Description of sample projects

Psychology/Usability/ Ergonomics

for The Observer XT

Noldus

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The Observer XT Sample Projects

The Observer XT installation USB stick contains a folder **Documentation\Sample Projects\Human Sample Project** with a backup file (*.vpb) of one sample project (Medical Communication).

You can download a large number of other sample projects on the website of Noldus IT. These projects are examples of commonly used tests with The Observer XT.

The following sample experiments are available:

To download a sample project

1. Login to the website. To be able to do so you have to register.
2. Browse to www.noldus.com/downloads.
3. Choose **Downloads and documentation** > **The Observer XT 15** > **Sample projects**.
4. Download the sample project and the accompanying videos.

Install the sample projects

1. Copy the sample project backup file (.vpb) to your computer.
2. Copy the associated video files to the default **Video Files** folder of The Observer XT:

   C:\Users\Public\Public Documents\Noldus\The Observer XT\Video Files.
3. In The Observer XT, choose **File** > **Restore Backup**.
4. Browse to the backup file that you want to restore. Optionally click **Browse** and select another experiment location. By default the project is saved in:

   C:\Users\Public\Documents\Noldus\The Observer XT\Projects
5. Click **Open** to restore the experiment in this location.

If you open a sample project with external data, but do not have a license for that function, you can open the project, visualize and make calculations with the event data, but not visualize or select or calculate with the external data.

Medical communication

This sample project shows the gazing behavior and communication of a doctor when he has a patients file either on paper or on a tablet. There are two observations, one with a paper patients file and one with a patients file on a tablet. Both observations were coded by three untrained coders. The realistic reliability analysis is, therefore, realistic.

Video files

- Paper patients file video 1.avi
- Paper patients file video 2.avi
- Tablet patients file video 1.avi
- Tablet patients file video 2.avi

SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The coding scheme contains three behavior groups:

- **Gazing** – with the individual behaviors *Gazing at patient*, *Gazing at patients file, Gazing at nurse* and *Other/No gazing*.
- **Communication** – With a number of communication types like *Businesslike (open/closed) question*, *Empathic (open/closed) question*, *Explaining*. Each behavior in this group is linked to two modifier groups. *To whom* indicates to which person communication is directed to. *Topic* indicates whether the communication is medical, personal or otherwise.
- **Doctor presence** – This behavior group only contains the two behaviors *Yes* and *No* and is used to select the intervals during which the doctor was present.

Independent variables

The project contains the following independent variables:

- **Patients file** – to indicate whether the patients file in the observation was on tablet or on paper.
- **Observer** – to indicate which observer has coded the observation.

OBSERVE

Choose **Observe** > **Observation** > **Open**. Choose one of the following:

- **Paper_OK** – Patients file on paper, coder Olga Krips.
- **Tablet_OK** – Patients file on tablet, coder Olga Krips.
- **Paper_LL** – Patients file on paper, coder Leanne Loijens.
- **Tablet_LL** – Patients file on tablet, coder Leanne Loijens.
- **Paper_PZ** – Patients file on paper, coder Patrick Zimmerman.
- **Tablet_PZ** – Patients file on tablet, coder Patrick Zimmerman.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

All data profiles, except for *All data* contain an **Interval** selection box to analyze only the time that the doctor was present.

- **All data** – Which includes all the data.
- **All data by type of patients file** – To obtain separate analysis results for each type of patients file.
- **Gazing for reliability analysis** – To carry out a reliability analysis on the gazing behaviors. This profile contains a filter on the behavior group *Gazing*.

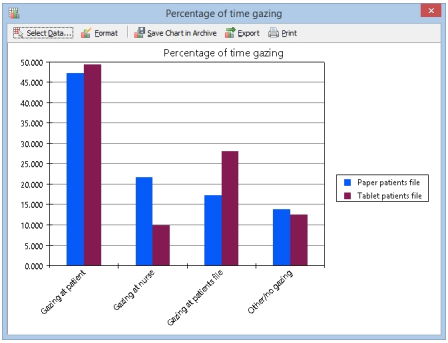
- **Communication for reliability analysis** – To carry out a reliability analysis on the communication behaviors. This profile contains a filter on the behavior group *Communication*.
- **Gazing by type of patients file** – To analyze the gazing separately for the observations with the tablet patients file and the paper patients file. The profile contains two result boxes. One branch has a filter box for the observations with the tablet patients file and the other branch a filter box for the paper patients file. Both branches have a filter box for the *Gazing* behavior group.
- **Communication by type of patients file** – To analyze the communication separately for the observations with the tablet patients file and the paper patients file. The profile contains two result boxes. One branch has a filter box for the observations with the tablet patients file and the other branch a filter box for the paper patients file. Both branches have a filter box for the *Communication* behavior group.

Behavior analyses

The project contains three behavior analyses in which the data obtained by the three coders are averaged. To open these analysis results, choose **Analyze** > **Behavior analysis** > **Open Archive**, and open an *.arx file.

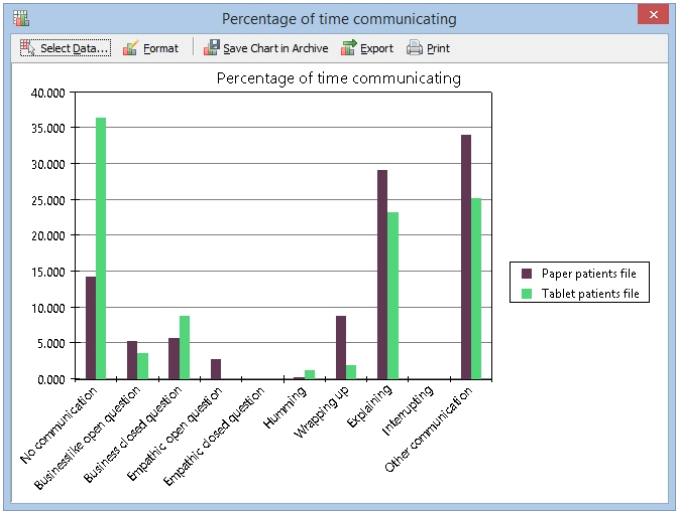
- **Gazing by type of patients file** – Based on the data profile with the same name. The analysis contains a chart *Percentage of time gazing* based on the analysis results. It shows that the doctor looks more

at the patients file when it is on tablet. When the patients file is on paper, he looks more at the nurse.



- **Communication by type of patients file** – Based on the data profile with the same name. The modifiers *To whom* and *Topic* are not analyzed. The analysis contains a chart *Percentage of time communicating* based on the analysis results. The behavior *No communication* is much higher when the patients file is on tablet. When the patients file is on paper, the behaviors *Businesslike open*

question, *Empathic open question*, *Wrapping up*, *Explaining* and *Other communication* are higher.,



- **All data by type of patients file** – Based on the data profile with the same name. This behavior analysis is a full analysis of the data grouped by type of patients file. The modifiers are also analyzed.

Reliability analyses

Reliability analyses were done to assess inter coder reliability. Three observation pairs per type of patients file were analyzed. Each pair compares two coders that coded the same observation.

Two reliability analyses were carried out, one on the behavior group *Gazing* and one on *Communication*. The default method **Frequency/ Sequence** was used.

To open these analysis results, choose **Analyze** > **Reliability analysis** > **Open Archive**, and open an *.arx file.

- **Reliability analysis gazing** – The reliability analysis was carried out on the behavior group *Gazing*. The analysis shows that the

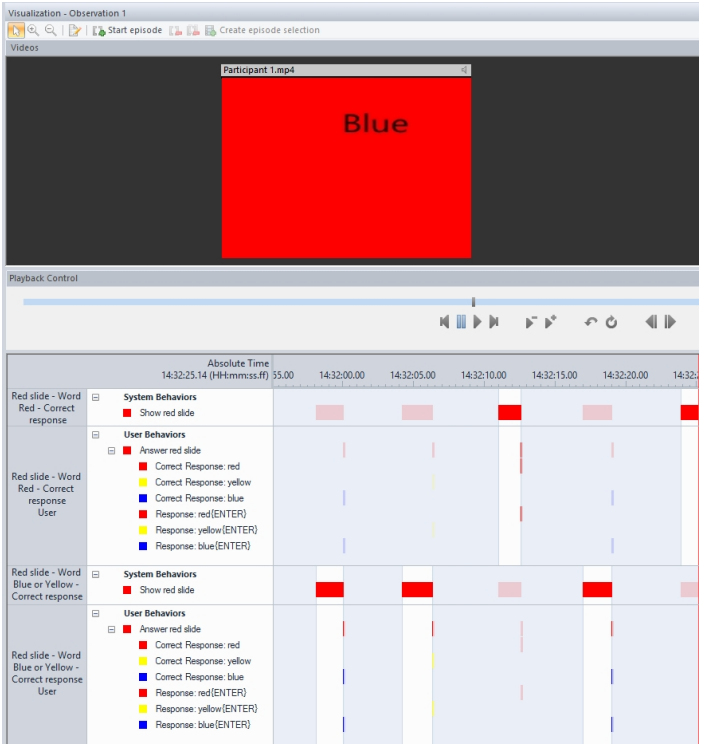
percentage of agreement between observation pairs varied between 74% and 96%.

- **Reliability analysis communication** – The reliability analysis was carried out on the behavior group *Communication* including the modifiers *To whom* and *Topic*. The percentage of agreement between observation pairs was much lower than for the behavior group Gazing. It varies between 27% and 62%. Note that the three coders were not trained beforehand. For trained coders one can expect a higher percentage of agreement.

The Reliability analyses show that a clear behavior like *Gazing* can be scored reliably without training beforehand. For *Communication*, that is much more sensitive to interpretation, it is more difficult to score reliably. Therefore for such behaviors, coders need to be trained.

