Contents

In this section you will find

ETHOVISION XT

EthoVision® XT is the premier video tracking system for the automatic tracking and analysis of animal movement, activity, and behavior, delivering variables such as velocity, distance moved, zone visits, and much more. EthoVision XT detects the center point of any kind of animal and, in addition, the nose point and tail base of rats and mice. This enables the assessment of behaviors such as body elongation, interest in objects, or nose to nose contact in social interaction studies.

It is also much more than just tracking software, EthoVision XT is a platform you can use to fully automate your research, increasing productivity and efficiency while reducing human error. Real-time analysis of animal behavior even allows you to create sophisticated protocols for the control of external equipment. In other words, you can control interactions between your animals and external sensor and stimuli devices such as pellet dispensers, lights, and doors. Additionally, rat behaviors such as grooming, rearing, and jumping can be recognized automatically.

BENEFITS

- Track any kind of animal in any type of enclosure, for any kind of test.
- Save time and reduce human error by automating your experiment.
- Choose the solution that fits your needs.
- Reliably track under varying conditions, even with background changes, uneven lighting, or multi-colored animals.
- Increase throughput by tracking animals in up to one hundred arenas simultaneously.
- Conduct social experiments with two or more animals.
- Freely select variables and parts of your data for analysis.
- Control when and where to track animals; either live or from video files.
- Use automatic behavior recognition for the automatic scoring of rat behavior.

FEATURES

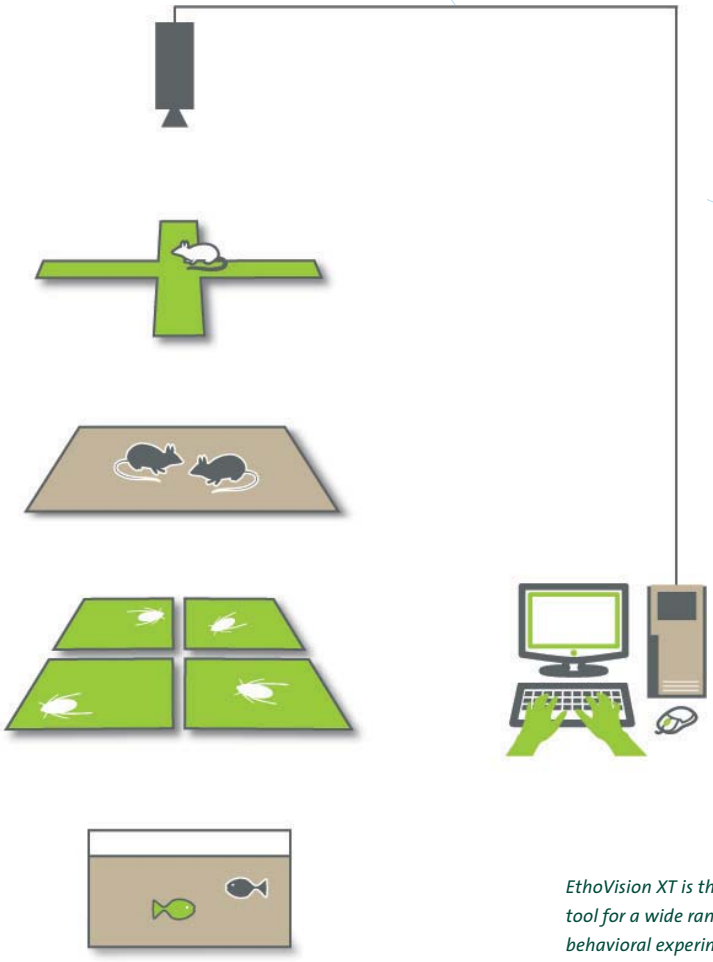
EthoVision XT is the ideal software tool for a wide range of behavioral experiments: it tracks any animal in any kind of enclosure. Both powerful and flexible, you can use it no matter what research field you are in: whether you want to test learning and memory in rats, measure the activity of zebrafish larvae, or conduct welfare studies with farm animals. With practical features for each phase of your experiment, EthoVision XT will help you out every step of the way – from setting up to the analysis of your data.

From straightforward to sophisticated set-ups

A basic EthoVision XT set-up consists of a video camera, positioned straight above the experiment arena (such as a maze or animal enclosure) and a computer running EthoVision XT. Camera images are sent to the computer and EthoVision XT tracks the animal and calculates a wide range of parameters related to activity, movement, and behavior. With EthoVision XT Base, you can conduct complete experiments with one animal in one testing area (arena). You can also use this base as a platform to build on. Add modules, more arenas, and other devices for the full automation of your research or a high throughput set-up. With the seven available modules, you can always create the package best suited for your research.

PREPARE YOUR EXPERIMENT

Get off to a good start by preparing a trial list and defining your experiment settings. Make a list with each trial planned and define the points of interest within the testing arena. Or better yet, follow the user guidance wizard and let EthoVision XT do most of the work for you!



EthoVision XT is the ideal tool for a wide range of behavioral experiments.

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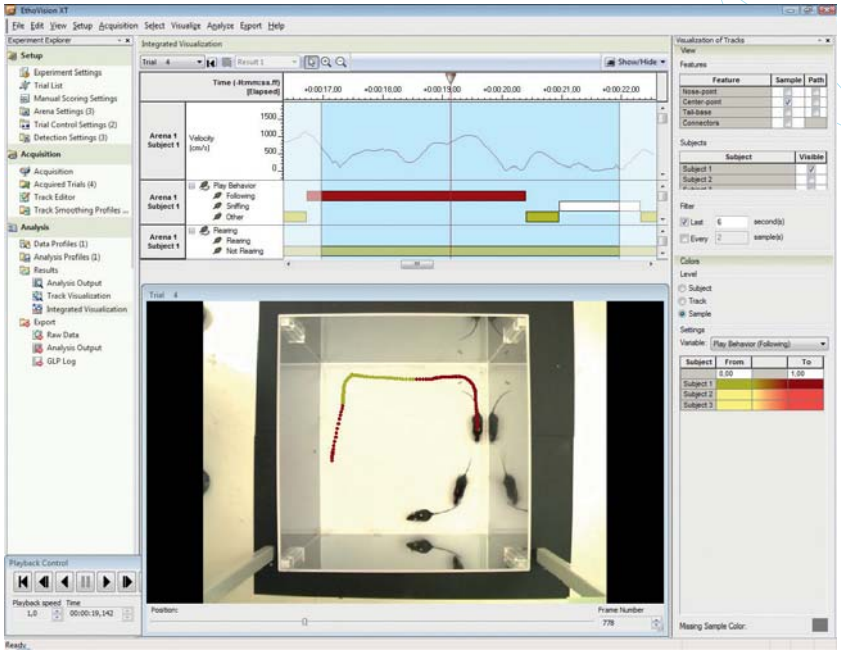


EthoVision XT offers you superb detection methods, offering accurate tracking of your animal.

