VREED: Virtual Reality Emotion Recognition Dataset using Eye Tracking & Physiological Measures

Dataset Summary

# Abstract

The paper introduces a multimodal affective data set named VREED (VR Eyes: Emotions Dataset) in which emotions were triggered using immersive 360° Virtual Environments (360-VEs) delivered via Virtual Reality (VR) headset. Behavioural (eye tracking) and physiological signals (Electrocardiogram (ECG) and Galvanic Skin Response (GSR)) were captured, together with self-reported responses, from healthy participants (n=34) experiencing 360-VEs (n=12, 1-3 min each) selected through focus groups and a pilot trial. Statistical analysis confirmed the validity of the selected 360-VEs in eliciting the desired emotions. Preliminary machine learning analysis was carried out, demonstrating state-of-the-art performance reported in affective computing literature using non-immersive modalities. VREED is among the first multimodal VR datasets in emotion recognition using behavioural and physiological signals. We hope that this contribution encourages other researchers to utilise VREED further to understand emotional responses in VR and ultimately enhance VR experiences design in applications where emotional elicitation plays a key role, i.e. healthcare, gaming, education, etc.

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# Credits

First and foremost, we would like to thank our participants in this study for having the goodwill and patience by giving us their time.

This dataset was collected by: Dr Luma Tabbaa.

The dataset was organised, digested and extracted by: Dr Luma Tabbaa, Ryan Searle, Saber Mirzaee Bafti and Dr Jittrapol Intarasisrisawat.

This work could not have been possible without the expertise and guidance of: Dr Chee Siang Ang, Dr Md Moinul Hossain and Maxine Glancy.

In addition, we would like to thank the following for supporting us during data collection and analysis: Dr Boris Otkhmezuri and John Allen.

# Dataset Summary

Prior to the study, researchers conducted a pilot trial to identify emotionally eliciting 360-VEs. Twelve volunteers engaged in and rated the selected 360-VEs (n=21). As a result, twelve 360-VEs were used in the study.

Thirty-four participants took part in this study. Using VR, participants engaged in and rated 360-VEs (n=12) distributed over four quadrants on emotions based on the Circumplex Model of Affects (CMA) [1] in a randomised order, where after each 360-VE, they rated how they felt in terms of valence and arousal using the Self-Assessment Manikin (SAM) [2], 10 different types of emotions using the Visual Analog Scale (VAS) [3] such as happy, sad, calm, and anxious as well as their sense of presence whilst engaging in the 360-VE [4]. Eye-tracking data was recorded whilst participants watched the 360-degree videos, as well as Electrocardiogram (ECG) and Galvanic Skin Response (GSR).

Thus, the VREED consists of the following parts:

* The 360-VEs selection process and pilots’ ratings.
* Experiment materials including a detailed description of the 360-VEs that were used in the study, inclusion and exclusion criteria, verbal instructions protocol and questionnaires used in the study.
* Study dataset including participants descriptive data, ratings of self-reported questionnaires, and eye tracking, ECG and GSR data.

For further details about the experimental set up, data collection process, measures, and equipment, please refer to the published paper (citation is in the abstract section).

# File Listing

The table below lists and briefly describes the files available to download within this dataset.