E-Prime and The Observer

In this experiment, test participants had to carry out two tasks on a computer. In the first task they were shown colored slides with a color in words. They had to type the word. The slides were displayed with E-Prime. The correct answer, the moment the slide was displayed and the moment the response was typed were logged in E-Prime data. The E-Prime logs and screen recordings were imported into The Observer XT.



In the second experiment a number of pictures, also displayed by E-Prime, were shown. The participants were asked to rate the pictures

with a number ranging from 1 (ugly) to five (beautiful). The ratings were imported as numerical modifiers into The Observer XT. This allowed to calculate average ratings per pictures with a Numerical analysis.

This sample experiment is an example to carry out a live observation in The Observer XT and running an experiment in E-Prime simultaneously. To control E-Prime with The Observer XT the Noldus E-Prime client and Noldus E-Prime server were used. With these tools E-Prime starts and stops together with a live observation in The Observer XT, and the E-Prime data are imported automatically in the observation.

Software versions

This sample project was made with the following software versions:

- The Observer XT 14
- E-Prime 2.0.10.356 (2.0 SP2)
- Noldus E-Prime Client 1.4
- Noldus E-Prime Server 1.4

For more information

You find more information about using E-Prime with The Observer XT and how to calculate statistics on the E-Prime data in the Technical Note - E-Prime - The Observer XT 14. This technical note also contains information on how to obtain high synchronicity between the E-Prime data and the manually scored events in The Observer XT. You find the technical note on The Observer XT installation USB stick. You can also download it from www.noldus.com/downloads.

Video files

- Participant 1.mp4
- Participant 2.mp4
- Participant 3.mp4

SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The Coding Scheme contains two Start-Stop behavior groups that were both imported from E-Prime.

- System behaviors – With the moments the different slides were displayed as state events.
- User behaviors – With the moment the user response was typed as point events. The responses to the colored slides contain the nominal modifiers *Actual response* and *Correct Response*. The responses to the pictures contain the numerical modifier *Predefined numerical response* with the ratings as numbers.

To keep the sample experiment simple, no behavior group for manual coding was added to the Coding Scheme. But it is, of course possible, to add behaviors to the Coding Scheme and analyze these together with the E-Prime data.

Independent variables

The Independent variables list contains a user defined variable *Participant name*.

OBSERVE

Choose **Observe** > **Observation** > **Open**. Choose one of the three observations. Each observation represents a test participant.

Each observation contains two Event logs:

- E-Prime – With the imported E-Prime data.
- Event log – That would contain the manually scored annotations. For simplicity this sample project does not contain any manual annotations.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All data** – the default data profile with no selection criteria.
- **Pictures only to calculate the average ratings and response times** – This data profile contains a filter on the pictures.
- **Colored slides only to calculate the responses and response times** – This complex data profile contains a number of filters and interval boxes. It splits up the data in the following way:

  a The color of the slide.

  b Whether the word shown on the slide is same as the slide color or different.

  c Whether the typed word is the same as the word on the slide (correct actual response) or not (incorrect actual response).

  See **THE DATA PROFILE FOR THE COLORED SLIDES** on page 20 for a detailed description of this data profile.

Visualize data

Select a data profile and choose **Analyze** > **Visualize data** and select the observations to visualize.

In the visualization of the colored slides, unfold the **Answer** item to display the responses. If the colors of the two lower bars match, like in the picture below, the test participant typed the correct word. If they do not match, the participant typed the wrong word.

Analysis results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

Under Behavior Analyses:

- **Picture ratings response times** - With the number of times a response for a picture was given and the average response time per picture. For this analysis the data profile **Pictures only to calculate the average ratings and response times** was used.
- **Number of correct and incorrect answers and response times** - With the number of times certain responses were given and the response times. The data are split up by slide color, correct and incorrect actual response and whether the word on the slide matched the slide color or not. For this analysis the data profile **Colored slides only to calculate the responses and response times** was used.

  The analysis contains a bar chart with the average response times.

Under Numerical Analyses:

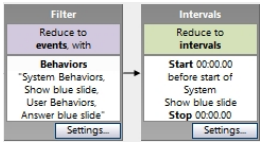
- **Numerical statistics on picture ratings** - With the minimum, maximum and mean ratings per picture. For this analysis the data profile **Pictures only to calculate the average ratings and response times** was used.

  The analysis contains a bar chart with the average response times per picture.

THE DATA PROFILE FOR THE COLORED SLIDES

To select the response time for the blue slides

The three filter boxes split up the data in blue slide, red slide and yellow slide.



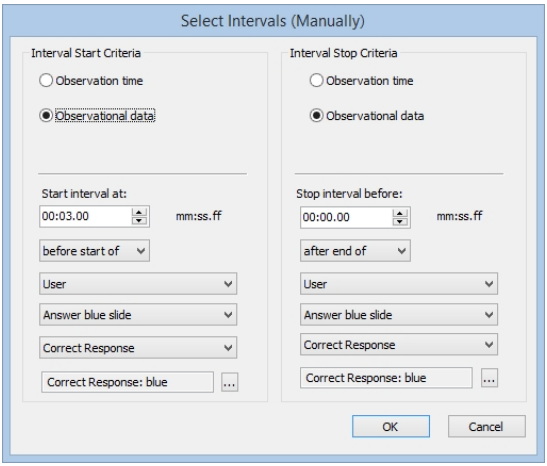
The interval box next to it selects the time interval the slide is displayed, independent of the response. Since displaying the slide

ends with typing the response, the interval length is the response time, independent of whether the response is correct or incorrect. To compare the response times of correct and incorrect responses, the free interval boxes described below are needed.

To select the correct responses for the word Blue on the Blue slide

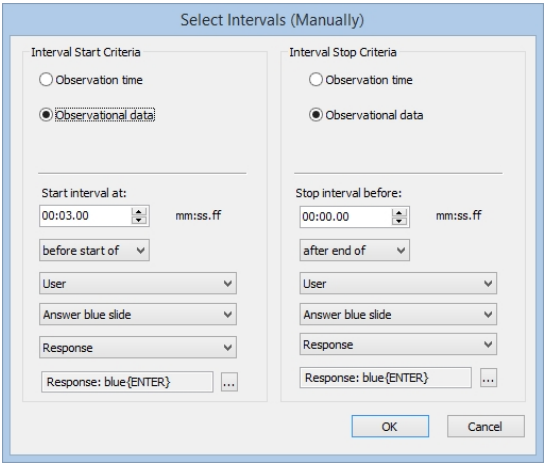
The responses are modifiers attached to a behavior without duration. So the responses themselves have no duration. To calculate the response time for correct and incorrect responses, you need to specify a time interval from the moment the slide is displayed until the moment the responses are given. This is done with a combination of interval boxes.

In the first free interval box, the correct response is specified, which is what the test participant should have typed. This is the word shown on the slide. In the example below, that was the word *Blue*. The time under **Interval Start Criteria** makes sure that you select a time interval before the response is given. This time should be larger than the largest response time in the experiment, but not so large that double slides are selected. In this experiment 3 seconds matched those criteria.



To select the actual responses for the word Blue on the Blue slide

The second Free interval box selects an interval of 3 seconds before the actual response, so the word that was actually typed by the test participant. In the example below that was also *Blue*. Combining this free interval box with the previous one selects an interval of three seconds in the situation where the word *Blue* was shown and the participant typed the word *Blue*, and thus gave a correct response.

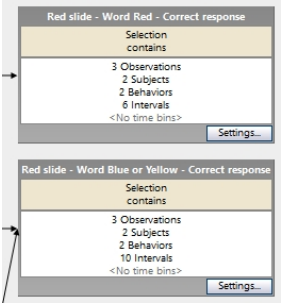


To select the response time for the correct actual responses for the word Blue on the Blue slide

These free interval boxes are combined with the first interval box, that selects the time interval the blue slide was displayed (see **To select the response time for the blue slides** on page 15). This way the time is selected from the moment the *Blue* slide with the word *Blue* is displayed, until the moment the test participant typed the word *Blue*. This is the response time for a correct actual response, for the *Blue* slide with the word *Blue*.

To select the other results

The other result boxes select other slide colors and responses in a similar way.



The data profile splits up the data in the following way:

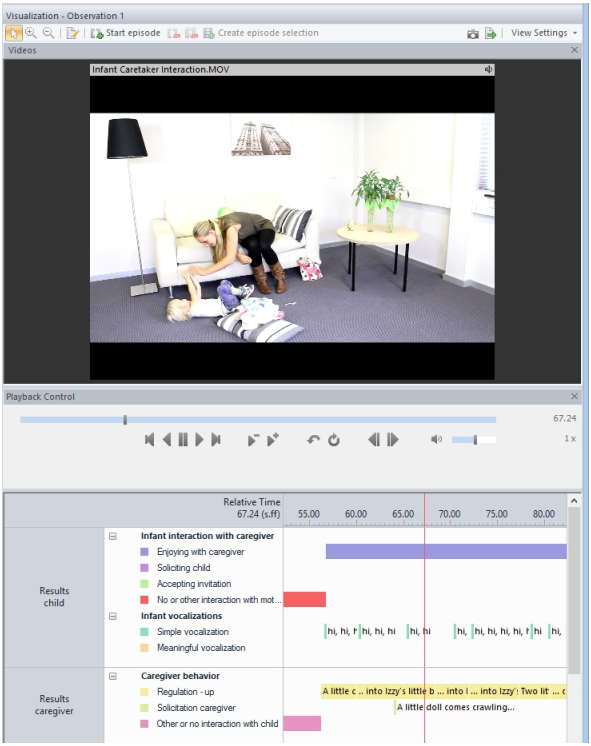
- Blue slide - Word Blue - Correct Response.
- Blue slide - Word Red or Yellow - Correct Response.
- Blue slide - Word Blue - Incorrect Response.
- Blue slide - Word Red or Yellow - Incorrect Response.
- Red slide - Word Red - Correct Response.
- Red slide - Word Blue or Yellow - Correct Response.
- Red slide - Word Red - Incorrect Response.
- Red slide - Word Blue or Yellow - Incorrect Response.
- Yellow slide - Word Yellow - Correct Response.
- Yellow slide - Word Red or Blue - Correct Response.
- Yellow slide - Word Yellow - Incorrect Response.
- Yellow slide - Word Red or Blue - Incorrect Response.