User guidance with predefined settings
EthoVision XT includes templates for several popular tests, such as an open field, water maze, radial arm maze, and 96-well plate. Ideal for first-time users, it gives you a basic set-up for the animal and experiment of your choice, including predefined zones of interest (simply resize, drag, and drop) and predefined parameters of interest. Of course, you can fine-tune the settings to your research needs.

Keep things organized
With EthoVision XT, you can build a comprehensive trial list. This incorporates all the planned trials and independent variables, such as the age, gender, experiment phase, or treatment group of each animal. Furthermore, each trial can be linked to a specific video file. When trials are coupled to prerecorded video files, you can perform a batch acquisition, meaning that all the files will be processed (tracked) consecutively, saving you a lot of time. This trial list is a practical tool: not only will it help you keep track of each test and the progress of your experiment, but you can also use the independent variables for selection and analysis. Your data for this trial list can be copied to and from Excel.

Take control
EthoVision XT has Trial Control to automatically start or stop tracking, based on your predefined conditions. You may program EthoVision XT to start acquisition as soon as the animal is detected in the arena or to stop when the animal is within the proximity of an object. You can also start and stop tracking based on timing; stop tracking after 15 minutes, for example. When working with multiple arenas, the condition is applied to each arena individually. Creating the protocols for this Trial Control is easy – simply drag and drop 'command blocks' that contain conditions (the animal is detected in a feeding zone) and actions (trial ends).

Trial Control can also be used for the control of external applications. You can define the start of a sound file or a movie in Windows Media Player. This action may be based on animal behavior. For example, 'play the movie when the animal is first detected in the outer zone of the arena'. These Trial Control features are part of EthoVision XT Base.

ACQUIRE DETAILED DATA

Once your experiment is prepared, you are ready to start tracking your animals. You can do this live and even use a live feed to acquire a series of trials from. You can also record from video files and record video files while tracking live. It is possible to use up to four video cameras simultaneously. During each trial, the animal's coordinates are tracked. This tracking is of the center point or color marker of the animal. In the case of rats and mice, the center point, tail base, nose point, a combination of these three, or the color marker can be tracked. These coordinates are the basis for data analysis. From these, several parameters and statistics can be calculated.

Series of trials from a live video feed
You can use a continuous live video feed to automatically acquire a series of trials. Take a water maze test, for example. You can program EthoVision XT to start tracking as soon as the animal is detected in the arena and stop after it has reached the platform or when 60 seconds have passed. Also, set an inter-trial interval of 10 minutes to give yourself time to guide the animal to the platform if necessary, remove the animal, clean up, and place the next subject. EthoVision XT will start the next trial automatically, but only after the 10 minutes have passed and the animal has be detected in the arena. Of course, you are able to choose start and stop conditions and the trial-interval yourself.

Reliable detection
Meaningful tracking data depends on reliable detection of your animal. Continued tracking after your animal has urinated or reorganized its bedding can lead to mistakes which influence the results of your research. Uneven lighting or multi-colored animals may also cause detection issues. Noldus has created a set of highly accurate detection methods. You can fine-tune every method to your specific experimental conditions. This ensures accurate tracking even when set-ups are prone to background changes.

Activity detection
In addition to tracking the animal, EthoVision XT includes activity detection. This detects changes in the arena instead of the animal's (body point) location. This method of detection is ideal for the study of freezing behavior, zebrafish embryonic tail flicks, zebrafish larvae heartbeat monitoring,

and more. It even works in situations where your animal is hard to detect, such as light animals on a light background.

Automatic behavior recognition
In addition to automatically acquired variables such as velocity, distance moved, rotations, and presence in a zone, EthoVision XT now also automatically recognizes ten specific rat behaviors. It is an accurate, consistent, and tireless system that will help you gain objectivity and efficiency in your research. Behaviors recognized include grooming, jumping, supported and unsupported rearing, twitching, sniffing, walking, resting, drinking, and eating.

Manual event recording
You can use the Manual Event Recorder in EthoVision XT to score behaviors manually. This built-in tool allows you to define a list of behaviors and score them during data acquisition. This data can be selected, analyzed, and visualized in sync with the tracking data gathered. The Manual Event Recorder is also an ideal tool to validate and fine-tune the detection of behaviors such as the stretch attend posture (body elongation).

GET MEANINGFUL RESULTS

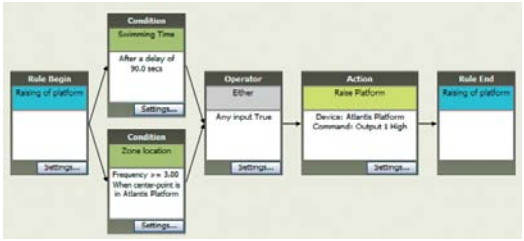
After the collection of data, it needs to be translated into meaningful results. The first step in analysis of your data, is data selection. Visualization of your data helps you to spot trends easily. Finally, a range of statistics will help you to analyze the results effectively.

Intuitive selection tools
EthoVision XT offers several tools for this job. You can pick certain trials or select segments according to time interval, independent variables, or animal behavior and location. Intuitive condition and action blocks allow you to easily create a data selection profile as straightforward or complex as you need it to be. For example, select the data from all male subjects that underwent treatment A.

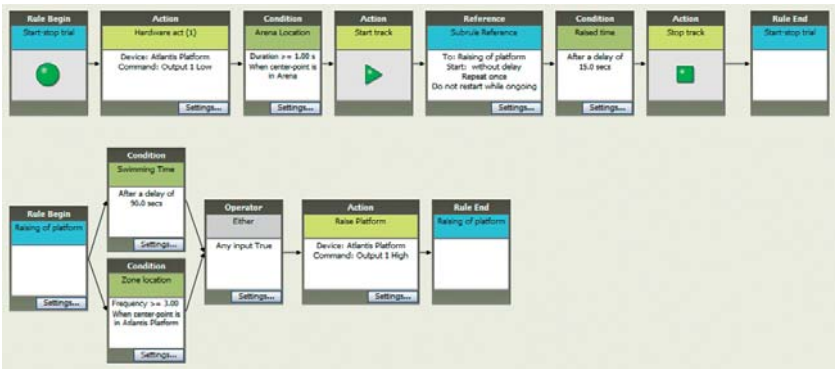
In-depth analysis
EthoVision XT offers a wide range of parameters to perform in-depth analysis. These can be related to the travelling distance, time, location, path shape, individual behavior, and social behavior. This list also includes manually and automatically scored behaviors and hardware events. For each parameter, several statistics can be calculated, such as latencies, durations, standard error, standard deviation, mean, total, and frequency. Think of total distance moved, minimum velocity, or frequency of visits to the feeding zone. There are also specific parameters for social interaction studies, such as percentage of time spent in prox-

With Trial & Hardware Control you can program external devices. This example shows three ways to program the on-demand Atlantis platform in a water maze.

Raise the platform in a water maze after the animal has spent 90 seconds swimming in search of it.



