Microsoft Excel (XLSX, XLS)

2.11.5 Inter-rater reliability

The Cohen's kappa coefficient can be calculated (Analysis > Inter-rater reliability > Cohen\'s kappa).

Cohen's kappa on Wikipedia

After selecting 2 observations and a time window (in seconds) for the analysis (the default value is 10 seconds) the Cohen's kappa will be displayed in the results window.

~	1RR - Cohen's Kappa (time-unit) 🛛 🕂								
Time u	unit (in seconds):								
1.000		-							
	× <u>C</u> ancel								

Implementation of IRR Cohen's Kappa in BORIS

If a time window of n seconds is set the 2 selected observations will be checked every n seconds for agreement/disagreement from the first event to the last event of the 2 observations. In case of a point event the presence of a corresponding event in the other observation will be verified using a time window of n seconds centered on the point event.

A IRR Cohen's Kappa analysis is available in the GSEQ program (http://www2.gsu.edu/~psyrab/gseq). For this the coded events can be exported as aggregated events in SDIS format. See export aggregated events.

2.11.6 Similarities

Needleman-Wunsch similarity

2.11.7 Co-occurrence

This function allow to determine the co-occurence of 2 behaviors.

2.11.8 Advanced event filtering

This function allows to filter events from one or more observations by selecting subjects, behaviors and logical operators.

To use the filter, select a subject, select a behavior and click on the button with the green arrow on the side of the behaviors list. The tuple subject/behavior will be added in the **filter text edit**. A complex filter query can be constructed by adding parenthesis and logical operator & (AND) or | (OR) for combining various subjects and behaviors.

Example of a summarized output showing the occurences of Himal resting while Nautilus in alert:

~			av l2/A	nced event filterin	ig	_	_	÷
Filte	er							
"Hi	mal Rest" & "Nautilus	Alert"					Filter events	🛚 Clear
•	Summary			🔘 Detail	s			
Sub	jects		Behaviors		Lo	gical operators		
Hir	nal		Alert		Al Al	ND		
Nir Sh	na arky		Breed Carry objects Chase Defecate Dig Drink Eat Interact with enri Locomotion	chment	•			4
Res	ults (197 observations)							
	Observation id 0015		er of occurences	Total duration 3.351	Mean 3.351	Std Dev		-
1		1						
2	0019	2		8.581	4.29	2.461		
3	0028	1		3.905	3.905	NA		
4	0030	1		8.231	8.231	NA		
5	0032	1		14.245	14.245	NA		
6	0043	1		9.219	9.219	NA		
•				2 916	2 916	NΔ		

Example of a detailed output showing the overlaping intervals while Himal rests and Nautilus is in alert:

~		P1017211	ced event filtering				÷
Filte							
"Hi	mal Rest" & "Nautilus Aler	t"				Filter events	🛾 Clear
0	Summary		 Details 				
Sub	jects	Behaviors					
	nal utilus	Alert Allogroom		AND OR			
	aa arky ults (146 events)	Breed Carry objects Chase Defecate Dig Drink Eat Interact with enric Locomotion	hment	•			
	Observation id	Comment	Start time	Stop time	Duratio	on	4
1	0019		3.559	6.088	2.529		_
2	0019		14.907	17.457	2.550		
3	0028		0.0	3.905	3.905		
4	0048		18.333	18.627	0.294		
5	0054		28.77	30.019	1.249		
	0138		174.796	178.699	3.903		
6							

The same subject can be used many times in the query with OR or AND (in case of non exclusive behaviors):

~		;	Advanced event	filtering			÷×
Filte							
"Hi	mal Drink" "Himal Eat"			Filter events	🛾 Clear		
\bigcirc	Summary		۲				
Sub	jects	Behaviors			Logical operators		
Na Nir Sha	nal utilus na arky ults (188 events)	Carry objects Chase Defecate Dig Drink Eat Interact with Locomotion Look for food Manipulate Play in the w	enrichment d		AND OR		
Res	Observation id	Comment	Start time	Stop time	Duration		
1	0004	connent	49.275	50.408	1.133		
2	0009		5.579	10.48	4.901		
3	0009		18.683	40.19	21.507		
4	0013		24.324	30.869	6.545		
5	0055		3.65	5.326	1.676		
6	0055		21.362	29.117	7.755		
7	0056		22.885	26.37	3./85		*
						Save results	Close