Infant-Caregiver interaction

In this project a child is playing in presence of her caregiver, in this case, her mother. The aim of this project was to assess the gazing behavior, vocalizations and interactions in response to the behavior of the caregiver. The meaningful vocalizations were transcribed and can be viewed together with the annotations.

Video File

Infant Caregiver Interaction.mp4.



SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The coding scheme contains two subjects:

- Child
- Caregiver

It has four behavior groups:

- **Infant gaze behavior** – with the gaze behavior as a response to the caregiver calling the infant's name, or spontaneous gazing towards the caregiver. This behavior group is linked to the subject *Child*.
- **Infant interaction with caregiver** – with several interactions like enjoying with caregiver and interactions to attract the caregiver's attention. This behavior group is linked to the subject *Child*.
- **Infant vocalizations** – with simple vocalizations and real words or sentences. This behavior group is linked to the subject *Child*.
- **Caregiver behavior** – with several behaviors like up-regulating or down-regulating the child's arousal and mood. This behavior group is linked to the subject *Caregiver*.

Independent variables

The project contains the following user-defined independent variables:

- **Gender** – with the gender for both the caregiver and the child.
- **Age child** – to keep track of the child's age.
- **Child identity** – to enter the name of the child.
- **Type of caregiver** – with the options *Mother*, *Father*, or *Other*.

OBSERVE

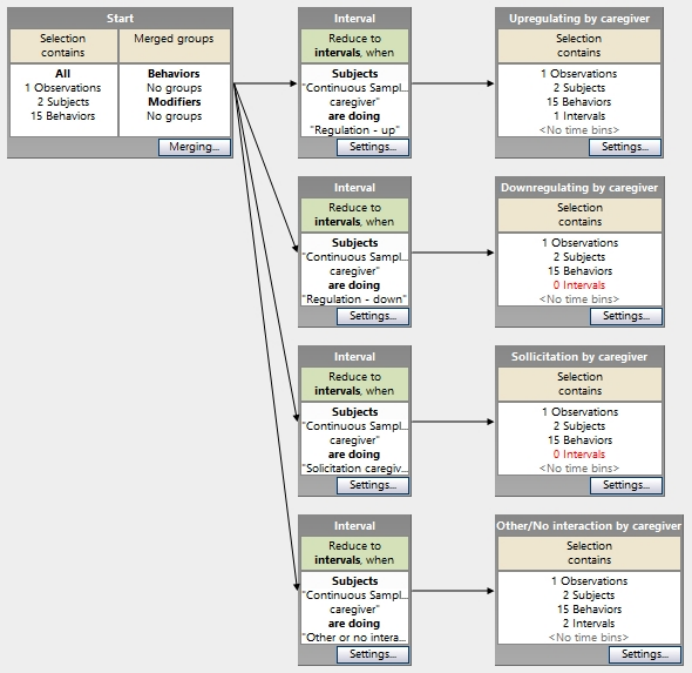
Choose **Observe** > **Observation** > **Open > Observation 1** to view the event log. Choose **Analyze** > **Visualize data** to visualize it. Choose **View Settings** > **Show Comments** to show the transcribed vocalizations. Zoom in the plot, if only part of the words are shown. The audio from the video files is shown in graphs.

ANALYZE

Data profiles

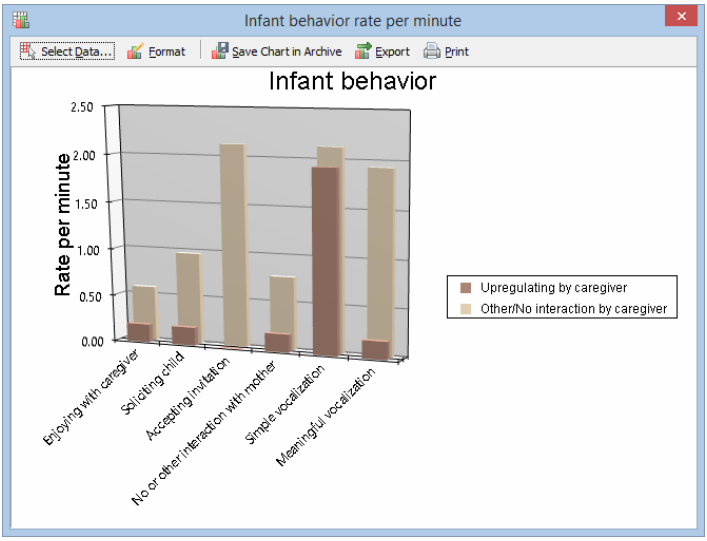
Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All data** – the default data profile with no selection criteria.
- **Data split by caregiver behavior** – with this data profile the data are split into four sections, based on the behavior of the caregiver. This way the child behavior can be analyzed over the time intervals the caregiver showed a certain behavior. The behaviors *Down-regulating by caregiver* and *Solicitation by caregiver* were not scored. Therefore the Result boxes based on these behaviors contain no data (see the picture on the next page).



Behavior analyses

The project contains a behavior analysis based on the data profile *Data split by caregiver behavior*. To open it, choose **Analyze** > **Behavior analysis** > **Open Archive**, and open *Infant behavior split by caregiver behavior.arx*. This behavior analysis contains a chart with the rate per minute of the child behaviors. This chart (see picture on next page) you shows that all child behaviors occurred more often when the caregiver was not interacting with the child than during the intervals in which the caregiver was up-regulating the child mood or arousal.


Infant behavior rate per minute
Select Data...
Format
Save Chart in Archive
Export
Print
Infant behavior
Rate per minute
2.50
2.00
1.50
1.00
0.50
0.00
Enjoying with caregiver
Soliciting child
Accepting invitation
No or other interaction with mother
Simple vocalization
Meaningful vocalization
Upregulating by caregiver
Other/No interaction by caregiver

FaceReader and SMI eye-tracker with the observer

In this project a test participant watched two short video clips from YouTube. One video contained a funny cartoon character, while the other showed people eating strange food. The aim of the project was to analyze the facial expression of the participant and her gaze behavior. The first was accomplished by recording a video of the participant with Media Recorder, and analyzing this video with FaceReader. The FaceReader's facial expression states were then imported into The Observer XT. Gaze data and video was obtained by using a SMI remote eye-tracker (RED) placed in front of the test participant. Gaze replay video and data were also imported in The Observer XT.

All data are in sync because The Observer XT sent a start command to both Media Recorder and the SMI eye-tracker.

Video files

- Funny video Gaze replay.avi
- Funny video Webcam.avi
- Strange food Gaze replay.avi
- Strange food Webcam.avi

SETUP

Choose **Setup** > **Coding Scheme**.

The coding scheme contains the following behavior groups:

- **FaceReader states** – This contains the seven categories of emotional states scored automatically by FaceReader when analyzing the webcam video, and imported in The Observer XT.
- **Fixation data** – Contains blinks and fixations, both imported from the SMI software BeGaze 3.0. Only fixations are analyzed in this project.

- **Areas of interest** – Contains one state event, named *Funny character*. An area of interest was drawn in SMI BeGaze 3.0 around a cartoon character which moves during the video. BeGaze can then determine when the test participant looked at the character (that is, when the gaze point was within the area of interest). These data were then imported in The Observer in the form of the state event *Funny character*.

OBSERVE

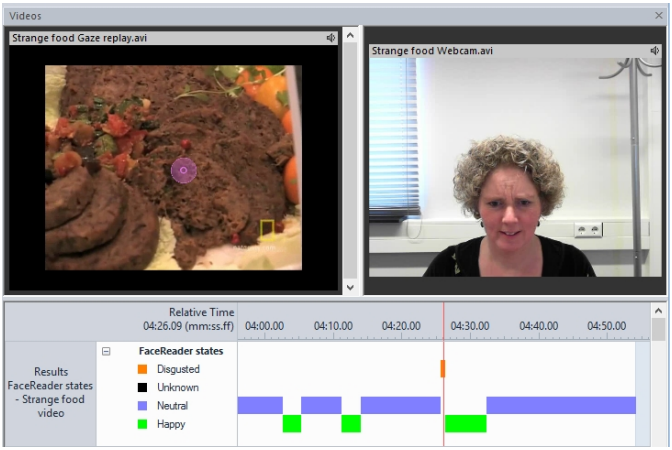
Choose **Observe** > **Observation** > **Open**. Choose one of the following:

- Funny video
- Strange food video

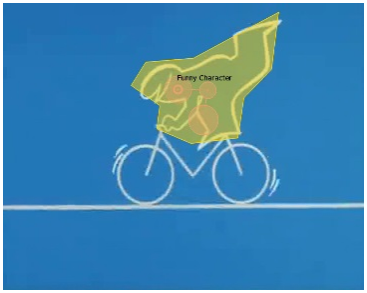
Each observation includes:

- **Event log0001** – This is the default event log that was created when The Observer XT sent the start command to Media Recorder and SMI Experiment Center. Since no data was scored manually during the test, the event log is empty.
- **FaceReader states** – Contains the emotional states imported from FaceReader.
- **Fixations** – Contains the fixation data from SMI BeGaze 3.0. For the funny video observation, it also contains the data of the Area of interest (AOI).

