Attention Tool FACET Module Guide
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Overview

- Collect facial expression data. Alone or in combination with Eye Tracking, EEG and GSR.
- Set up a simple Face Camera recording if you wish to focus solely on facial expressions.
- Analyse emotions. Positive, Negative, Neutral, Joy, Anger, Sadness, Surprise, Fear, Contempt, Disgust, Neutral, Positive, Negative. Per individual or aggregated.
- Import externally recorded videos for analysis on FACET.
- Raw data export to look deeper into the raw data. Use markers to segment and annotate data.
Section A

Introduction
Applications

Facial expression analysis finds its use in broad range of research topics.

- Market research
- Neuromarketing
- Human-computer interaction
- Usability research
- Advertisement research
- Child development
- Neuroeconomics
- Learning
- Diagnostisation of neurological disorders
- Driver fatigue
- Robotics, artificial intelligence
- Gaming

Facial expression analysis offers an estimation of the entire valence spectrum of basic emotions. It is non intrusive in the sense that it does not require a device to be attached to a person’s body but uses a simple camera, such as a webcam built into a laptop. Facial expression analysis may be used alone or in combination with biometric sensors such as EEG, GSR EMG FMRI or eye tracking sensors.

Triangulation between the different modalities of emotion measurement can reveal even more about the emotional state of a test subject. Combining facial expression analysis with EEG, GSR and/or eye tracking as well as the use of self-report surveys like SAM (Self-Assessment Manikin) to measure emotional state may reveal additional insights. Attention Tool software by iMotions makes such triangulations accessible to researchers. Attention Tool makes it possible to easily run studies with individual sensors or in any combination desired.

Applying facial expression analysis within scientific research, market research, gaming, usability and user experience (UX) research as either a stand-alone sensor or in combination with other biometric sensors has never before been easier.
**FACET** is an facial expression recognition and analysis software based on more than 20 years of scientific research. Its predecessor CERT has been deployed by more than 130 Universities.

Via real-time frame-by-frame analysis of the emotional responses of users, the software detects and tracks seven expressions of primary emotion. Furthermore it supports blended composites of two or more of these emotions. The seven emotional dimensions can also simply be collapsed into a Positive, Neutral, Negative distinction.

The system delivers critical facial expression data, analysis and insights that can be leveraged by both public and private research firms to provide valuable and actionable insights.

FACET achieves high classification accuracy across a wide variety of conditions due to the large dataset it is based upon. Conditions include variations in age, gender, race, facial hair, glasses and other adornments, as well as head pose, and lighting conditions.
The FACET module is divided into two parts:

**FACET Valence**
Provides the following classification categories

  Positive and Negative categories.

**FACET Emotion**
Provides the following classification categories

  Joy, Anger, Sadness, Surprise, Fear, Contempt, Disgust, Neutral, Positive, Negative

Each of the above mentioned signals is assigned a numerical value called the Evidence number. The Evidence number is a raw data value. When presented in the user interface, this value is transformed into a probability between 0 and 1, which makes it easier for interpretation and presentation. See more about the data output on the following pages.
Prerequisites

- Windows 7 Professional 64 bit edition with 8 GB memory.

- Attention Tool 5.0 (Patch 1) with FACET Module:
  - FACET Valence – Positive/Negative Valence
  - FACET Full – All seven basic emotions.

  - In order to get FACET module running you do not need to run additional installations as FACET is fully integrated into Attention Tool. The screen dumps below show you how to verify whether the FACET module is enabled through the Attention Tool licensing system.

- Web camera of good quality. Recommended:
  Logitech HD Pro C920597 or similar (around 80 USD).
Section B

Collecting Data
Enable FACET Data Collection

Preferences > Global Settings

> Video Tab
Ensure the camera is physically connected.
Select to “Enable VideoCam Capture”
Select the video camera in the “Camera” dropdown.
If you need audio to be recorded enable “Include Audio”.

Format
Use the default option of 640x480. In the general case there will not be any performance increase with higher resolution. Only set it to a higher value if the experimental protocol requires it.

Overlay
To timestamp video frames check Date, Time, FPS (Frames Per Second)

FACET
Check ”Enable Data Collection”

Use intensity in live graphs (demo mode): This makes the calculation of FACET values more presentable when running demos (non recording mode).

Disable baselining in replay graphs: If you would like to have a raw data view of the recorded data without subtraction of baseline.
Check FACET Connection

Click on the icon to see the live viewer.