An unlimited number of conditions can be used:

~	Aslvan	nitest event filterin	ป	_	_	÷×
Filter						
"Himal Rest" & "Nautilus Re	est" & "Nina Rest" & "Sharky Res	it"			Filter events	Clear
Summary		O Details	5			
Subjects	Behaviors		Logic	cal operators		
Himal Nautilus Nina Sharky	RestRoll objectsRubSelf-groomSleepSniffSpot keeperStompSwimTearUrinateMonoline		AND OR)		
Results (2 observations) Observation id	Number of occurences	Total duration	Mean	Std Dev		
	1	0.403	0.403	NA		
	2	2.769	1.384	1.592		
			I	•	Save results	Close

Parenthesis can be used to group logical conditions into block(s):

Filter						
"Himal Alert" & ("Nautilus Ea	at" "Nina Eat" & "Sha	rky Eat")			Filter events	Clear
Summary		(Details 			
Subjects	Behaviors			Logical operator	s	
Nautilus Nina Sharky	Carry obj Chase Defecate Dig Drink Eat Interact v Locomoti Look for Manipula Play in th	vith enrichment ion food ite e water		OR		
Results (30 events) Observation id	Comment	Start time	Stop time	Duration		
1 0055	Connient	8.689	12.435	3.746		
2 0055		19.778	21.361	1.583		
3 0055		29.118	30.692	1.574		
4 0055		66.079	69.591	3.512		
5 0055		199.744	200.81	1.066		
6 0239		149.63	152.719	3.089		
		163,807	164 859	1.052		

The results can be saved in a Tab Separted Values (TSV) file using the **Save results** button. Other formats will be added in future.

2.11.9 Latency

The latency will analyze the time between one or more markers (arbitrary behaviors(s)) and other behaviors.

2.11.10 Plugins

From version 9 you have the possibility to write plugins to analyze the coded data.

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Use this function for testing purposes, as it is currently experimental and may be subject to changes in the future.

Some plugins are built into BORIS (see the **BORIS plugins** list), and you can also create your own custom plugin using Python and Pandas.

Go to **Preferences > Analysis plugins**, then choose the plugins you'd like to enable.

-					Prefei	rences					×
Proje	ect	Observations	Analysis plugins	FFmpeg framework	Spectrogr	am/Wave form	Plot colors	Interface			
BOR	IS plu	ugins				Plugin info					
✓ N	umb	udget er of occurence er of occurence		ubject by independent_	variable						
Pers	onal	plugins									
/tmp	o/per	sonal_plugins			Browse						
⊻ Tì	me b	udget (hours)									
									Refresh	Cancel	ОК

You can view more information by clicking on the plugin name.

•				Prefe	eferences					
Project	Observations	Analysis plugins	FFmpeg framework	Spectrogr	ram/Wave form	Plot colors	Interface	•		
BORIS pl	lugins				Plugin info					
✓ Numl Persona /tmp/pe	ber of occurence		ubject by independent	_variable	- Inter-event	14) ollowing value on of occurent on of behavio ean of behavio viation of bel intervals mea intervals star	es: ces of behav r (in seconds ior (in second havior durat an (in second	ior s) ds) ion (in seconds)		
							Refresh	Cancel	OK	

You can find the plugin code in the boris/analysis_plugins directory.

How to use an Analysis plugin

Go to **Analysis > Plugins**

All plugins are listed (the BORIS plugins and your personal plugins)

Select the plugin you want to use

Select the observations to analyze $% \left({{{\left({{{{{{\bf{n}}}}} \right)}}}} \right)$

Select the subjects and the behaviors

You should obtain a window with the results of the plugin analysis

	Subject	of behaviors v. 0.1.0 (2024-11-14 Behavior	number of occurences
0	Himal	Alert	2962
1	Himal	Allogroom	114
2	Himal	Breed	27
3	Himal	Carry objects	174
4	Himal	Chase	4
5	Himal	Defecate	77
6	Himal	Dig	176
7	Himal	Drink	33
8	Himal	Eat	155
9	Himal	Interact with enrichment	26
10	Himal	Locomotion	2329
11	Himal	Look for food	26
12	Himal	Manipulate	911
13	Himal	Plav in the water	15

The results can be saved in various formats (TSV, CSV, ODS, XLSX, Pandas dataframe, R dataframe and HTML)

Anatomy of an Analysis plugin

A plugin is a Python script consisting of two functions: **main** and **run**. The **main** function must remain unchanged, while the **run** function contains your custom code.