- **Video** – One video of the test participant and one video of the gaze replay. The gaze replay video was created in BeGaze 3.0.



In the video *Funny video Gaze replay.avi* at about 2'05" you can see the area of interest appear as a yellow contour around the cartoon character. The area of interest is active for about 20 seconds. It is an example of how you can analyze moving objects on a screen by combining the eye-tracker and The Observer XT.



- **External data files** – FaceReader scores were also imported as numerical values. Each of the seven categories can be viewed in a chart.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All data** – Contains all data of the observations *Funny video* and *Strange food video*.
- **All data except when FaceReader state *Unknown*** – All data, except the time when the emotional state *Unknown* was scored by FaceReader (this can happen when the test participant lowers his/her head). You can use this profile to obtain relative percentages of duration for each emotional state.
- **Fixations when Happy vs. other states** – This profile combines FaceReader data with gaze data. The aim is to compare fixations when the subject is scored by FaceReader as *Happy* and when in other states. To do so, two Interval boxes are inserted. One specifies the time that the FaceReader state is *Happy*, and the other that specifies the time when any other state is active excluding *Unknown*. Filters specify the behaviors to analyze (*Fixation*). The results are presented in two separate Result containers.
- **Fixations when Happy > 2 s vs. when Happy < 2 s** – This profile combines FaceReader data with gaze data. The aim is to calculate fixations when the subject is scored by FaceReader as *Happy* for more than 2 seconds, in comparison to when *Happy* lasted shorter than 2 seconds. To do so, an extra **Result** box is inserted and two sequences are made. In both sequences an Interval box specifies the time that the FaceReader state is *Happy*, and a Filter box specifies the behavior to analyze (*Fixation*). In the upper sequence an **Interval By duration** box specifies that the duration of the interval should be at least 2 s. In the lower sequence an **Interval By duration** box specifies that the duration of the interval should be shorter than 2 s.
- **Filter FaceReader data only** – Contains a filter specifying the emotional states scored by FaceReader.

- **Filter FaceReader external data only** – Contains a filter specifying the event log with the FaceReader scores that were imported as external data. This data profile can be used for numerical analysis on the external data.
- **Filter Eye-tracker fixations only** – Contains a filter specifying the fixation data imported from BeGaze 3.0.

Episode Selections

Choose **Analyze** > **Episode Selection** > **Open**.

This project contains an episode selection, FaceReader state *Disgusted*. It was created by extracting the instances of the emotional state *Disgusted*. This happens two times during the observation *Strange food video*. You can see in the webcam video that FaceReader detected the facial state correctly.

Analysis results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

Under Behavior Analyses:

- **Fixation rate during Happy vs. other states** – Here you can see that, for both observations *Funny video* and *Strange food video*, the average duration of fixation is lower and the fixation rate is higher when the current FaceReader emotional state is *Happy*, than when other states are active.
- **Fixations dependent on Happy duration** – Two **By duration** interval boxes in the Data profile split the data into the intervals during which the FaceReader emotional state *Happy* lasted shorter than 2 s and the intervals during which *Happy* lasted longer than 2 s. The behavior analysis result shows that for both observations *Funny video* and *Strange food video*, the average duration of fixation is lower in the intervals when the FaceReader emotional state *Happy* lasted shorter than 2 s than in the intervals when the state *Happy* lasted longer than 2 s.

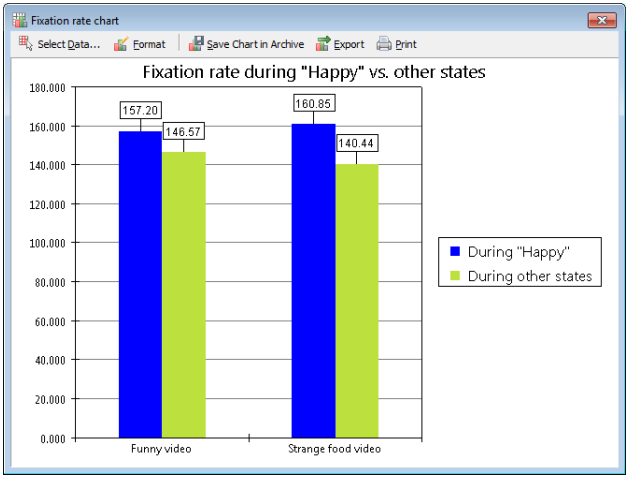
- **Fixation general statistics** – Shows the average duration, the standard deviation of the duration and the rate of fixation (occurrences per minute) for the two observations.

Under Numerical Analyses:

- **FaceReader numerical results** – Shows statistics of the numerical values for each emotional category imported as external data from FaceReader.

Charts

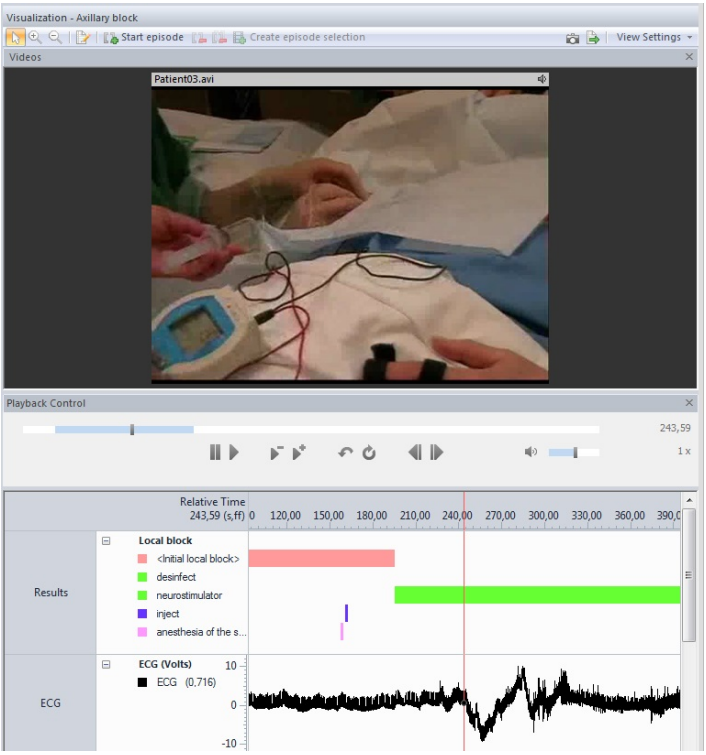
Under **Behavior Analyses**, you find two charts: **Fixation duration chart** and **Fixation rate chart**. They were obtained by plotting the data of the analysis result *Fixation rate during Happy vs. other states*.



There is also a chart *Effect of Happy duration on Fixation duration*. This is obtained by plotting the data in the analysis result *Fixations dependent on Happy duration*.

Medical research

This project is an example of the use of The Observer XT in medical research. Surgery is carried out on a patient's hand. The patient has received local anesthesia. During surgery, the pulse transit time is measured using the BIOPAC system; this is the time for the blood pulse wave to travel from the heart to the index finger of the patient. The pulse transit time is through the stiffness of the arterial vessels an indirect measure of sympathetic tone and therefore pain. When the patient experiences pain, the pulse transit time shortens.



The pulse transit time was measured using the ECG (electrocardiogram) module and four PPG (photoplethysmogram) modules of the BIOPAC system. With the ECG, the moment of contraction of the heart is determined, while the PPG measures the arrival of the artial pulse in the finger. During acquisition, a synchronization signal was sent from The Observer XT computer to the BIOPAC system. After acquisition, the BIOPAC data file was imported into The Observer XT and synchronized with the event log and recorded video file. Data selection was done using the scored markers in the event log. Analysis of the pulse transit time was done in Mat Lab on the exported physiological data.

Video file

Patiento3.avi – the video recording of the surgery. For this sample project, the video file was truncated to 450 seconds.

SETUP

Choose **Setup** > (choose one of the options below).

Coding Scheme

The coding scheme contains one mutually exclusive group in which the different events, like applying neurotransmitter are defined as point events.

Independent variables

The project has a user defined variable *Patient no*, with which you can keep track of the patients' identity in each observation.

OBSERVE

Choose **Observe** > **Observation** > **Open** > **Auxillary block**. The observation opens, which contains the following:

- **An event log** – with state and point events marking certain events, such as, disinfecting the arm, injecting the anesthetic, using the neurostimulator.
- **External data** – with the ECG data, PPG data (4 channels, 2 for the finger on the treated side of the body, 2 for the finger on the contralateral side) and the synchronization signal. The external data have been resampled from 2000 to 200 Hz for this sample project.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All Data** – The default data profile which contains all available data.
- **1 minute after skin anesthesia** – In this data profile, an interval was created from the moment the skin was anesthesized (start of *Anesthesia of the skin*) until 1 minute later.
- **From disinfecting to skin anesthesia** – In this data profile, an interval was created from the moment that the skin was disinfected (start of *Disinfect*) until the skin was anesthesized (start of *Anesthesia of the skin*).

Analysis Results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

- **Disinfecting - Skin anesthesia** – This archived analysis result contains the latency for *Disinfect* and the calculated independent variables **Number of intervals** and **Total interval duration**. This interval duration can be used to determine how long it took to anesthesize the skin after disinfection.