Raise the platform in a water maze after the animal has spent 90 seconds swimming in search of it OR when he has been swimming over its location 3 times or more.



Start the trial when the animal is detected for one second inside the wate maze. Raise the platform in the water maze after the animal has spent 90 seconds swimming in search of it OR when he has been swimming over its location 3 times or more. Wait 15 seconds after the platform is raised before ending the trial.

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EthoVision XT allows me to track videos accurately and reliably. Now I can use the hours that I used to spend with timers, pen and paper working on other areas of my research. [Jacqueline Womersley – South Africa]

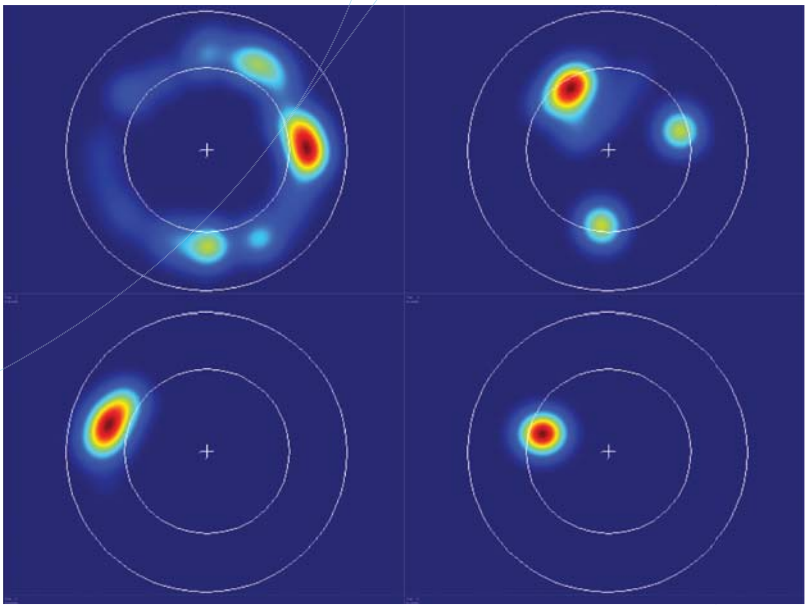
imity to another animal and relative movement. Some examples of the results of EthoVision XT data selection and analysis include: the time spent in the open zones of an elevated zero or plus maze, which allows you to measure anxiety related responses. The stretch-attend posture (body elongation) is often used to measure risk assessment or exploratory behavior. Additionally, the time spent immobile serves as a measure of fear.

Group statistics
In most experiments, you are interested in how the results compare amongst different groups of animals. In addition to statistics presented per trial, EthoVision XT also compares different groups for you. Results are displayed in tables and graphs and the data presented is based on your selection of data (data profile) and variables of interest (analysis profile). This way, you can compare the results of the training phase with those of the testing phase and/or the results between treatment groups. You can adjust the layout of the graph and use box or line graphs to easily spot trends in your data.

Automatic analysis
Analysis can also take place automatically, right after your trial has ended. This is based on your pre-selection of data (data profile) and variables of interest (analysis profile). You can also perform a batch analysis, analyzing all your trials at one push of the button. On top of that, you can combine this with batch acquisition. This means that when you line up your videos and select the parts of the data and the variables you are interested in, it will only take one push of the button to acquire and analyze all your data. You can even let EthoVision XT do this overnight!

Multifunctional visualization
Visualization of your data is useful for a number of reasons. You can visualize data to get an immediate feel for it and see how you want to proceed with the selection. Visualization is also a form of analysis itself and it is an intuitive way of showing others the results of your data. With EthoVision XT, you can visualize your data in several ways. Plot the trials to view multiple trials side by side or choose integrated visualization to display the video, the animal's path, and the values of the selected parameters in one dynamic, synchronized view. To instantly recognize values of parameters, you can display tracks in a color gradient and show, for example, variation in velocity with low speed in yellow to high speed in red.

Heatmaps
It is easy to spot where your animals spent their time when your data is presented in heatmaps. EthoVision XT has a built-in Heatmap Generator. This intuitive visual representation of animal distribution works great for presentations and publications. You can view heatmaps per individual or per group and you can select the data you want to appear in your heatmap. Use time intervals or combine different periods within a trial. Then sort a series of heatmaps in such a way that you can easily compare between trials, between individuals, or between groups. You can export it for use in presentations and publications.



A heatmap is a great way to visualize how your animal spent its time during the test. EthoVision XT offers high resolution export so that you can use these heatmaps in presentations and publications.

Export
Both raw data as well as data analyzed with EthoVision XT can be exported to other programs for further analysis. Several formats are possible, such as Microsoft Excel, ANSI text, and Unicode. Graphs and heatmaps can be exported as PNG, JPEG, BMP, and GIF.

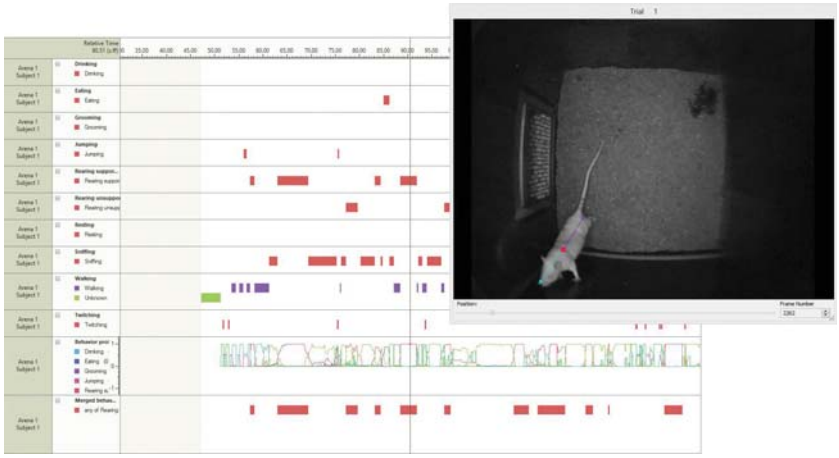
MODULES

EthoVision XT Base allows you to perform a wide range of tests, tracking the center point of one animal in one arena. If you need more, the modular approach of EthoVision XT grows with you and allows you to create the solution to meet your research needs. You can pick and combine the modules. For example, combine the Social Interaction Module and the Multiple Body Points Module to track the interaction between two mice in great detail or combine the Trial & Hardware Control Module and the Multiple Arenas Module to automate operant conditioning tasks.

ETHOVISION XT

Automatic recognition of rat behaviors
The Rat Behavior Recognition Module automatically recognizes ten rat behaviors: grooming, jumping, supported and unsupported rearing, twitching, sniffing, walking, resting, drinking, and eating. Automating this part of your research increases the objectivity and efficiency of your research as it has a number of advantages over human observations. The system is accurate, consistent, and tireless. It will score the same behavior in the same way each time around. Especially long-term observations become much more efficient. While human observers can become tired and scoring behaviors from minutes of video can take hours, the Rat Behavior Recognition software works tirelessly and never fails you.