The plugin code must define the following global variables:

__version__ = "x.y.z" __version_date__ = "YYYY-MM-DD" __plugin_name__ = "PLUGIN NAME" __author__ = "AUTHOR - INSTITUTION"

The **run** function takes a Pandas DataFrame as its sole argument and must return a Pandas DataFrame.

The DataFrame passed to the ${\bf run}$ function includes the following columns:

Column Dtype Observation id object independent variables object Subject object Observation duration by subject by observation int64 Behavior Behavioral category object object Behavior modifiers object Behavior type object Start (s) Stop (s) object object Duration (s) object Comment start Comment stop object object

The DataFrame will include a column for each independent variable defined in your project.

The DataFrame will include a column for each behavior modifier set defined in your project.

Here is an example of the DataFrame structure, including 4 independent variables and various behavior modifiers:

#	Column	Dtype
0	Observation id	object
1	independent variable 'Location'	object
2	independent variable 'Weather'	object
3	independent variable 'Temperature'	object
4	independent variable 'Number of visitors'	object
5	Subject	object
6	Observation duration by subject by observation	int64
7	Behavior	object
8	Behavioral category	object
9	(Carry objects, set #1)	object
10	(Chase, set #1)	float64
11	(Eat, set #1)	float64
12	(Eat, set #2)	float64
13	(Interact with enrichment, set #1)	float64
14	(Locomotion, set #1)	object
15	(Play in the water, interaction)	object
16	(Play on the ground, set #1)	object
17	(Rub, set #1)	object
18	(Sniff, set #1)	object
19	(Spot keeper, set #1)	float64
20	(Tear, set #1)	object
21	Behavior type	object
22	Start (s)	object
23	Stop (s)	object
24	Duration (s)	object
25	Comment start	object
26	Comment stop	object

You can find the code for a simple plugin that counts the number of occurrences of behaviors for each subject at the following link: number_of_occurences.py

You can modify the **run** function to implement your custom logic, but the **main** function must remain unchanged.

2.12 Plot

2.12.1 Plot events

The recorded events can be plotted along a time axis.

Analysis > Plot > Plot events

Select the **observations** you want to plot. If more than one observation are selected BORIS will ask you for a directory where to save the plots.

1443	observa	tions									
id		▼ contains	•								
	id 🔻	date	description	subjects	observation duration	exhaustivity %	media	Location	Weather	emperatur	Visitors
	0001_a	2016-05-17 00:00:31	Vegetation	Himal, Nautilus	32.400	100.0	#1: 20160517162539.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
2	0001_b	2016-05-17 00:00:31	Vegetation	Himal, Nautilus	32.400	98.5	#1: 20160517162539.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
	0002	2016-05-17 00:00:24	Vegetation	Sharky, Himal, Nautilus	34.470	89.6	#1: 20160517162540.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
	0003	2016-05-17 00:00:05	Vegetation	Sharky, Himal, Nautilus, Nina	22.500	87.1	#1: 20160517162641.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
	0004	2016-05-17 00:00:59.000	Central trunks	Sharky, Himal, Nautilus, Nina	50.697	72.9	#1: video1.mp4	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
	0005	2016-05-17 00:00:49	In the pool	Sharky, Nautilus	40.770	100.0	#1: 20160517163131.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
	0006	2016-05-17 00:00:42	In the pool	Sharky, Himal, Nautilus	61.830	73.3	#1: 20160517163231.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	24	1046
	0007	2016-05-17 00:00:13	In the pool	Sharky, Himal, Nina	124.986	41.3	#1: 20160517163347.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
	0008	2016-05-17 00:00:17	In the pool	Sharky, Himal, Nautilus	64.800	85.1	#1: 20160517163743.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
)	0009	2016-05-17 00:00:10	In the pool	Sharky, Himal, Nina	46.277	84.6	#1: 20160517163927.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	25	1046
1	0010	2016-05-17 00:00:57	Area near the glass window	Sharky, Himal, Nautilus	16.779	81.1	#1: 20160517164021.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
2	0011	2016-05-17 00:00:50	Area near the glass window	Sharky, Himal, Nautilus, Nina	25.101	49.1	#1: 20160517164106.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
3	0012	2016-05-17 00:00:45	Area near the glass window	Sharky, Nautilus, Nina	78.210	62.4	#1: 20160517164204.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	26	1046
4	0013	2016-05-17 00:00:25	Central trunks	Sharky, Himal, Nautilus, Nina	63.631	66.2	#1: 20160517164715.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
5	0014	2016-05-17 00:00:52	In the pool	Sharky, Himal, Nautilus, Nina	242.596	53.5	#1: 20160517164927.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046
6	0015	2016-05-17 00:00:18	Central trunks	Sharky, Himal, Nautilus, Nina	111.302	49.7	#1: 20160517165631.m2ts	44° 55′ 59″ N - 7° 25′ 18″ E	sun	16.0	1046