Data export

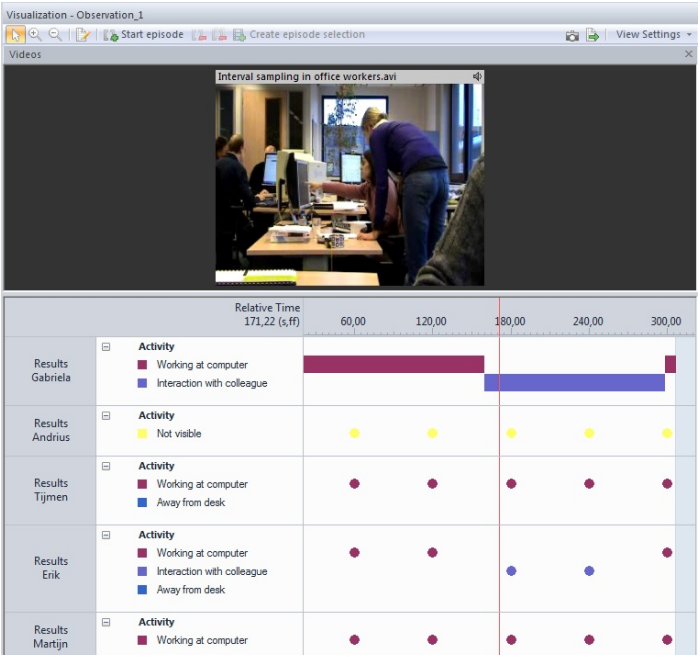
Based on the data profile *1 minute after skin anesthesia*, the ECG data and PPG data were exported to a Text file (this file can be found in the **Export** subfolder of the project folder). This Text file was used in Mat Lab to calculate the difference in pulse transit time between the treated hand and the control hand.

Acknowledgements

Video recording and physiological data by courtesy of Dr. M.C. Kortekaas, Experimental Anesthesiology, Erasmus Medical Centre, Rotterdam, The Netherlands. Both patient and surgeon granted permission for the use of the video recording in this sample project.

Interval sampling in office workers

This sample project shows the behavior of a group of people working in an office. It shows how you can use the observation method **Combine Continuous and Instantaneous Sampling**. The lady in the group is new and her behavior was scored continuously, to get a complete record of her behavior. The other people were monitored instantaneously to get an average time budget per person.



Video file

Interval sampling in office workers.avi

SETUP

Choose **Setup** > (choose one of the options below).

Project setup

- **Observation method** – Combine Continuous and Instantaneous Sampling.
- **Sample interval length** – 1 minute.

Coding Scheme

The Coding Scheme includes 5 subjects: *Gabriela* who is scored continuously and five subjects which are scored instantaneously (*Tijmen*, *Erik*, *Martijn* and *Andrius*).

The Coding Scheme contains one mutually exclusive, exhaustive behavior group *Activity* with four behaviors. All behaviors are state events which are scored as sample points for the four instantaneous subjects.

Independent Variables

The project contains user-defined independent variables:

- Day of the week.
- Team ID.
- Function.

OBSERVE

Choose **Observe** > **Observation** > **Open** > **Observation0001** to view the observation.

ANALYZE

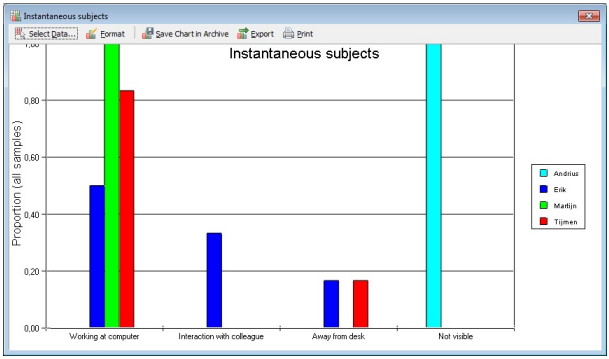
Behavior Analysis

The project contains one archived analysis result. To open it, choose **Analyze** >**Behavior analysis** > **Open Archive**, and open **Behavior Analysis Result.arx**.

The statistics are on tabs. **Total number**, **Total duration** and **Mean** apply to the continuous subject. **Proportion (all samples)** and **Scored Samples** apply to the instantaneous subjects.

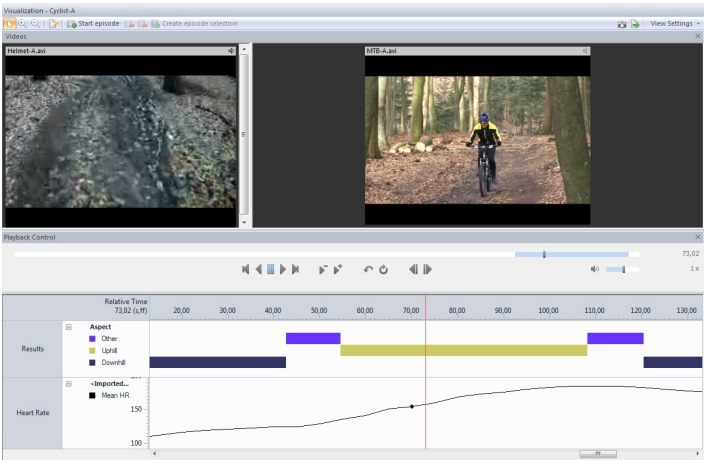
Charts

- **Continuous subject** – Pie chart showing the total duration of the different behaviors of *Gabriela*.
- **Instantaneous subjects** – Bar chart showing the proportion of samples for each behavior and each instantaneous subject.



Cycling

In this sample project the behavior of two mountain bikers is shown. The project contains a side video and a head-mounted camera from each cyclist, and a number of external data files quantifying the movement of the bike. You need the external (physiological) data add-on to see these data files. Clear differences can be seen between the two cyclists and also when they are going uphill and downhill.



Video files

- Helmet A.avi
- Helmet B.avi
- MTB A.avi
- MTB B.avi

SETUP

Choose **Setup** > **Coding scheme**.

The Coding scheme contains a mutually exclusive behavior group *Aspect* with the behaviors *Uphill*, *Downhill* and *Other*. These behaviors are used to analyze the imported external data in the time intervals in which the cyclists either go uphill or downhill.

OBSERVE

Choose **Observe** > **Observation** > **Open**. Choose one of the following:

- Cyclist A.
- Cyclist B.

In each observation the cyclist goes down and then up an off-road track two times. The observations each contain:

- **Two video files** – A side-view and a head-mounted camera. The head mounted camera does not show a lot of detail, but it can be used to determine the time when the cyclist turns round. The files are in DivX format.
- **An event log** – with a very simple coding scheme, just when the cyclist goes up or downhill, or other (turning, etc.)
- **GPS data** – We used GPS data recorders with a 1 second sample interval. *Elevation* is accurate to 1m, and this can clearly be seen in the step-like profile of the curve. *Velocity* and *Acceleration* show different characteristics for the different cyclists. *Meander* is a measure of how straight (or curved) a line is. It is calculated for each sample as turn angle/distance.
- **Physiological data** – Heart rate (beats-per-minute) was measured with a Polar sports watch. The sample interval was 5 seconds.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

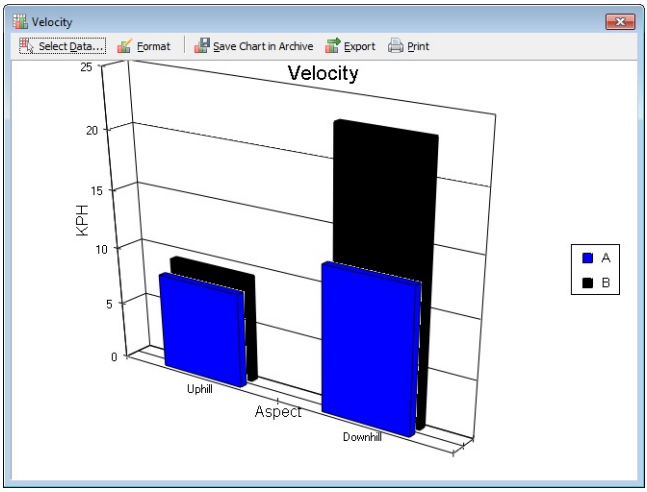
- **All data** – The default data profile with all the data.
- **Uphill or downhill** – Intervals were created for the direction the cyclists went, so that calculations can be carried out on the external data during the time the cyclists went uphill or downhill.
- **Meander uphill or downhill** – Is a high-pass filter to remove large values of this variable. This is because (especially in Observation001), there are two components to *Meander*. Large values are caused by turning the bike around at the top and bottom of the hill, and small values are caused by the cyclist maneuvering around small objects and rough ground, especially going uphill.

  Intervals were created for the direction the cyclists went, so that calculations can be carried out on the external data during the time the cyclists went uphill or downhill.
- **Velocity >20** – Selects the portions of the observation when the cyclists were going above 20 kph. If you wanted, you could use this to export the meander and acceleration data for those periods for further analysis (from the **Analyze** menu, choose **Select Data** and then **Export Selected Data**) or you could create an episode selection for that period.
- **Heart rate > 155** – Selects the portions of the observation in which the heart rate was higher than 155 bpm.

Numerical analysis results

The project contains archived numerical analysis results. To open these analysis results, choose **Analyze** > **Numerical Analysis** > **Open Archive**, and open an *.arx file.

- **External data uphill or downhill**– Mean values of the external data based on the data profile *Uphill or downhill*. The chart shows that although both cyclists went at similar speed uphill, cyclist B went much faster downhill than cyclist A. This calculation uses the *Direction* data profile. Of course, uphill is slower than downhill.