Rat Behavior Recognition does not require expensive hand-labeled lists of behaviors, nor does it need any previous training. It works in different set-ups, with different strains of rats, and with a practical top-view camera position. This software can also be custom-tailored to automatically recognize additional behaviors. If you are interested in this, contact us for more information. (This module only works in combination with the Multiple Body Points Module.)



The Rat Behavior Recognition Module automatically recognizes ten rat behaviors. It is a great way to increase the objectivity and efficiency of your research.

Full automation
With the Trial & Hardware Control Module, automation takes on a new meaning for video based behavioral research. It not only allows you to connect and control external equipment (such as pellet dispensers, lights, doors, and levers) but it also allows you to use the real time behavioral and positional parameters to control them. The possibilities for your behavioral research are endless!

Similar to Trial Control, Trial & Hardware Control in EthoVision XT is an easy and straightforward tool that allows you to build complex test protocols in a quick and easy way. You do this by simply dragging predefined condition or action blocks into the flow diagram. Each condition block (such as time, location, hardware event, or behavior event) can generate a rule by connecting it to an action such as the opening of a door or counting a number of certain events. Ultimately, by connecting the blocks or individual rules in an AND/OR manner, you can realize even the most complex test protocols. Of course, the Trial and Hardware Control Module is not only suitable for relatively straightforward test protocols such as the raising of an Atlantis platform. It also allows you to control more complex behavioral paradigms such as the radial arm maze with automated doors and pellet dispensers, the 5-choice serial reaction time task, or a fear conditioning experiment, to name just a few.

For our research, EthoVision XT is an essential tool for sophisticated analysis of behavior as it relates to neural circuit function. [Garret Stuber – USA]

The great advantage of using EthoVision XT to control your operant conditioning experiment is that you can use the automatic real-time positional and behavioral data of EthoVision XT as part of your test protocol. For instance, the 5-choice serial reaction time task requires the animal to poke its nose in a hole situated under a light within a few seconds after it is turned on. There are five lights with five holes. If the animal succeeds, a reward will be given in the feeding area. With Trial & Hardware Control, you can prevent the animal from missing the cue by assigning the condition that the animal will only receive the cue while orientated in its direction. Additionally, you can prevent the animal from sitting near the correct nose poke hole by adding a condition that he has to be more than 10 cm away from its location before the stimulus can be given again.

Trial & Hardware Control is also great when performing behavioral studies with optogenetic stimulation. You can control the stimulation with Trial & Hardware Control, based on animal behavior or timing. It also registers what happens during a trial, so you can easily analyze what occurred as a behavioral consequence of optogenetic stimulation.

High throughput with multiple arenas
EthoVision XT's Multiple Arenas Module enables high throughput experiments, since it allows you to track in up to one hundred testing areas (arenas) simultaneously. You can easily copy and paste arena settings from one arena to the other. Trial control conditions are still applied to each arena individually. This module offers great possibilities for studies such as those performed with multiple open fields or with zebrafish larvae in a 96-well plate.

Tracking multiple body points
With the Multiple Body Points Module, EthoVision XT can identify the nose point and tail base of rats and mice – an ideal way to measure exploratory behavior. The proximity of the animal's nose to a certain object or the direction towards which

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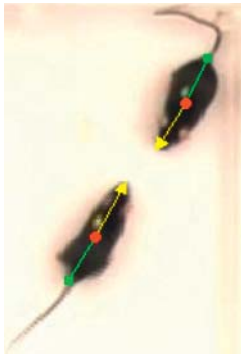
the animal's head is pointed are very informative parameters when studying memory in rats or mice. 'Head direction to zone' is especially useful in the novel object recognition test or any other test in which an animal's interest in an object either inside or outside the arena is investigated. Exploration of the novel object is generally defined by the animal's head being within a certain radius of the object. The 'head direction to zone' variable analyzes the degree in which the head of a rat or mouse is directed towards a point of interest.

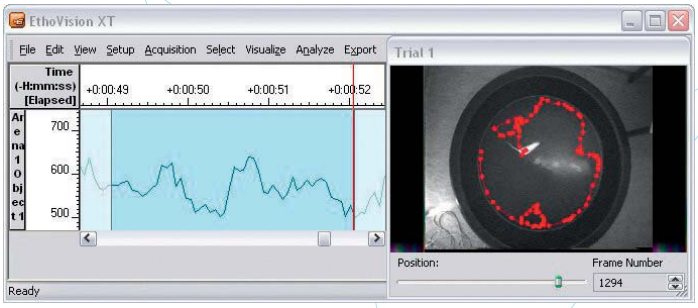
You can also use the Multiple Body Points detection to more accurately analyze entrances into arms of a maze or other zones and define which body points should have entered the arms for it to be counted as an entry. Finally, this module is also a great addition for social interaction studies.

Social interaction studies
With the Social Interaction Module you can track multiple animals within one arena and study their interaction in great detail. Unlike with other solutions, the Social Interaction Module does not require color marking of animals. Of course, it is possible to track the marker instead of a body point, making it easier to identify the individual animals. A range of social parameters give you meaningful results, such as the time spent in proximity of another animal, the movement of two or more animals relative to one another, or the amount of nose to nose contact (when used in conjunction with the Multiple Body Points Module).



The Social Interaction Module lets you study social interaction in great detail. Combine this module with the Multiple Body Points Module to extract even more information from your experiment.

Exploring physiological data streams
When working with telemetry or other physiological data acquisition systems, the Physiology Integration Module allows you to synchronize and visualize these physiological data streams alongside your tracking data. EthoVision XT sends



Use the Physiology Integration Module to integrate physiological data streams with the acquired tracking data.

out a synchronization signal during tracking, so after acquisition you can import the physiological data and both data streams are automatically synchronized. This powerful combination of information sources can lead to a better understanding of your research results.

Quality Assurance
EthoVision XT's Quality Assurance Module ensures the protection of your data. Unauthorized persons cannot open the experiment and you can assign different rights to different users. For example, give full rights to the professor, but limit the options for students. This way you can be sure that your data is safe. This module also logs all changes and settings in the project, so you can always look back and see what happened. This helps in making your experiment GLP (Good Laboratory Practice) compliant (meeting 21 CFR Part 11 requirements).

INTEGRATED SYSTEMS

Noldus offers you completely integrated systems, including cameras, computers, and testing mazes and arenas. Additionally, PhenoTyper® and DanioVision™ systems are powered by EthoVision XT. With the Trial & Hardware Control Module and the Noldus USB-IO box, you can connect several hardware devices. In all, EthoVision XT is a great platform to build your experiment on.

Heartbeat Detector
EthoVision XT activity detection allows for the detection of changes in the arena, based on the differences in grey shade between the frames. Heartbeat detection is commonly measured in zebrafish larvae as they are transparent and their hearts are therefore visible. EthoVision XT detects heartbeat activity and the Heartbeat Detector, a free software program (compatible with EthoVision XT versions 9.0 and up), extracts a power spectrum from this data. The dominant frequency is detected, which is the heartbeat of the animal.