Select the observations to plot

The **subjects** and **behaviors** you want to include in the plot can be selected in the following window:

~	Select sub	ojects and	behaviors	×
Subjects				
Select all	Unselect all	Reverse s	election	
 ✓ Nina ✓ Himal ✓ Sharky ✓ Nautilus 				
Behaviors				
Select all	Unselect all	Reverse s	election	
physiology ✓ Eat ✓ Defecate ✓ Drink ✓ Rest ✓ Urinate ✓ Vomit social ✓ Play on the Play in the reproduction Breed No category ✓ Tear				
Include mod	difiers Exc	lude behav	iors without ev	ents
Time interval		ser defined	🔿 Media file	(s) duration
			Cancel	ОК

You can choose to include or not the behavior modifiers (if any) and to exclude behaviors without coded events.

The time interval can be selected (See time budget)

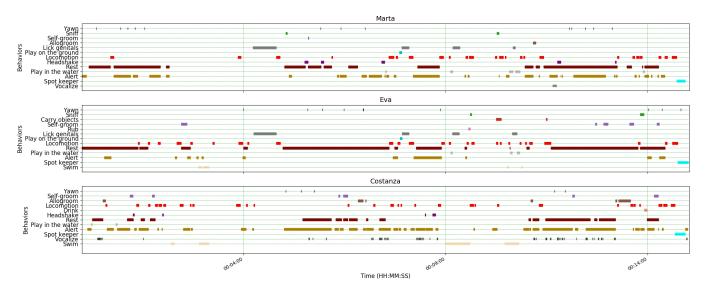
The plot can be exported in various formats like bitmap (PNG, JPG, TIFF) or vectorial graphic (SVG, PDF, EPS, PS). The SVG format can be further edited with the Inkscape vector graphics editor.

Aportant

If a STATE behavior has an odd number of coded events, you will see this error message: "The STATE behavior XXX is not paired"

This function creates one plot by subject on one figure.

The color of behaviors can be customized. See plot colors



2.12.2 Plot time budget

The duration and number of occurences can be plotted for each subject and behavior.

Analysis > Plot > Plot time budget

The subjects and behaviors you want to include in the plot can be selected in the following window:

~	Select sub	jects and	behaviors	×			
Subjects							
Select all	Unselect all	Reverse s	election				
 ✓ Nina ✓ Himal ✓ Sharky ✓ Nautilus 							
Behaviors Select all	Unselect all	Reverse s	election				
 ✓ Eat ✓ Defecate ✓ Drink ✓ Rest ✓ Urinate ✓ Vomit social ✓ Play on the 							
reproduction Breed No category ✓ Tear				•			
Select all Unselect all V Nina V Himal V Sharky V Nautilus Behaviors Select all Unselect all Reverse selection physiology V Eat V Defecate V Drink V Rest V Vomit social Vomit V Play on the ground Play in the water reproduction Breed No category							
	events 🔾 Us	ser defined	🔿 Media file	e(s) duration			
			Cancel	ОК			

The behavior modifiers can not be included in the plot for now.