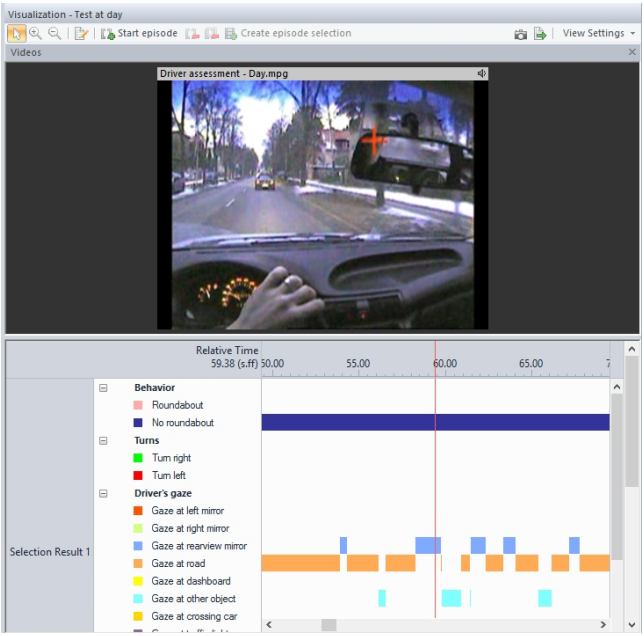
- **Meander uphill or downhill**– The chart was created using the *Meander uphill or downhill* data profile (which removed meander due to turning the bike at the top/bottom of the hill and leaves in meander due to maneuvering). Both observations were grouped, by deselecting **Observations** in the numerical analysis **Layout** page. It is clear that the cyclists went in much more of a straight line going downhill, and when they were going uphill they maneuvered around roots, rough ground, etc.
- **Heart rate** – Based on the data profile *Uphill or downhill*. Both observations were grouped, by deselecting **Observations** in the numerical analysis **Layout** page. The analysis results shows the mean heart rate going uphill or downhill (from the *Direction* data profile). The mean heart rate was higher going uphill than going downhill.

Acknowledgements

This project was recorded on the Posbank mountain bike route which is owned and maintained by 'Natuurmonumenten', a nature conservation organization in The Netherlands.

Driver assessment

This project illustrates how you can use The Observer XT to code and analyze the behavior of a driver. The accompanying video footage has been taken from a camera and an eye-tracking device that the driver was wearing during the test. The gaze point of the driver was then superimposed on the video image to help the observer record manually where the driver is looking at. This way one can combine gazing behavior with route characteristics, driving behavior and other data like car speed that can be imported in The Observer XT.



Video files

- Driver assessment - Day.mpg
- Driver assessment - Night.mpg

SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The coding scheme contains:

- **Behavior** – Contains *Speed*, *Roundabout* (to mark the points of the video where the car enters a roundabout) and *No roundabout* (to mark the points of the video where the car was not in a roundabout).
- **Turns** – To mark turns along the route.
- **Driver's gaze** – To score the object the driver is looking at, indicated by the cross symbol moving over the video image.
- **Car movement** – To mark the sections of the video when the car is *Moving* or *Not moving*.

External data

In this project, speed data have been imported as external data (just like physiological data).

OBSERVE

Choose **Observe** > **Observation** > **Open**. Choose one of the following:

- **Test at day** – Contains an event log, named *Events* with the with the manually scored events, and an external data file named *Speed* containing the speed values recorded with a separate device and imported as observational data. Speed values are stored as numerical modifiers.
- **Test at night** – Contains an event log, named *Events* with the manually scored events.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All data** – Includes all events and imported data in the observations.
- **At the roundabout** – Selects the events scored when the state *Roundabout* is active.
- **Car in motion** – Selects the events and the speed data of the observation 'Test at day' when the car was in motion.
- **Car in motion** - Mirror data merged like the previous profile, but the behaviors describing gazing at a mirror (left, right, rearview) have been merged (Click **Merging** and select the **Behaviors** tab).
- **Gaze at mirrors - for LSA** – Filters behaviors gaze at mirror and turns, and ignores the others. This helps you analyze the temporal relation between turns and gazing at a mirror (see lag sequential analysis below).
- **Interval with Speed data** – Three free intervals are defined to analyze the part of the observation with speed data (up to 2'13'') in three equal sections. An additional interval is defined for when the car enters a roundabout. The four intervals are analyzed independently.
- **Test duration split in 3 sections** – An example of data profile with time bins. Some gazing behaviors are analyzed in three equal sections of one observation.

Analysis results

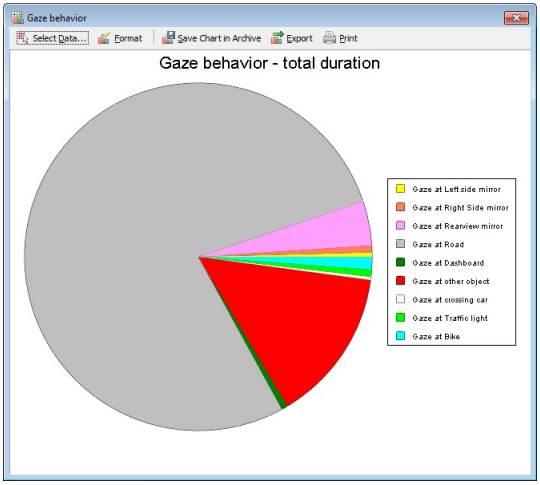
The project contains archived analysis results. To open these, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

- **Behavior analysis result *Attention data*** – based on the data profile *Test duration split in 3 sections*. This result compares the behavior *Gaze at road* with *Gaze at other objects* in different sections of the test route.

- **Behavior analysis result *Driver's gaze statistics*** – based on the data profile *Car in motion*.
- **Behavior analysis result *Driver's gaze statistics - At any mirror*–** based on the data profile *Car in motion - Mirrors data merged*.
- **Numerical analysis result *Speed statistics*** – based on the data profile *Interval with Speed data*.
- **Lag sequential analysis result *Gaze at mirrors at turns*** – based on the data profile *Gaze at mirrors - for LSA*. This results shows how often turning (on the rows) is associated with looking at a mirror within one second.

Charts

- **Attention data** – Bar chart based on the behavior analysis result with the same name, showing how much time the driver is looking at the road and how much time he is looking at other objects in different sections of the test route.
- **Gaze behavior** – Pie chart based on the behavior analysis result *Driver's gaze statistics* showing the duration of gazing at the different targets. The driver mostly gazes at the road.

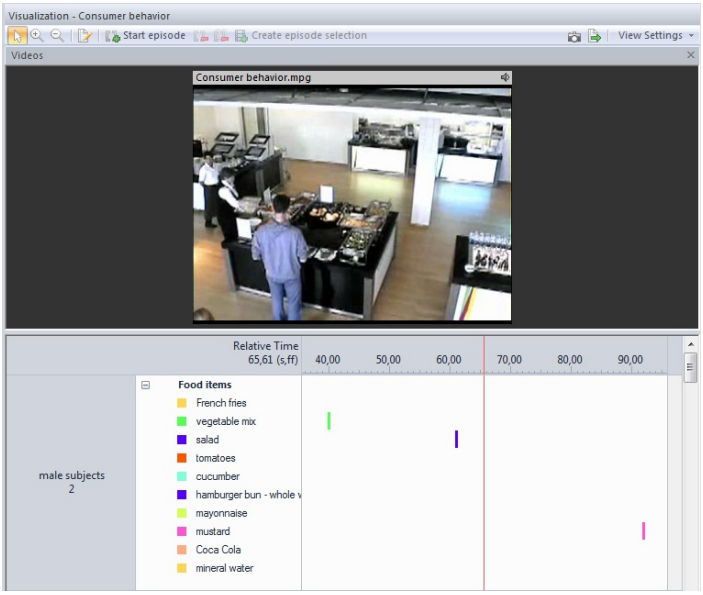


- **Gaze behavior - At any mirror** – Pie chart based on the behavior analysis result *Driver's gaze statistics - At any mirror*. Similar to the previous chart but now the three mirrors (left, right, rearview) are merged.
- **Speed statistics** – Bar chart based on the numerical analysis result *Speed Statistics* showing the average speed in the three section of the test route and at the roundabout. The speed at the roundabout is much lower than in the other three sections.

Consumer behavior

The Consumer behavior sample project is an example of a study carried out in the Restaurant of the Future. The Restaurant of the Future is a facility for research on food-related behavior in Wageningen (The Netherlands). The restaurant is part of the campus of Wageningen University and looks like a normal restaurant but is equipped with cameras mounted in the ceiling.

In the sample project, 29 consumers were observed while choosing their lunch from a buffet in the restaurant. The buffet contained three chicken burgers (schnitzel-like products) that were labeled as either 'healthy', 'welfare friendly' and 'new'. Other products in the buffet were: french fries, vegetables, salad, tomatoes, cucumber, hamburger buns, onions, mayonnaise, ketchup, mustard, mineral water and Coca Cola.



Video file

Consumer behavior.mpg.

SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The coding scheme contains:

Subjects – With 29 consumers that visit the restaurant.

Food items – With the different choices at the buffet.

Behavior – With the behavior of the consumers.

Independent Variables

The independent variable list includes the independent variable *Gender*. The variable is used in the analysis to group the subjects and assess the differences between male and female subjects.

OBSERVE

Choose **Observe** > **Observation** > **Open** > **Consumer behavior** to view the observation.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All data** – Data profile without any filtering, intervals or grouping.

- **Behavior of males and females at buffet** – Data profile in which only the consumers' behaviors are selected (choosing, reading food descriptions and other behavior). The subjects have been filtered in male and female subjects.
- **Choice of males and females for chicken types** – Data profile in which only the three chicken burgers are selected. In this profile the subjects have again been filtered according to gender.
- **Choice of males and females for other products** – Data profile in which all the food items have been selected, except the chicken burgers which are filtered in the profile above. Again two groups of subjects have been created, a male and a female group.