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MORE INFORMATION?
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PHENOTYPER

PhenoTyper® is a complete video-based observation system that is used for a wide range of experiments with laboratory rodents. It offers the perfect test set-up for activity and open field studies, interactive home cage testing, and circadian studies.

BENEFITS

- Plug and play - the test environment and video equipment are completely integrated.
- Record video completely independent of light conditions in your laboratory.
- Standardize your experiments.
- Expand PhenoTyper with specially designed accessories and integrated visual and acoustic stimuli.

FEATURES

PhenoTyper is a combination of a cage and a top unit with light and video sources. The walls of the cage are standard, designed to be compatible with drinking bottles, feeders, shelters, etc. Two of the walls contain ventilation holes. All the walls can be customized to fit any device you might want to add, such as nose poke devices or cage dividers. The top unit contains a camera, light sources, a light filter, and adjustable visual and acoustic stimuli. PhenoTyper provides a complete observation environment:

- The infrared (IR)-sensitive camera with IR band pass filter, and IR light sources ensure robust recording regardless of ambient light condi-tions in the laboratory.
- The built-in acoustic and visual stimuli can be used to elicit behavioral responses, such as anxiety-related and operant behavior.
- PhenoTyper can be adjusted to make room for any kind of external device you want to use in your behavioral protocol.

PhenoTyper is available in two versions; a basic, empty cage and a home cage equipped with a shelter and food and drink station. Several add-on sensor and stimuli devices can be added. Both versions are available in two sizes: the PT3000 (30 x 30 cm) and the PT4500 (45 x 45 cm). The size of the ventilation holes, number of bottles, and the size of the shelter differ according to the number and the type of animals that are used.

PhenoTyper is ideal for home cage assessment studies. Combine PhenoTyper with one of our add-on products such as the Noldus lickometer or the Noldus pellet dispenser to get more out of your research.

Basic cage
The PhenoTyper basic cage is an empty cage suitable for conducting several tests that require an open field, such as learning and memory tests, anxiety tests, or for the recording of locomotor activity.

Home cage
A PhenoTyper home cage is the basic cage equipped with one or two drinking bottles, a feeder, and a shelter to create an environment suitable for home cage experiments. Performing anxiety studies or operant conditioning tasks in a home cage environment helps you to refine and automate your research in a better way than with conventional tests.

Combine with EthoVision XT
PhenoTyper is powered by EthoVision® XT, software that tracks the animal's activity, movement, and behavior in great detail. The addition of the Trial & Hardware Control Module provides the ability to set up protocols to control and receive feedback from several hardware devices (such as the accessories presented on the right). The combination of PhenoTyper and EthoVision XT allows you to run experiments for any duration, from a couple of minutes to several weeks in a row.

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ACCESSORIES

PhenoTyper can be combined with accessories such as shelters and hardware devices such as the Noldus pellet dispenser and the Noldus lickometer. You can use any TTL-based device, connect it to the Noldus USB-IO box, and fully automate this set-up with EthoVision XT Trial & Hardware Control.

PhenoTyper IR translucent shelter
Rats and mice are nocturnal animals, so to study them during their active phase, IR lighting is often applied in laboratories. It is invisible to the animal, but behavior can be recorded using an IR sensitive camera. The PhenoTyper top unit contains a video camera and IR LED units. To observe and track animals while they are inside their shelter, this shelter can be used. Although it appears black to the naked eye, it is made from IR translucent material.

Although it is black in appearance, this shelter is IR translucent, making it ideal for use in experiments with IR light conditions.

Noldus lickometer
The animal's intake of water, or certain compounds dissolved in water, is important in many research studies. However, keeping track of this manually can be time consuming and prone to mistakes. The lickometer accurately registers the drinking behavior of your animal and signals this to EthoVision XT. The software records and time stamps these drinking events and stores this data together with other data acquired during tracking. The lickometer consists of a small device with a clip to attach to the nipple of the water bottle. It measures contact between the animal and the water bottle by detecting any change in capacitance between the ground plate and the drinking nipple. No current flows through the animal, so there is no negative effect on animal health or drinking behavior.

Noldus pellet dispenser
The pellet dispenser with pellet drop detection can be used to stimulate interactivity between an animal and its environment by rewarding specific behaviors. In combination with PhenoTyper and EthoVision XT Trial & Hardware Control, you can use it to automate learning and operant conditioning tasks. Simply program EthoVision XT to activate the pellet dispenser as soon as the user-definable conditions are met, for example when the animal is detected on top of its shelter or when a lever is pressed. Feedback from the pellet dispenser to EthoVision XT is also provided, so that the pellet dropping event is registered alongside behavioral data.

Noldus illuminated shelter
The illuminated shelter is ideal for passive or active avoidance tasks. You can use it to assess learning and memory based on an aversive stimulus, in this case light. It is a corner shelter with two entries and lights inside. With EthoVision XT's Trial & Hardware Control you can program the interior lights to turn on when the animal enters the shelter through the (as previously determined) preferred entry side, while the lights stay off when it uses the other entry. This way you test the mouse's ability to learn and adapt its preferred entry side.

PhenoWheel
The PhenoWheel measures the activity of the mouse in a running wheel. It can be placed inside any basic or home cage. It consists of a running wheel and a counter module. By means of a magnet and a magnetic sensor, the number of rotations is counted and sent to the EthoVision XT software. Furthermore, you can use EthoVision XT to measure the amount of time spent in the running wheel.

Mouse Feeding Monitor
The Mouse Feeding Monitor measures the interaction between a mouse and a stainless steel feeder, measuring frequency and duration of feeding behavior. It is placed between the feeder and the PhenoTyper mouse cage wall (PT3000) and works with a beam-break mechanism. Connected to EthoVision XT Trial & Hardware Control, you can collect data from the monitor to incorporate it with your tracking data. Of course, you can also use this input for Trial & Hardware Control protocols, transforming the monitor into a nose-poke device for operant conditioning tasks.

The Mouse Feeding Monitor registers feeding behavior.