The time interval can be selected (See time budget)

The plot can be exported in various formats like bitmap (PNG, JPG, TIFF) or vectorial graphic (SVG, PDF, EPS, PS). The SVG format can be further edited with the Inkscape vector graphics editor.

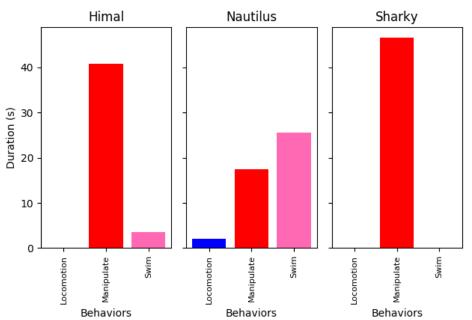
Aportant

If a STATE behavior has an odd number of coded events, you will see this error message: "The STATE behavior XXX is not paired"

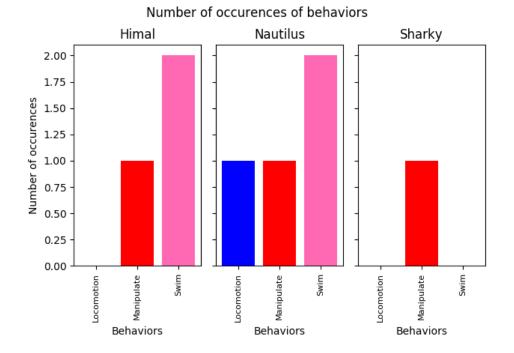
This function creates 2 plots with all subjects for each observation:

- a plot of the behavior durations for the behaviors defined as STATE event.
- $\ensuremath{\bullet}$ a plot of the number of occurences for all the behaviors.

The color of behaviors can be customized. See plot colors



Durations of behaviors



- 115/127 -

2.13 Preferences

You can customize BORIS using the Preferences window (File > Preferences)

2.13.1 Project preferences

,	,		Pr	refer	ences				×
	Project	Observations	FFmpeg framework	Sp	oectrogram/W	Vave form	Plot colors	Interface	
	Default p	roject time format	:		hh:mm:ss.m	ISS			•
	Auto-save	e project every (mi	nutes)		0				-
	Separator	for behavioural s	trings (events export)						
	✓ Check	for new version a	nd news						
	MPV play	er hardware video	decoding		auto				•
	Project fil	e indentation type	2		Newline				•
						Refresh	Cancel	ОК	

Refresh button

Option to reinitialize the configuration to default. BORIS will be closed.

Default project time format

This option allows the user to choose the format for displaying time in the project. Please note that time is internally always saved in seconds with a precision of 3 decimal digits

Auto-save project every (minutes)

if set BORIS will save your project automatically every n minutes. 0 indicate no automatic backup. The project will be saved if the project is already saved and an observation is open.

Separator for behavioural strings

Character (or string) used to separate behaviors when exporting events as behavioural strings. See also Behatrix

Check for new version

Check for new version on BORIS web site every 15 days (internet access required)

2.13.2 Observations

*	Pr	eferences		×				
Project Observations FFmpeg framework Spectrogram/Wave form Plot colors Interface Fast forward/backward value (seconds) 10 • • Adapt the fast forward/backward jump to playback speed • • • Playback speed step value 0.1 • • Time offset for video/audio reposition (seconds) 0 • • Play sound when a key is pressed • • • • Close the same current event independently of modifiers • • • • Beep every (seconds) 0 • • • • Display subtitles • • • • • • Alert if focal subject is not set • • • • • • Plause media before "Add event" command • • • • • •		Interface						
Project Observations FFmpeg framework Spectrogram/Wave form Plot colors Interface Fast forward/backward value (seconds) 10 * * * Adapt the fast forward/backward jump to playback speed 0.1 * * Playback speed step value 0.1 * * Time offset for video/audio reposition (seconds) 0 * * Play sound when a key is pressed . . * Close the same current event independently of modifiers . . * Beep every (seconds) 0 . * Display subtitles Alert if focal subject is not set 								
Adapt the fast forward/	backward jump to playba	ack speed						
Project Observations FFmpeg framework Spectrogram/Wave form Plot colors Interface Fast forward/backward value (seconds) 10 \$<								
Project Observations FFmpeg framework Spectrogram/Wave form Plot colors Interface Fast forward/backward value (seconds) 10 * Adapt the fast forward/backward jump to playback speed * * Playback speed step value 0.1 * Time offset for video/audio reposition (seconds) 0 * Play sound when a key is pressed * * Close the same current event independently of modifiers * * Beep every (seconds) 0 * * Display subtitles * * * Tracking cursor above current event * * * Alert if focal subject is not set * * *								
Play sound when a key i	s pressed							
Close the same current	event independently of r	nodifiers						
Beep every (seconds)		0		*				
Display subtitles								
Tracking cursor above c	urrent event							
Alert if focal subject is n	ot set							
✓ Pause media before "Ad	d event" command							
		Refresh	Cancel	ОК				