Live Viewer for demo mode
Create a Study with FACET

1. Connect to web camera and FACET in Global Settings
2. Click + in the Library section, select Study > Add
3. Fill in the Study Parameters (see next slide)
Create a Study with FACET

1. Fill in the study parameters

2. Add Camera and FACET to Study’s sensors.

3. When you have filled in the study parameters and defined the associated sensors, click Add.

4. Load the stimuli.

You can also run FACET in combination with all the other supported sensors like Eye Tracking, EEG and Galvanic Skin Response (GSR).
Add Stimuli

1. Click the + in the upper right-hand corner
2. Select a stimulus type
3. Configure the stimulus type (browse for file, enter URL, etc), Add Stimuli
4. Add Respondent (next slide)
Add Respondent(s)

1. Click the + in the lower right-hand corner, under Respondents
2. Fill in the respondent parameters
3. Add the respondent

See the data collection guide on next page
Record Data

1. Connect to web camera and FACET in Global Settings
2. Fill in the study parameters
3. Fill in the Sensor information
4. Load Stimuli
5. Add Respondent

Press Record to start data collection

See the data collection guide on next page
Guide for Data Collection

Illumination
Best results are obtained with uniform diffused illumination of face and dark background. Strong background lightning may decrease performance, since most cameras calibrate light on the full image – hence the face will become darker if there is strong backlight.

Camera
Web cam of good quality. However high resolution is not needed and will in general not improve performance – just generate more data and slow processes down. Resolution beyond 64 pixels ear to ear do not improve classification results. The camera should be situated at approx. the users eye level and face with less than a 10 degree variation from the upright position.

Head pose
The rotation and tilt of the head will affect emotion values measured by the system. Some emotions are more sensitive to tilt and rotation than others, contempt in particular. The system is designed to operate within 10 degrees from a frontal, upright head pose. Best results will be obtained if head position in relation to the camera is frontal and straight for all respondents.

Respondent positioning
The face should not take up the entire image plane – this will lower performance of face detection algorithms. Place respondents so that there is a good chance they will stay within the image for the entire recording. Take into account that respondents change positions now and then to be maintain comfort.

Encourage respondents to relax, not talk, and stay neutral during the calibration sequence in the beginning of the slideshow of stimuli.

Other
- No hats, sun glasses
- No chewing gum or beverages
To reach optimal performance, the FACET system requires a baseline measurement.

An individual’s face can have a default appearance that resembles any of the emotional categories even though he or she may be in a neutral state (e.g. a “natural frown”). In order to remove this bias a calibration slide is introduced to measure this default appearance. Measurements on the subsequent stimuli will be processed by a simple subtraction using the values obtained during the baseline stimulus.

Attention Tool has an feature built in to obtain a baseline. See the next page.

The illustration below demonstrates the difference between a non-baselined recording on a stimulus vs. the baselined version.
After hitting the record button, the system will check if there is a calibration slide for FACET.

If “Emotient_Baseline.jpg” is not present, such a slide will be inserted in the study as the first slide.

Immediately after the test will start. This dialog will only appear for the first recording.
Visualisation – Data Collection

Data collection started

Double click this area to see data in full screen.

Live view of stimuli and raw data from FACET (no baseline)
Section C

Analysis
Create An Analysis for FACET

1. Click + in the Library section, select Analysis > Add
2. Provide a name for the Analysis, > Next
3. Input desired segmentation criteria > Add
Create an Analysis to start working with the collected data

Right Click to get options

Right Click to get options

See next page for more info
Visualisation – Analysis

**AOI & Markers**
Interact with your data. Create markers on the timeline with annotations.

**Replay**
Simple replay of the recorded data for each individual.

**Aggregate**
The FACET graphs are averaged across respondents in order to get a segment response.
A standard web camera can record at 30 frames per second. During recording the FACET classification system will try to classify each frame of video in real time. However, depending on the resources available during the recording, the system may skip frames to keep up with the incoming data.

The skipped video frames can be calculated after the recording. Use the right click menu on the study to find the "Emotient Video Processing" selection.

Note: the calculation will go through all video frames of all respondents on all stimuli in the study. This may take some time to finish.
Data Export Dialog:
Right click on the name of the analysis you are working on.

Default Location of the data files is under the user’s Documents/Attention Tool 4/<name of study>
Data Export

FACET study data export, shown in Excel.

Information about sampling and face detection performance.

Each emotion is output as columns of Evidence and Intensity. For definitions and interpretation see following slide.
Each category is assigned a numerical value called the Evidence number. The Evidence number is a raw data value which when presented in the user interface is transformed to a probability between 0 and 1, which makes it easier for interpretation and presentation. See more about the data output on the following pages.

**For in depth analysis use Evidence and neither Intensity nor Probability**

If you wish to apply statistical analysis to the data, using the Evidence numbers works significantly better than the intensity and probability metrics.

The basic reason is that $P$ and intensity are soft-threshholding functions of the evidence. The soft threshholding can have some shortcomings if the values are not set optimally. So by using intensity or $P$ without the proper baselining, you are taking a big risk.

Evidence is very similar to a $Z$ score. As with $Z$ scores, positive values larger than 3 indicate that you have evidence for a strong positive effect, e.g., you can safely bet that the person is showing a joyful expression. As with $Z$ scores, values smaller than -3 indicate you have evidence for a strong negative effect, i.e., you can be sure that the person is not showing a joyful expression. As with $Z$ scores a value of zero indicates that you don’t have evidence either way. (See next page for elaboration).