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DANIOVISION

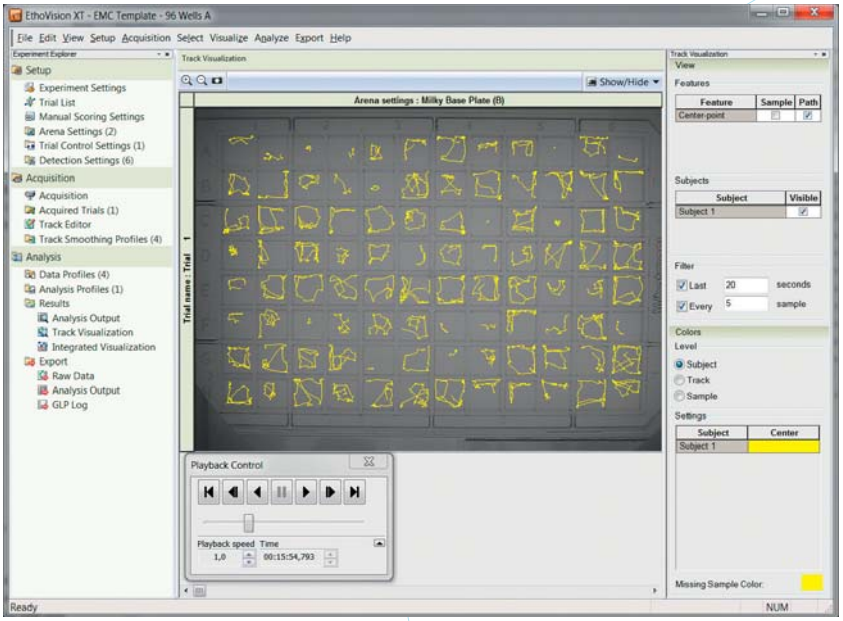
DanioVision™ is the innovative system designed for the high-throughput tracking of zebrafish larvae or other very small animals. Powered by EthoVision® XT, it allows for highly accurate tracking of up to 96 animals simultaneously in multi-well plates. All in a compact and controlled environment; DanioVision is shock resistant and gives you complete control over light and dark settings, and the temperature of the water directly beneath the well plate.

BENEFITS

- Get robust and reliable tracking data.
- Set up your experiment easily and quickly.
- Control light and dark conditions.
- Analyze your data visually and statistically.

FEATURES

DanioVision is a complete solution, consisting of the DanioVision Observation Chamber, the Temperature Control Unit, and EthoVision XT pre-installed on a class-A computer. The DanioVision Observation Chamber features a compact and user-friendly design. It is small yet has everything you need; an infrared (IR) backlit holder for a multi-well plate, a high quality IR-sensitive camera, and a white light source which can be TTL-controlled to operate automatically, based on animal behavior or time. The Temperature Control Unit lets you control the temperature of the water that flows underneath the well plates, and flows through the system. DanioVision is compatible with any ANSI & SBS compliant multi-well plate. Overall, this system offers the ideal controllable environment for the tracking of activity, movement, and behavior of zebrafish larvae.



EthoVision XT provides accurate tracking of the activity of each zebrafish larva.

The DanioVision Observation Chamber offers a compact desktop model that is easy to use and handle. The large sliding opening provides easy access.

High throughput testing made easy
DanioVision is designed as a plug-and-play system; just hook up the wiring to connect the Observation Chamber to the computer, plug in the power, and you are ready to go! The large sliding opening of the DanioVision Observation Chamber provides easy access to quickly replace the well plate between trials. The plate holder assures the wells are always positioned in the same place, so the camera and the wells stay perfectly aligned. EthoVision XT's user-guided experiment set-up with pre-installed experiment templates allows for a quick set-up of your experiment. High throughput tracking has never been this easy!

Reliable image for tracking
To ensure a steady view, DanioVision is equipped with anti-vibration feet to absorb shocks to the image that might occur in a laboratory setting. The high quality camera and the innovative optical design of the observation chamber prevent angular distortion at the edges of the wells. Additionally, the backlit plate holder provides even lighting to each well and prevents shadowing. The combination of the IR backlight and the IR-sensitive camera makes reliable tracking in the dark possible. All these features combined guarantee you of a reliable view of each individual well.

High quality camera
The DanioVision Observation Chamber has a built-in camera. The high resolution and high frame rate of the camera allow you to monitor movement in details. It also includes a zoom lens, allowing you to zoom in up to a level of four wells.

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Take control
The DanioVision Observation Chamber creates a controlled experimental environment for testing. It shuts out external light, and allows for control of the internal white light conditions with EthoVision XT. The white light is integrated in the backlit plate holder and can be used for long term studies on circadian rhythmicity or to induce a startle reflex when the light is turned on. Furthermore, you can adjust the white light gradually, from dimmed to bright. EthoVision XT guarantees perfect tracking under all light conditions, even when you switch from dark to light, or gradually change the light gradient during your experiment. You can choose between very low light levels or standard white light levels. The standard white light levels range from approximately 150 Lux to 4500 Lux. The low light maximum intensity value is 1 Lux. The low light settings can be used to mimic more natural situations.

Multiple days in a row
The Temperature Control Unit lets water flow beneath the well plate at a user defined temperature. The unique design lets you either cool or heat the water, so you can accurately set the conditions for your experiment.

The unit is very compact, and easily connected to the Observation Chamber with two water tubes and two cables. When you set the desired temperature the system will start to heat or cool the water until the user-defined temperature is reached, which takes only a few minutes. The temperature of the water is measured directly at the position of the well plate, so the temperature read from the display is accurate to the temperature inside the wells.

Additional stimuli
In addition to light control and flow-through of water, you can connect other external devices to the system. DanioVision has four TTL connections to add your own custom stimuli, such as a vibration stimulus, which can be controlled with EthoVision XT.

The Temperature Unit allows the flow-through of water at a user defined temperature.

Expand the possibilities
DanioVision includes a fully functional version of EthoVision XT. This means that this software is also ready to use for other purposes, such as:
- zebrafish larvae heart rate monitoring
- zebrafish embryo activity (tail coilings) monitoring
- adult zebrafish tracking in a T-maze to study learning and memory
- multiple aquaria studies

The innovative optical design assures a stable and distortion free image of each individual well.

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MORE INFORMATION?
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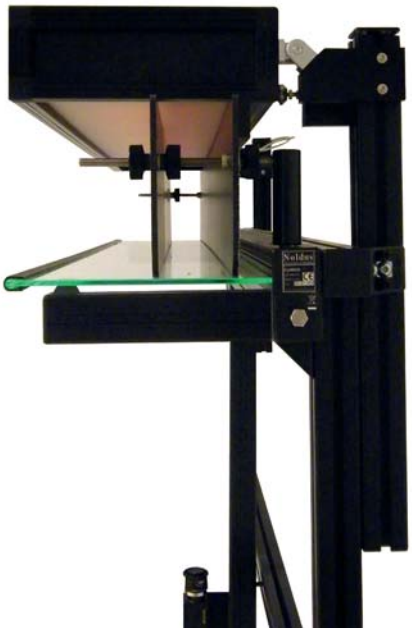
CATWALK XT

CatWalk™ XT is the quickest way to assess locomotor deficits and pain-induced gait adaptations in voluntarily walking rodents. Consisting of both software and hardware components, CatWalk XT can be used for any rodent model with defects to the CNS, PNS, muscular system, or skeletal system, and has been validated in research on spinal cord injury, neuropathic pain, arthritis, stroke, Parkinson's disease, ataxia, brain traumatic injury, and peripheral nerve injury.