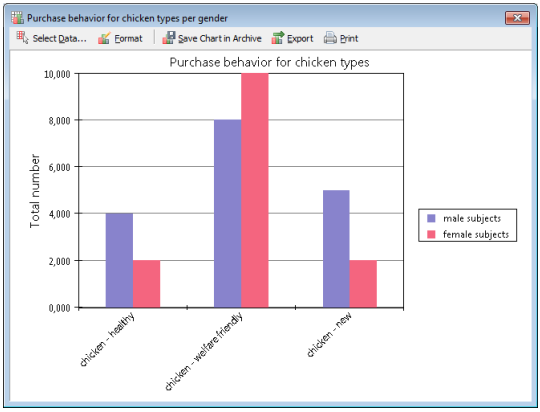
Analysis results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

- **Behavior of males and females at buffet** – Based on the data profile with the same name. In this analysis result you can see that men and women behave differently when choosing their meal from the buffet. Women spend more time reading the chicken burger descriptions and choosing their meal.
- **Choice of males and females for chicken types** – Based on the data profile with the same name. The welfare-friendly chicken burger was the most popular meat type, both among females and males. Healthy and new burgers were equally often chosen. The welfare friendly burgers were more often chosen by female than by male subjects. Healthy and new burgers were more often chosen by male subjects.
- **Choice of males and females for other products** – Based on the data profile with the same name. In this analysis result you can see what other products were chosen together with the chicken burgers.

Charts

- **Reading behavior per gender** – Bar chart based on the behavior analysis result *Behavior of males and females at buffet* showing the total duration the male and female subjects spent reading the three product descriptions.
- **Purchase behavior for chicken types per gender** – Bar chart based on the behavior analysis result *Choice of males and females for chicken types* showing the number of chicken burgers that were bought by the male and the female subjects.



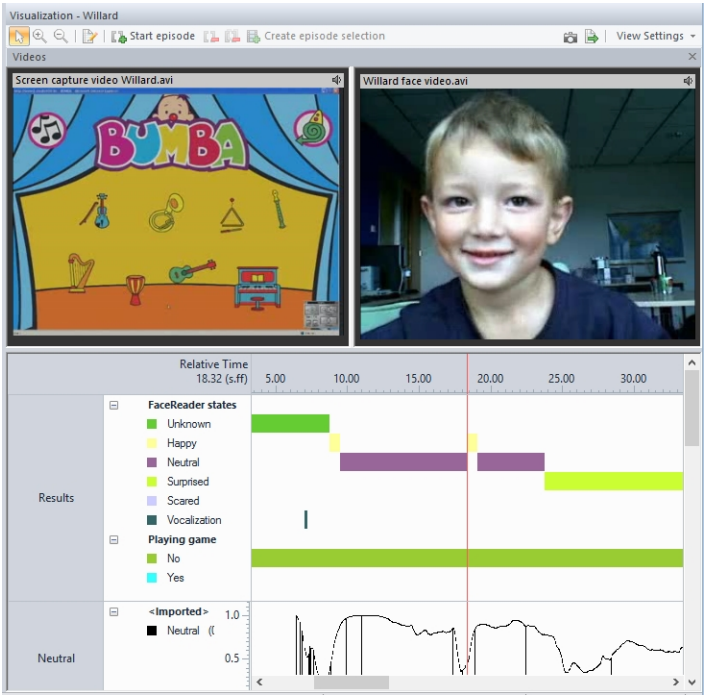
- **Other products chosen per gender** – Bar chart based on the behavior analysis result *Choice of males and females for other products* showing what other products were chosen together with the chicken burgers.

Acknowledgements

This study was carried out by the Consumer Science & Intelligent Systems group, Food & Biobased Research, Wageningen University and Research Center, The Netherlands.

Child facereader

In this project a 3-year old boy (Willard) is observed during play with an online game. His face is filmed with a webcam, while the screen is captured with the Noldus screen capture device. In order to get a good image for FaceReader, the face should be filmed from the front, no other faces must be visible in the background and the lighting must be even, diffuse and come from the front (so, casting no shadows on the face).



The video of Willard's face was analyzed in FaceReader. Both the state log and detailed log were exported from FaceReader and imported into

the observation *Willard* in The Observer XT. The video files mentioned below were added to the observation.

By combining FaceReader and The Observer XT one is able to study both the behavioral and emotional response while playing the online game.

Video files

- Willard face video.avi
- Screen capture video Willard.avi

SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The project contains the following behavior groups:

- **Facial States** — With the imported data FaceReader data.
- **Playing game** — To annotate the time fragments in which the child was playing.

OBSERVE

Choose **Observe** > **Observation** > **Open** > **Willard** to view the observation.

The event log contains the imported FaceReader emotional states (*Neutral*, *Happy*, *Sad*, *Surprised*, *Scared*, *Angry* and *Disgusted*). During analysis in FaceReader, each emotion is expressed as a value between 0 and 1. Each time the dominant emotion changes and the dominant emotion is displayed for at least 1 second, a record with the emotion is added to the State log. When no face is found or when the face could not be modeled, the state changes to Unknown.

External data

The FaceReader detailed log is imported as external data in The Observer XT. The Detailed log contains a 'continuous' record (sampled with a fixed interval) of the values of all emotions.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **All data** – Contains all the data in Observation *Willard*.
- **Gaming or not gaming** – Data profile with two interval criteria: *Playing game* and *Not playing game*.
- **While happy** – Contains only the intervals when Willard's face showed the emotion *Happy*.

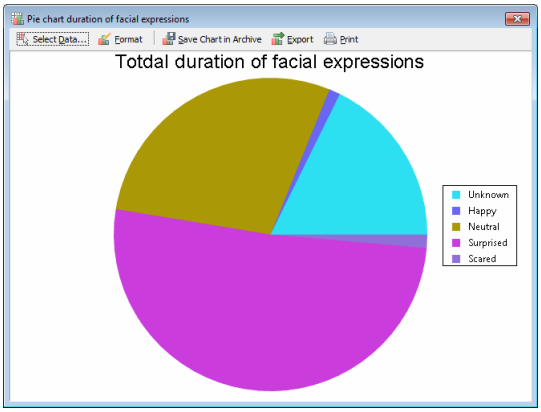
Analysis Results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

- **Behavior analysis result *Happy Intervals*** – Based on the data profile *While happy*. Contains the **Total number**, **Total duration** and **Mean** for the emotion *Happy*.
- **Behavior analysis result *Facial expressions*** - based on the data profile *All data*. Shows the total duration of each facial expression.
- **Numerical analysis result *Mean intensity during gaming - not gaming*** – Based on the data profile *Gaming or not gaming*. This result shows the mean intensity of each emotion during bouts of game playing and during non-playing bouts.

Chart

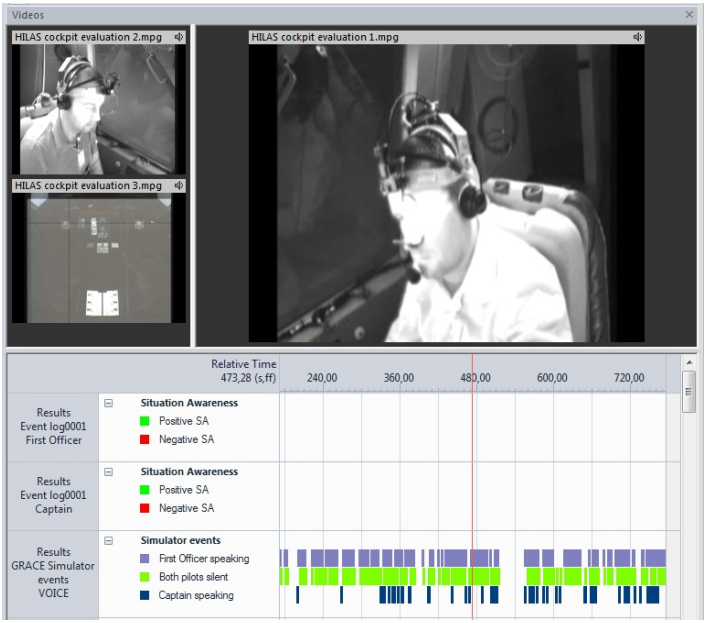
- **Duration of facial expressions** – Pie chart based on the behavior analysis result *Facial expressions*. Shows the total duration of each facial expression.



- **Mean intensity during playing - not playing** – Bar chart based on the numerical analysis result with the same name showing the mean intensity of each emotion during bouts of game playing and during non-playing bouts.

Hilas cockpit evaluation

This sample project illustrates an example of how The Observer XT can be used to analyze human factors in the development of aviation systems. It is a simplified version of The Observer XT projects used in the EU-funded research initiative HILAS (Human Integration into the Lifecycle of Aviation Systems). Data come from one of the project's strands named Flight Deck Technology: it aims at developing a registry of human factors measurements tools.



The experiment was carried out in a flight simulator named GRACE (Generic Research Aircraft Cockpit Environment) in a scenario where an unexpected event (fuel imbalance in the aircraft wings) occurred. The main computer (The Observer XT computer) recorded the behavior of the pilots on video while another computer (External data recording

system) recorded continuous data such as altitude and speed of the aircraft. The data were synchronized with a signal sent out by The Observer XT computer. The flight data were then imported as external data into The Observer XT.

For more information, see www.hilas.info.

Video files

- HILAS cockpit evaluation 1.mpg – footage of the First Officer.
- HILAS cockpit evaluation 2.mpg – footage of the Captain.
- HILAS cockpit evaluation 3.mpg – showing various front deck displays.

SETUP

Coding scheme

The events of the simulator are grouped in the behavior group *Simulator events*. Manually coded behaviors can be found in the group *Situation awareness*. Several subjects are used to divide the data in different streams.

Independent variables

The project contains the following user defined variables:

- **Crew nr** – To keep track of the crew that was observed
- **Scenario nr** – To note down to which scenario the crew was subjected in the observation.
- **Pilot flying** – With the values *Captain* and *First Officer*.
- **Runtype** – With the values *Reference* and *Evaluation*.

OBSERVE

Choose **Observe** > **Observation** > **Open** > **H7SAC10** to view the observation.