Transformation of Evidence into Probability (as shown on the user interface in Attention Tool)

$$PP = \frac{1 - LLR}{1+10^{-LLR}}$$

*(LLR is the Evidence number as can be seen in the export)*
**Definition Evidence**
The evidence output for an expression channel represents the odds, in logarithmic (base 10) scale, of a target expression being present.

Using Joy as an example:
- An Evidence value of 1
  The observed expression is 10 times more likely to be categorized by an expert human coder as joyful than not joyful.
- An Evidence value of 2
  The expression is 100 times more likely to be categorized by an expert human coder as joyful than not joyful.
- An Evidence value of -1
  The expression is 10 times more likely to be categorized by an expert human coder as not joyful than joyful.
- An Evidence value of -2
  The expression is 100 times more likely to be categorized by an expert human coder as not joyful than joyful.
- An Evidence value of 0
  There is an equal chance that the expression is to be categorized by an expert human coder as joyful than not joyful.

**Definition Intensity**
The intensity output for an expression channel is a number between 0 and 1, which represents the perceived intensity of the expression as estimated by expert human coders:

- An intensity below 0.2 indicates the expression is likely absent.
- An intensity between 0.2 and 0.4 indicates a low intensity expression.
- An intensity between 0.4 and 0.6 indicates medium intensity expression.
- An intensity between 0.6 and 0.8 indicates high intensity expression.
- An intensity above 0.8 indicates very high intensity expression.
Section D

Face Recording Stimulus
From Attention Tool 5.0.1 You can collect face data without having to have a stimulus on the screen – Face Recording Stimulus.

The purpose of this stimulus type is to have a way to have studies focusing only on aspects of facial responses, with or without any of the additional biometric sensors supported by Attention Tool. The Face Recording Stimulus is special as this stimulus does not present anything on a screen like the other stimuli types do.
Create A Study With Face Recording

1. Add a new study.
2. Fill in the Study Settings and Sensors options.
3. Under Study Settings click on Add to add the study to the library.
Create A Study With Face Recording

1. Add stimulus to the study.
2. Fill in the stimulus settings.
3. Click Add.

After clicking Add you will see the Face Recording icon in the stimulus bar.
Add respondent to the study. Then click the record button to start the recording.

Check that you are connected to web camera and FACET is running.

Recording button

Add respondent

Note: for the first respondent the system will suggest to insert a FACET calibration slide in the study. This is described in Section B.
Create A Study With Face Recording

View During Data Collection
Note: there is no visual stimulus associated with this type of recording.

Live view for operator during recording

End Recording: press SHIFT + SPACE on the keyboard

Tip: You may also add live markers to the recording, in order to mark certain events that happen during the recording. Markers are created during the setup of the study.

To know more about live and post processing markers, see the Guide to Markers manual, can be found on the iMotions Extranet or write to support@imotionsglobal.com to request a copy.
Create A Study With Face Recording

Analysis:
Analysis of Face Camera recordings is identical to the description in Section C.
Section E

Import External Face Recordings
Import External Face Recordings

If you have video recordings that were done outside of Attention Tool, you can import these into Attention Tool for further analysis with FACET.

The steps to import are very similar to setting up a study with a Face Recording stimulus. Only instead of collecting data you will go through an import dialog pointing to a folder containing the video files to be imported.

Note: The video format supported by Attention Tool is WMV.
1. Add a new study.
2. Fill in the Study Settings and Sensors options.
3. Under Study Settings click on Add to add the study to the library.
Import External Face Recordings

1. Add stimulus to the study.
2. Fill in the stimulus settings.
3. Click Add.

After clicking Add you will see the Face Recording icon in the stimulus bar.
Import External Face Recordings

Import the videos into the newly created study:

1. Right Click on study to access the import dialog Import External Data.
2. Point to the folder containing your WMV video files.
Calculate FACET on the imported videos.

1. Right Click on study to access the Emotient Video Processing dialog.
2. Choose settings for processing.

**Minimum face size:** The calculation can skip faces under a certain size. The percentage is relative to the size of the video frame. The lower the value the smaller the face is accepted for analysis (evaluated for each frame).

**Process every Nth frame:** As FACET calculations can take long time for long recordings you may set this lever to optimise calculation speed at the cost of granularity on the output.

**Note:** After clicking OK processing will start. It is a resource intensive process and can take long time to finish.
Import External Face Recordings

Analysis:
Analysis of imported Face Camera recordings is identical to the description in Section C.
You can import the external video recordings with a correspondent dataset for GSR and EEG. The steps are similar to the process outlined from the start of Section E. To import the EEG and GSR data, you will have to have files for each sensor with same respondent naming convention.

**Study Setup**
Set the parameters for both camera, FACET, GSR and or EEG.
Import External Face Recordings with GSR/EEG

Import the videos into the newly created study:

1. Right Click on study to access the import dialog Import External Data.
2. Point to the folder containing your WMV video files, EEG files and GSR files.
Import External Face Recordings with GSR/EEG

Request a demo dataset of face camera import with GSR and EEG from support@imotionsglobal.com
...can we help you?

support@imotionsglobal.com

The iMotions Team