Fast forward/backward value (seconds)

This option allows the user to customize the amount of time for "jumping" forward or backward in media.

Adapt the fast for/backward jump to playback speed

The jump value will be adapted to the playback speed.

Playback speed step value

This value indicate how much the speed will be increased or decreased after pressing the *change playback speed* buttons.

Time offset for media reposition (seconds)

This value indicates the time offset for repositioning the media after double-click on a row event of the *Events* table. 'for example -4 seconds indicates that after a double-click the media will be repositioned 4 seconds before the recorded event.'

Play sound when a key is pressed

Activate a sound signal after every keypress event

Close the same current event independently of modifiers

Option used to STOP the current behavior without regarding the modifiers

Display subtitles

Option to display or hide the visualization of subtitles. In case of separate file, the file containing subtitles must have the same base name than the video files with a .srt extension.

Tracking cursor above current event

Check this box to position the tracking cursor above the current event in events list table.

Alert if focal subject is not set

If this option is activated BORIS will show an alert box if no focal subject is selected

Pause media before "Add event" command

Option to pause the media before manually adding an event.

2.13.3 FFmpeg framework

Ŧ			Pr	eferences				×
Pro	oject	Observations	FFmpeg framework	Spectrogram/	Wave form	Plot colors	Interface	
FFm	npeg p	ath: ffmpeg						
FFm	npeg ca	ache directory						
					Refresh	Cancel	ОК	

The path for the ffmpeg executable program is displayed. The FFmpeg executable is included with BORIS for Windows. The FFmpeg framework is required to run BORIS.

FFmpeg cache directory

This indicates the directory that will be used as image cache for frame-by-frame mode and spectrogram visualization. If you do not specify a path, BORIS will use the default temporary directory of your system.

2.13.4 Spectrogram / wave form

*		Pr	eferences			×
Project	Observations	FFmpeg framework	Spectrogram/Wave form	Plot colors	Interface	
Spectrogr	am color map		viridis			•
Default ti	me interval (s)		10			\$
			Refresh	Cancel	ОК	

Spectrogram height

Select the height of generated spectrogram (in pixels). You will need to restart the current observation to apply changes.

Color map

Select the color map for displaying the generated spectrogram. See Matplotlib colormaps for details.

2.13.5 Plot colors

The color of behaviors in the plot events functions can be customized. The first color will be associated to the first behavior in your ethogram, the second color to the second behavior and so on. Various color formats can be used to specify a color: **named color** or **hex RGB** (like #0F0F0F). See https://matplotlib.org/api/colors_api.html and https://matplotlib.org/examples/color/ named colors.html for details

The **reset colors to default** button will reload the default colors.

		Pr	references		
Project	Observations	FFmpeg framework	Spectrogram/Wave form	Plot colors	Interface
List of col	ors for behaviors.		ist of colors for behavioral cat #FF96CC	egories. See <u>m</u>	atplotlib colors
tab:orang	ae		#96FF9C		
tab:greer	-		#CCFFFE		
tab:red			#EEFF70		
tab:purp			#FF4F64		
tab:brow			#F8BF15		
tab:pink		1	#3DC7AD		
tab:gray tab:olive					
tab:cyan					
blue					
green					
red					
cyan					
magenta	1	-			
vellow					
	Reset colors to	o default	Reset colors	s to default	
			Refresh	Cancel	ОК

2.13.6 Interface

•				Preferences			×
Project	Observa	tions	FFmpeg framework	Spectrogram/Wave form	Plot colors	Interface	
Toolbar i	cons size	36					*
🗆 Dark n	node						
					Refresh	Cancel	ОК

Toolbar icon size

Set the size of the icons in the toolbar (in pixels)

Dark mode

Switch to dark mode

2.14 Various

2.14.1 Removing path of media files

Using BORIS you can choose to store the full path of the media/data files into the file project (for example: /home/user/Video/ video_n1.mp4 or c:\Users\user\Documents\video1.avi).

