

The Observer XT: a tool for the integration and synchronization of multimodal signals

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The Observer was originally developed as a professional and complete manual event recorder for the collection, management, analysis and presentation of observational data in animals [7]. However, due to its flexibility it soon became clear that The Observer was suitable for almost any study involving collection of observational data. Since then The Observer has been used in a wide range of research areas, such as applied ethology [e.g., 6], zoology [e.g., 8], entomology [e.g., 2], neuroscience [e.g., 1], psychology [e.g., 5] usability testing [e.g., 4] and sports sciences [e.g., 3].

More and more researchers combine behavioral observations with measurement of other types of data such as heart rate, blood pressure or eye movements. The benefit of combining different modalities is that you get a more complete picture of the phenomena you are studying. For instance, when you are testing the usability of your company's website, it might be useful to also use an eye tracking system. Eye fixations measured with an eye tracking system can tell you what the focus is of your participant's attention. This is very useful information that is hard to obtain from behavioral observations or questionnaires. Another example is the measurement of physiological data of a rat in an open field. The open field test is a paradigm used in neuroscience to study the effects of drugs on, for instance, anxiety or depression-like behaviors. Physiological data, e.g. heart rate or EEG data, may be of

great value here. It is very well possible that on a behavioral level you do not find any effects of your drug, while your physiological data indicate that there is a significant effect (or the other way around).

The Observer XT allows you to import almost any kind of external data acquired with an external Data Acquisition (DAQ) system, such as an eye tracking system or a physiological DAQ system to measure ECG or EEG. The only requirements for import of external data into The Observer XT are: a) the external data must be in ASCII format, b) the external data file must contain information about sample rate and c) the external data must have been sampled with a constant sample rate. It is also possible to import event data obtained with another program than The Observer, for instance uLog. Event data do not necessarily have to be observational data, but can also be R-tops from an ECG or blood pressure spikes. The only requirement is that the event data are in ASCII format and the data file consists of a column with time stamps and one or more columns with values.

Firstly, by importing external data into The Observer you achieve the integration of multimodal signals, such as observational data, eye tracking data, physiological data or video files. Secondly, you need to synchronize all signals. For example, when studying the psychophysiological response of a patient during a medical consult with a physician, you want

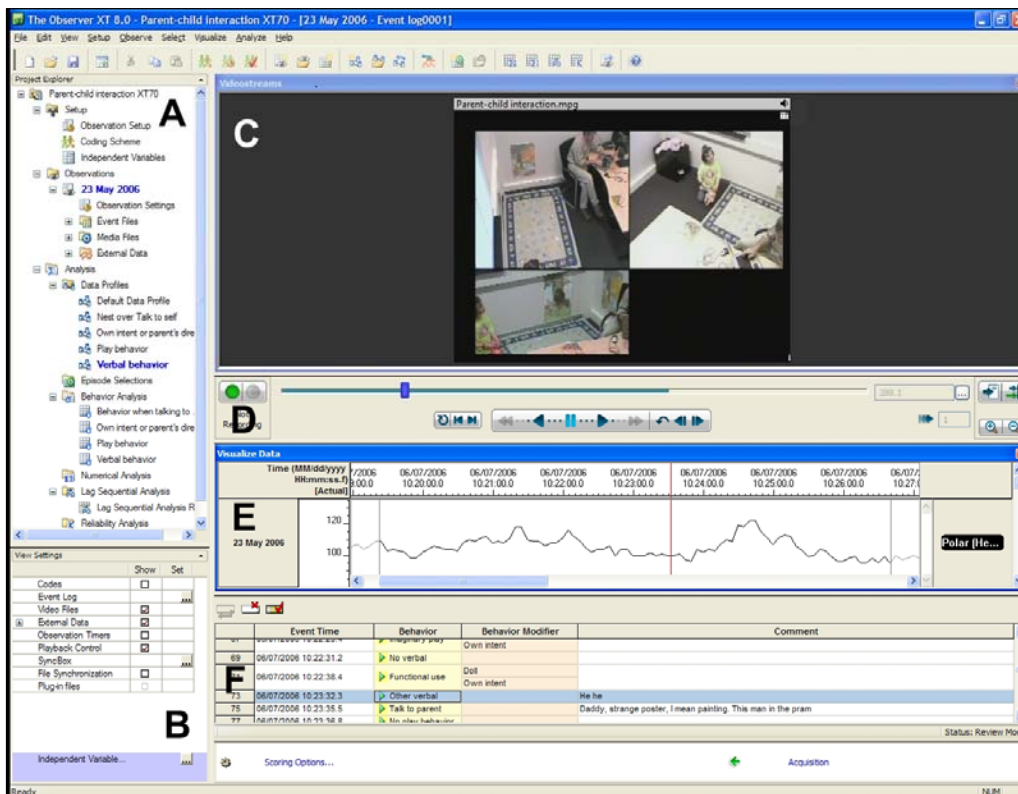


Figure 1. Screenshot of the user interface of the Parent-child interaction sample project in The Observer XT. This sample project shows the interaction between a 6-year old girl, Suzanne, and her father. Her behavior is videotaped and her heart rate is measured using a Polar heart rate monitor. A: Project Explorer, B: View Settings, C: Video window, D: Playback Control, E: External data window with heart rate data, F: Event Log window with behavioral data.

to record how physiological measures, such as heart rate or blood pressure, change as a result of specific types of questions asked by the physician (see the case study on our website for more details: http://www.noldus.com/site/content/files/case_studies/cs_psycho_holt.pdf). It is obvious that in this example the observational data, physiological data and video files must be synchronized, in order to see the relationship between events in the separate data sources.

The Observer XT offers several mechanisms to synchronize your behavioral data, external data and video files. You can manually set the offset for each modality to synchronize all signals. However, the easiest method to synchronize behavioral and physiological data is to carry out a live observation while The Observer XT sends out a synchronization signal to the external DAQ system on which you simultaneously acquire physiological data. The synchronization signal, with time/date information, is sampled by the DAQ system as if it is a physiological signal. Upon import of the physiological data in The Observer, the time/date information in the synchronization signal is used to automatically synchronize the physiological data with the behavioral data (see figure 1 for a screenshot from another project).

Next, you can select and visualize your data in a chart in The Observer XT; the scored behaviors and the associated physiological data are plotted against a time axis. When you play back or scroll through the observation, the behavioral and physiological data and video file(s) are played back synchronously. This allows you to visually inspect the relation between behavioral and physiological data in detail. Furthermore, you can export your behavioral data and

associated physiological data to ASCII files for further analysis in other programs.

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