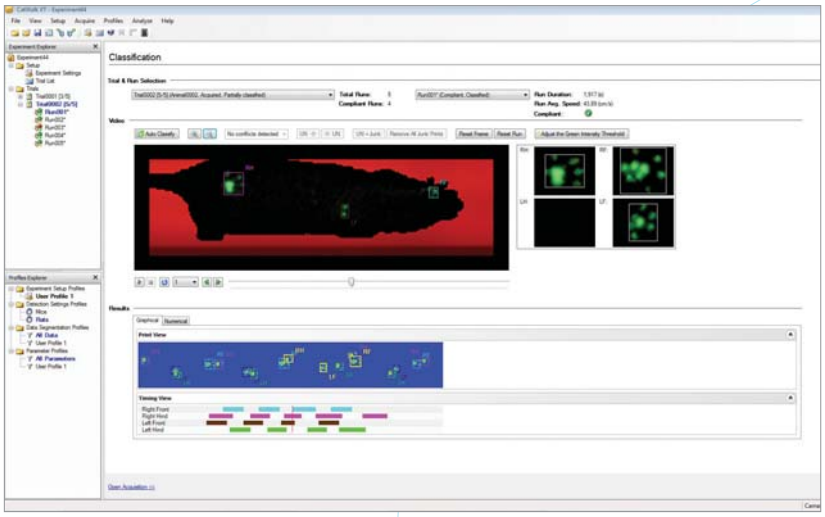
CatWalk XT objectively measures various dynamic aspects of animal locomotion and footprints. Unlike other methods, CatWalk XT allows you to assess the temporal dimension of gait, at a rate of one hundred times per second! This timing information, combined with the position, and surface area of each footfall, enables the calculation of numerous parameters. You can perform a detailed quantitative and qualitative evaluation of rodent locomotor performance.

BENEFITS

- Benefit from a complete and easy-to-use turnkey system for rodent gait analysis.
- Collect, analyze, and store the most accurate gait data.
- Assess gait and locomotion behavior in an unforced and low stress manner.



The CatWalk XT walkway; a corridor with glass plate, light source, and camera to accurately record footprints.



CatWalk XT accurately records footprints and classification is easy! CatWalk XT can even do this automatically with the Automatic Footprint Classification Module. With a wide range of parameters to choose from, CatWalk XT helps you to get the most out of your experiment.

- Easily compare treatment groups and/or time points.
- Capture the real footprints of rodents.
- Use a product that is under constant development in collaboration with the scientific community.

FEATURES

All in one
CatWalk XT is a complete system: a test apparatus and analysis tool in one. The walkway consists of a glass plate, corridor, light source, and mobile frame. It incorporates Illuminated Footprints™ technology to assure real footfall assessment. The computerized high speed processing of footprints from video results in highly detailed, reliable, and retraceable data. No other method is a match for CatWalk XT!

Voluntary movement
The CatWalk XT method is based on a non-invasive and low stress manner of testing. The recording of footprints on video occurs while the rat or mouse voluntarily moves across the walkway, unlike systems that use treadmills or running wheels. This way, a natural gait is evoked; there is no forced movement as a cofounding factor of gait.

To make it easy to train your animal, and to motivate it to cross the walkway in one consistent run during the experiment, CatWalk XT includes a goal box. Mounted at one end of the walkway, this goal box consists of a black shelter and the animals own home cage accessible through a hole in the shelter floor.

The goal box helps you to get consistent runs easier and faster – animals are less likely to turn around or stop along the way, motivated by the desire to go to the safety of familiar surroundings. This enhances the quality of your data. Additionally, several filters in the software are available to assure high quality data with low variability.

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Illuminated Footprints
While the animal traverses the walkway, the Illuminated Footprints technology ensures an accurate distinction between the parts of the animal that touch the walkway, and parts that do not. Light is sent through the glass walkway while the animal walks over it. Only at those areas where the animal makes contact with the glass plate, light is able to escape.

The light reflected by the body parts touching the glass is recorded with a high speed camera, positioned underneath the walkway, sending data to a computer running the CatWalk XT software. The intensity of this green light is adjustable from within the software. This is especially useful when you are using extremely heavy, very young, or severely impaired animals. This technology allows for assessment of body weight distribution across the paw during locomotion, which is represented in a dynamic 3D graph.

Red light conditions
Red light is used by the software to visualize the animal's body contour and is different from the light in the glass runway. That means that you can work under red light conditions, instead of in complete darkness. The body contour lighting facilitates (automatic) classification of footprints and other contact areas. The intensity of the red light is also adjustable from within the software.

The complete instrument: the walkway consists of a corridor with a glass plate bottom with Illuminated Footprints technology: light shines through to reveal each footprint. This is captured with a high speed camera positioned below the walkway. The roof provides red light, for practical working conditions. The goal box provides an easy training tool and motivates your animals to cross in one consistent run, leading to better data.

Set up and preselect
You can set up and plan your experiment by defining time points, treatment groups, run criteria, and trial lists. You can then save this as a profile and re-use it in later experiments, saving you time and preventing errors. Since walking speed is an important factor affecting gait parameters, CatWalk XT will only use those sections of the runs that adhere to predefined criteria. This will not only compensate for speed differences, it will also give you higher quality data. Thresholds can also be adjusted after data collected.

Footprint classification / Automatic Footprint Classification
After data acquisition, all footprints need to be classified. With CatWalk XT this is easy to do: the body contour lighting makes it easy to see which print belongs to which paw, and where one footprint ends and the next one begins. Or, to make it even easier, Automatic Footprint Classification™ eliminates the need to classify each foot-print manually. At the push of a button, all the footprints in a run are automatically classified.

The run video (left) and a dynamic representation of the de combined image of each current footfall (right).

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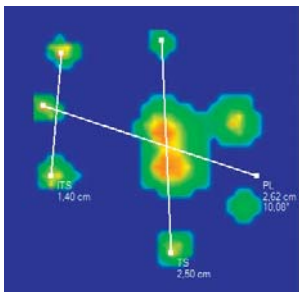
Classification in detail
In some instances, for example with severely impaired animals, classification might be difficult. CatWalk XT automatically detects classification conflicts and lists them in a drop-down box. You can also zoom into the run video, up to four times, for a detailed look at each print.

Interactive Footprint Measurements
The Interactive Footprint Measurements™ Module allows you to calculate the distance between the toes of each paw, the paw print length, and its angle relative to the body axis and movement vector. Additionally, the Sciatic Functional Index, Tibial Functional Index and Peritoneal Functional Index are calculated, allowing you to assess the recovery of sciatic nerve functioning in rats and mice.