If you want to move your project on a different computer or if you want to move your media/data files you may want to do not store the full path. For this you can choose to add media/data files with relative path (See **Add media files** section). You can also remove the full path of your media/data files from all observations of the current project (**File > Remove path from media files**. Please note that this operation is irreversible. After remotion the full path of your media will be lost and will not be recoverable.

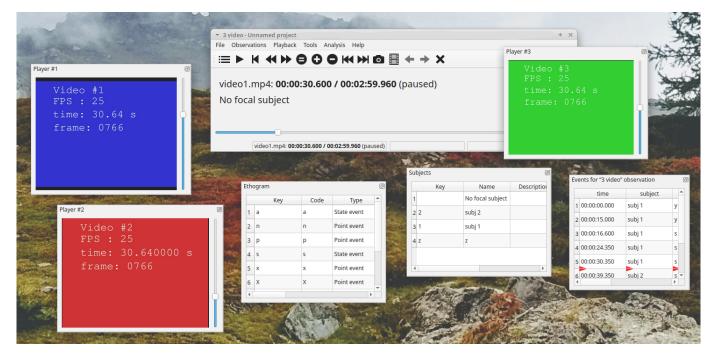
If you choose to do not store the full path of media/data files the path of the media/data files must contain the path of your BORIS project file.

Example: if you BORIS project file is saved in /home/user/projects/test.project your media/data files can be saved in the /home/user/ projects/videos directory but **NOT** in the [/home/user/videos]{.title-ref}` directory.

2.14.2 Docking / undocking graphical elements

All elements, including all the media players can be undocked from the main window and positioned where you prefer (e.g. they can be on the same desktop over one or many screens).

The position of the various widgets is saved in the configuration file at the end of the work session.

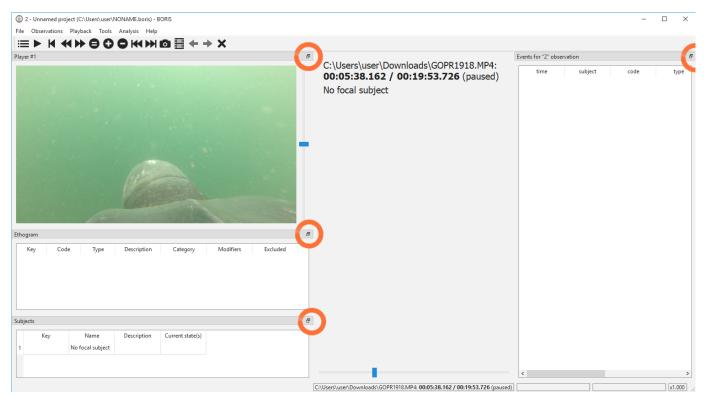


Click the icon present at the top-right corner of the widget (for MacOS the icon is located at the left-top corner) will undock the widgets that can be repositioned on another docking area or moved out of the main window. A double-click on the top bar of the widget will reposition it on the main window.

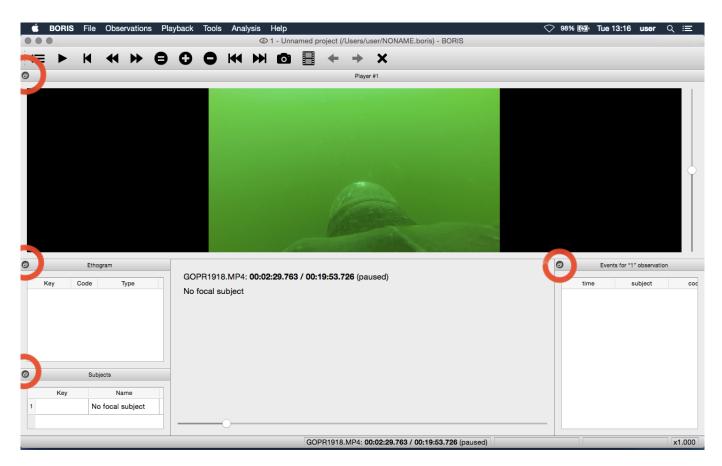
For Linux:

e Observations Playback	Tools Analysis Help					- BORIS	_	-
-	900₩₩@ 🌉 +	×						
layer #1	ayer				layer #3			
Video #1 FPS : 25 time: 0. frame: 0	04 s	<pre>Video # FPS : 2 time: 0 frame:</pre>	5 .04000 0001	0 s	E t	Video # TPS : 2 time: (trame:	25).04 s	
thogram	video1.mp4: 00:00:00.000	Events for "3 video	subject	code	type	modifier	comment	
1 a a	/ 00:02:59.960 (paused)	1 00:00:00.000	subj 1	y	START			
2 n n	No focal subject	2 00:00:15.000	subj 1	у	STOP			
3 p p	5	3 00:00:16.600	subj 1	s	START			
4 s s _		4 00:00:24.350	subj 1	s	STOP			
		5 00:00:30.350	subj 1	s	START			
Subjects		6 00:00:39.350	subj 2	s	START			
Key Name		7 00:00:50.600	subj 2	s	STOP			
1 No focal subject		8 00:01:00.350	subj 1	s	STOP			
2 2 subj 2								
3 1 subj 1								
4 z z 🗸								
		-						
		video1	.mp4: 00:00:00.00	0 / 00:02:59.960 (paused)			x1.

For Microsoft-Windows:



For MacOS:



If you fill uncomfortable with the dockwidgets you can block them on the main window by checking the **Lock dockwidgets** option (see **Tools > Lock dockwidgets**). All the dockwidgets will be docked on the main window and locked on it except the player dockwidgets.

2.14.3 Configuration files

BORIS saves the configuration (user preferences, windows position, widgets position) in a configuration file. This file is named **.boris** and it is saved on the home directory of the current user:

for Linux: /home/USERNAME/.boris for Microsoft-Windows: C:\Users\USERNAME\.boris

for MacOS: /Users/USERNAME/.boris

If you have some trouble using BORIS try to close the program, delete this file and relaunch BORIS.

The **recent projects list** is saved on the **.boris_recent_projects** file in the home directory of the current user.

2.14.4 Lock the dockwidgets

The dockwidgets (except the player dockwidgets) can be locked on the main window (See **Tools** > **Lock dockwidgets**).

2.14.5 Valid keys for triggering behavior

BORIS makes difference between lower case and upper case characters

- keys from a to z
- keys from A to Z
- keys from 0 to 9
- function keys from F1 to F12
- •àéèùìç
- ! " £ \$ % & / () = ? ^ [] { } @ | § ° #

3. Community

3.1 Acknowledgement

The authors would like to acknowledge all the users that report bugs and/or request features for their precious help.

3.2 Citing BORIS

If you have used BORIS for publications, please cite:

```
Friard, O. and Gamba, M.,
BORIS: a free, versatile open-source event-logging software for video/audio coding and live observations.
(2016) Methods Ecol Evol, 7: 1325–1330.
```

DOI: 10.1111/2041-210X.12584

You can also send us a nice postcard.

Please consider to give a star to the BORIS GitHub repository.

3.3 Bug reports and features request

Please report any bug you will find in the latest BORIS version using the GitHub repository.

Prior to report a bug please:

- Check the Frequent Asked Question (FAQ) section
- · Check if the issue was not already reported (GitHub repository)
- Delete the configuration file and try again (see configuration file).

Remember to indicate:

- your operating system
- the version of your operating system
- the computer you are using (model, RAM ...)
- the version of BORIS you are using
- Information on the mediafile you are coding (if any) See Tools > Media file information

Give all the information that will allow to reproduce the bug: a detailed procedure, a screen recording, etc.

In case of crash please send me the file boris_error.log generated in your home directory just after the crash (before relaunching BORIS):

Linux: /home/YOUR_PROFILE_NAME/boris_error.log Microsoft-Windows: c:\Users\YOUR_PROFILE_NAME\boris_error.log

Note

If the bug you have reported is fixed remember to close the issue.