The observation contains the event log *GRACE Simulator events* from the flight simulator and the event log "Event log0001" with manually coded events.

Note - At about half way in the observation, the simulator was reset as a consequence of the simulated fuel imbalance. As a result, external data graphs show a gap (all values are reset to zero).

ANALYZE

Data Profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **Default Data Profile** – Contains all the data in the observation *H7SAC10*.
- **From 7000 feet to Touch down** – Selects the time of descent of the aircraft. This provides and example of an interval defined on both external data and event data.
- **From Fuel imbalance warning to Touch down** – Typical interval defined by two events.
- **One-minute intervals (time bins)** – To analyze the data in 1-minute intervals each (for example, to visualize the average speed in 1-minute intervals).
- **Vertical velocity > 500 ft/m** – Selects the time that vertical velocity (rate of aircraft descent) was higher than 500 ft/m. As a results, it creates a number of intervals of variable length.

Click one of the data profiles and then visualize the observation to view the time intervals selected (these are shown in white).

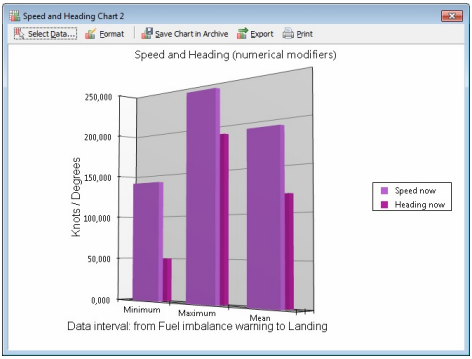
Analysis Results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

- **Numerical analysis result *Flight parameters* (External data)** – Shows the overall statistics of the flight parameters imported as external data (the color lines that you can view in the visualization). **Minimum**, **Maximum** and **Mean** value are calculated using the data profile *From 7000 feet to Touch down*.
- **Numerical analysis result *Speed and Altitude* (External data)** – Shows the statistics of the external data *Barometric Altitude* and *Calibrated air speed* for each of the 1-minute intervals defined in the data profile *One-minute intervals* (time bins).
- **Numerical analysis result *Speed and Heading* (numerical modifiers)** Shows the statistics for the numerical modifiers of the behaviors *Speed now* and *Heading now* when the data profile *From fuel imbalance warning to Touch down* is active. This is an example of how continuous data can be entered in The Observer XT as event (discrete) data, not external data.

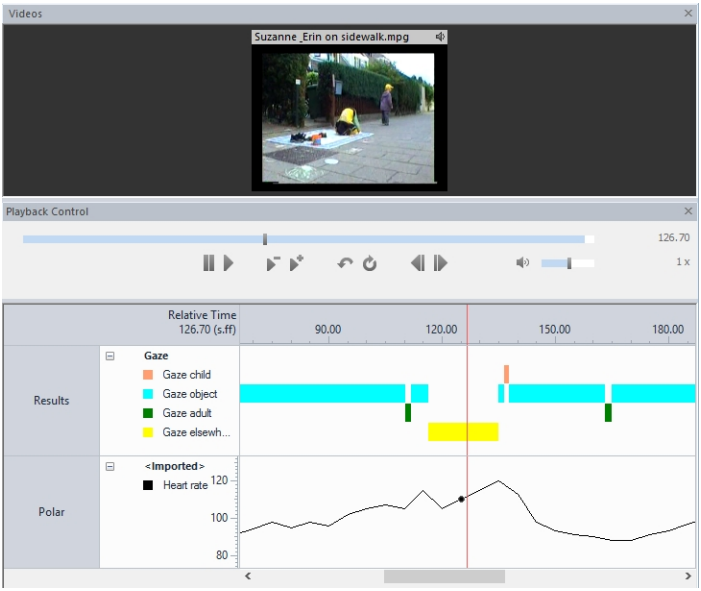
Chart

Speed and heading chart – Column chart created from the analysis result *Speed and Heading* (Numerical modifiers).



Kids at play

This sample project concerns the behavior of two children, Suzanne and Erin.



Video files

- **Suzanne & Erin on sidewalk** – showing the children at the age of two and three when they are playing on the sidewalk.
- **Suzanne & Erin in sandpit** – showing the children two years later when they are playing in a sandpit.

SETUP

Choose **Setup** > (choose one of the options below).

Coding scheme

The coding scheme contains the following:

- **Behavior groups** – *Gaze*, *Interaction*, and *Verbal behavior*.
- **Modifier groups** – *Type of play* (linked to the behavior *Play*), *Interaction type* (linked to the behavior *Play*), and *Subject talking to* (linked to the behavior *Talk*).

Independent variables

The project contains the following user defined variables:

Name – The name of the observed child.

Gender – The gender of the observed child.

Age – The age of the observed child.

Observer – The name of the person that annotated.

OBSERVE

Choose **Observe** > **Observation** > **Open**. Choose one of the following:

- Erin 3 years old.
- Erin 3 years old_edited.
- Erin 5 years old.
- Suzanne 2 years old.
- Suzanne 4 years old.

The observation *Erin 3 years old* contains fictitious Polar heart rate data. When you open this observation, the **Visualize data** window shows the heart rate data. The observation *Erin 3 years old_edited* is used for comparison with the original *Erin 3 years old* in reliability analysis.

ANALYZE

Data profiles

Choose **Analyze** > **Select Data** > **Open Data Profile**. Choose one of the data profiles listed below and click **OK**.

- **Default Data Profile** – which includes all the data.
- **Gaze behavior** – in which only *Gaze behavior* is selected. As the observations are of different length, only the first 4.5 minutes of each observation is selected. In addition, only four of the five observations are selected (*Suzanne 2 years old*, *Suzanne 4 years old*, *Erin 3 years old* and *Erin 5 years old*).
- **Heart rate > 100** – in which the intervals were selected when the heart rate was above 100 bpm. Only the observation *Erin 3 years old* is selected because only this observation contains heart rate data.
- **Intervals with gaze behavior** – in which the intervals were selected when the child was showing *Gaze behavior*. Only *Erin 3 years old* was selected.
- **Intervals with play behavior** – in which the intervals were selected when the child was *Playing*. Only *Erin 3 years old* was selected.
- **Play behavior** – in which only *Play behavior* is selected. Again only the first 4.5 minutes of the following observations are selected: *Suzanne 2 years old*, *Suzanne 4 years old*, *Erin 3 years old*, *Erin 5 years old*.
- **Verbal behavior** – in which only *Verbal behavior* is selected. Again only the first 4.5 minutes of the following observations are selected: *Suzanne 2 years old*, *Suzanne 4 years old*, *Erin 3 years old*, *Erin 5 years old*.

Episode selection

Choose **Analyze** > **Episode Selection** > **Open**.

Gaze behavior based on the data profile with the same name. Play the episode selection to view all video fragments in which 

Gaze behavior took place. You can make a video of these episodes. To do so, click the **Generate Episode Video** button on the toolbar.

Analysis results

The project contains archived analysis results. To open these analysis results, choose **Analyze** > [analysis type] > **Open Archive**, and open an *.arx file.

- **Behavior analysis result *Behavior when heart rate higher than 100*** – with the behavior of Erin (at the age of 3) when his heart rate was above 100 bpm. There were three intervals when the heart rate was higher than 100.
- **Behavior analysis result *Gaze behavior*** – with the statistics **Total number**, **Total duration** and **Mean** of *Gaze behavior* in separate sheets.
- **Behavior analysis result *Play behavior*** – with the statistics **Total number**, **Total duration** and **Mean** of *Play behavior* in separate sheets.
- **Behavior analysis result *Verbal behavior*** – with the statistic **Total number** of *Verbal behavior*.
- **Numerical analysis result *Heart rate during gaze behavior*** – with Erin's minimum, maximum and mean heart rate when he was showing *Gaze behavior*.
- **Numerical analysis result *Heart rate during play behavior*** – with Erin's minimum, maximum and mean heart rate when he was playing.

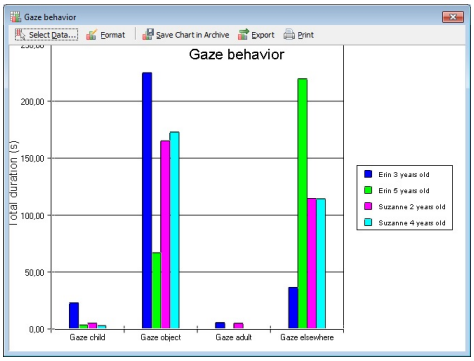
When you compare the two numerical analysis results, you will see that Erin's mean heart rate was higher during *Play behavior* (103.7 bpm) than during *Gaze behavior* (99.9 bpm).

- **Lag sequential analysis result** – with the four observations displayed in separate sheets.

- **Reliability analysis result '*Erin 3 years old*'** – in which the observations *Erin 3 years old* and *Erin 3 years old_edited* were compared.

Charts

- **Gaze behavior** – Bar chart based on the behavior analysis result *Gaze behavior* showing the total duration of the different types of gaze behavior during the first 4.5 minutes of each observation. The children mostly looked at the object they were playing with and elsewhere. They did not look so much at the other child or the adult.



- **Type of interaction** – Bar chart based on the behavior analysis result *Play behavior* showing how much the children played alongside (parallel) and how much they played together (duet). At the age of 2 and 3 Suzanne and Erin only play alongside, when they are 4 and 5 they also play together.
- **Type of play** – Bar chart based on the behavior analysis result *Play behavior*. The children mostly show manipulative play behavior.
- **Verbal behavior** – Bar chart based on the behavior analysis result *Verbal behavior*. At the age of 4 and 5 the children talk more to each other than when they are younger. At the age of 4 Suzanne talks less to herself than when she is 2.