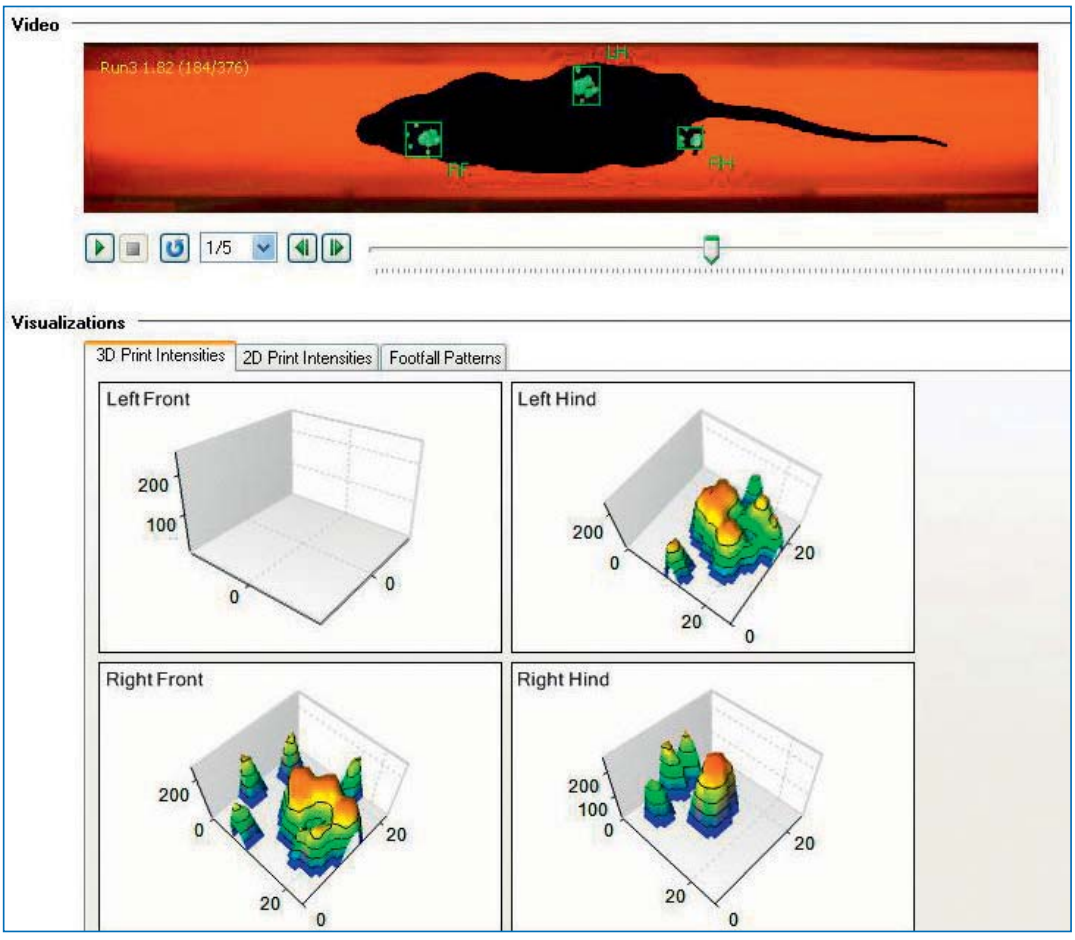
The Interactive Footprint Measurements Module allows you to measure toe spread, intermediate toe spread, and print length.

Data Segmentation Profiles
To further enhance the quality of your data, you can fine-tune the selected data with Data Segmentation Profiles before analysis. The result is a selection of runs or partial runs that comply with your criteria, which you can then subject to analysis.

Numerical and graphical output
After the runs are acquired, the footprints are classified, and data is selected, CatWalk XT automatically generates numerical and graphical outputs. Parameter charts provide you with graphs for every parameter you have selected in your profile. In one view, you can see how gait changes over time or differs between treatment groups. All parameters (explained below) can be exported to statistical packages for further analysis. You can also export the Run Video. Graphs can be exported to software programs such as PowerPoint or as a PDF file.

PARAMETERS

Parameters related to individual footprints
Besides footprint dimensions, CatWalk XT measures the stance and swing phase durations and the brake-propulsion phase ratio which is determined by the change in footprint area during the stance



Graphical representation of paw weight distribution of each individual footfall.

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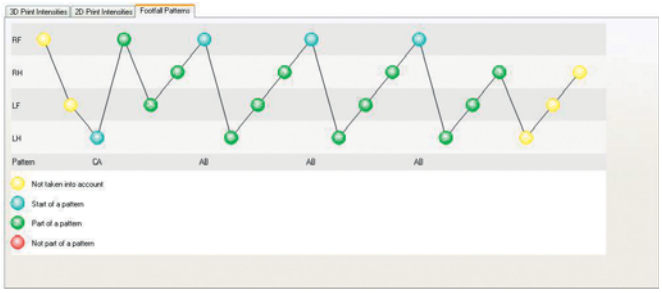
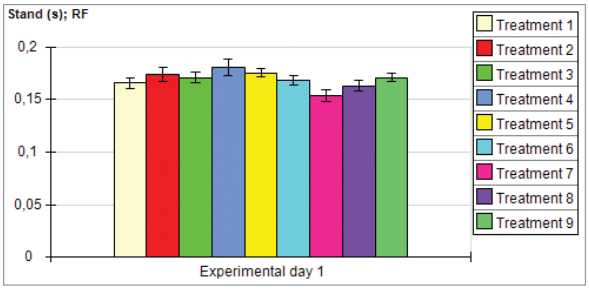


Footfall patterns show the order in which paws were placed and if they were part of a detected step cycle.

phase. Due to a relationship between the footprints and the pressure exerted by each paw, CatWalk XT is able to assess the distribution of weight support across each one of the four paws. An animal with, for example, an inflamed knee joint will likely avoid supporting too much weight with this particular limb. Values are also expressed as ratios between contralateral paws in order to correct for body weight differences between different animals.

Parameters related to the relative positions of footprints
CatWalk XT measures the distance between consecutively placed footfalls (stride length) and the distance between contralateral footprints (base of support) and ipsilateral footprints.

Parameters related to time-based relationship between footprints
CatWalk XT provides time-based relationships between footfalls. It measures the sequence of the steps taken by the four paws and determines whether steps belong to regular sequences or not. An index is calculated for the degree in which steps belong to regular sequences. This index is regarded as an objective measurement of interlimb coordination. Besides this measurement of ordinal scale, CatWalk XT also provides parameters related to phase lags: the timing of a step is expressed as a percentage of the stride duration of another step. Measurements are also provided on the relative duration of simultaneous contact with the ground for different paw combinations. For example, recent additions are single stance, initial dual stance, terminal dual stance. They are used in research to determine how much time the animal spent on one or both of his hind legs.



Parameter charts show you how each parameter of interest changes over time or differs between treatment groups.

Parameters related to toe spread and paw angle
CatWalk XT provides parameters on toe spread, intermediate toe spread, print length, and paw angle. Paw angle can be measured as the angle between the paw axis and the body axis or between the paw axis and the movement vector. Additionally, toe spread and print length are used to calculate Sciatic Functional Index, Tibial Functional Index, and Peritoneal Functional Index.

Other parameters
CatWalk XT provides many other parameters that give valuable information about the locomotor activity of your animal, such as cadence and contact duration of body parts other than the paws.

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