|  |  |  |
| --- | --- | --- |
| **File Name** | **Format** | **Brief Description** |
| **01 Dataset Summary** | | |
| Dataset Summary | .pdf | (This document) contains information on the content of the dataset and describes all variables used in this dataset. |
| **02 Stimuli Selection** | | |
| 360VEs Selection Process & Pilots’ Ratings | .xlsx | Contains the list of 126 360-VEs that the researchers first discussed, and the results of the pilot with 12 volunteers. |
| Final Videos’ Description | .xlsx | All information related to the 360-VEs used in this study (i.e. author, link, video code …etc.) and statistics of videos’ ratings during the pilot. |
| **03 Self-Reported Questionnaire & Metadata** | | |
| Participants Profile & Pre-Exposure Ratings | .xlsx | Responses of a one-time questionnaire at the beginning of the session containing descriptive information: age, sex, ethnicity…etc., health screening, Immersive Tendencies Questionnaire (ITQ) [5], ratings using SAM and VAS on how they felt "right now, at the moment". |
| Post-Exposure Ratings | .xlsx | Responses of a post-exposure questionnaire where participants repeatedly filled this questionnaire after engaging in each 360-VE. The participants’ responses consist of SAM and VAS responses based on how they felt “whilst watching the video” as well as responses to the Presence Questionnaire. |
| **04 Eye Tracking Data** | | |
| Eye Tracking Data (Pre-Processed) | .dat | The pre-processed data (eyes and head movement were combined and converted to vertical and horizontal view) per participant, per 360-VE. |
| Eye Tracking Data (Features Extracted) | .csv | Eye Tracking features extracted per quadrant. |
| **05 ECG-GSR DATA** | | |
| ECG-GSR Data (Pre-Processed) | .dat | The pre-processed (down sampling, noise removal, filtering, segmenting etc.) ECG and GSR data recordings from the experiment, per participant, per 360-VE. |
| ECG Data (Features Extracted) | .csv | ECG features extracted per quadrant. |
| GSR Data (Features Extracted) | .csv | GSR features extracted per quadrant. |
| **Supporting Documents** | | |
| VE Randomisation Order Per Participant | .xlsx | A table that explains the order of the 360-VEs participants engaged in, per participant. |
| Verbal Instructions Protocol | .docx | A verbal instructions protocol was written to be read out to all participants from the beginning of the session till the end to ensure that instructions are held constant. |
| Participant Profile & Pre-Exposure Questionnaire | .docx | A sample of the participant profile and pre-exposure questionnaire. All questionnaires were filled digitally using an online survey platform, therefore, whilst the wording and organisation remains the same as this document sample, this sample was not used as is. In this questionnaire you will find a thorough description on the questions that posed as inclusion/exclusion criteria. |
| Post Exposure Questionnaire | .docx | A sample of the repeated post-exposure questionnaire where participants filled this questionnaire after engaging in each 360-VE. All questionnaires were filled digitally using an online survey platform, therefore, whilst the wording and organisation remains the same as this document sample, this sample was not used as is. |

# 360-VEs Selection Process & Pilots’ Ratings

This document contains three sheets that describes the 360-VEs selection process and the results of the pilot. Starting from the sheet on the far left:

* Initial List of 360VEs: This sheet lists the 360-VEs that five researchers experienced in VR and discussed thoroughly afterwards. The output of this brainstorm session was to produce inclusion criteria and choose a sample of videos for the pilot. The table below describes the variables used in this sheet:

|  |  |
| --- | --- |
| **Variable** | **Label** |
| Video\_ID | This is a unique ID assigned to each video |
| Brief\_Title | Brief title the researcher’s team used to describe the video |
| Video\_Link | Link to where the video can be found and watched |

* Volunteers Demographics: This sheet describes the volunteers’ demographics. The table below describes the variables used in this sheet:

|  |  |
| --- | --- |
| **Variable** | **Label** |
| ID | This is a unique ID assigned to each volunteer |
| Age | Continuous Numerical Variable where the integer represents age in years |
| Sex | Nominal Categorical Variable where 0=female, 1=male |

* Volunteers’ Ratings of 360VEs: This sheet lists the volunteer’s individual ratings, ratings statistics, and decision on whether to include the 360-VEv in the study. The table below describes the variables used in this sheet:

|  |  |
| --- | --- |
| **Variable** | **Label** |
| Video\_ID | This is a unique ID assigned to each 360-VE |
| Brief\_Title | Brief title the researcher’s team used to describe the 360-VE |
| Video\_Link | Link to where the 360-VEs can be found and watched |
| Emotion\_Parameter | Joy, Anger, Calmness, Sadness, Surprise, Disgust, Relaxation, Depression, Happiness, Fear, Excitement, Anxious, Valence, Arousal |
| Vol1 | Volunteer 01’s individual ratings |
| Vol2 | Volunteer 02’s individual ratings |
| Vol3 | Volunteer 03’s individual ratings |
| Vol4 | Volunteer 04’s individual ratings |
| Vol5 | Volunteer 05’s individual ratings |
| Vol6 | Volunteer 06’s individual ratings |
| Vol7 | Volunteer 07’s individual ratings |
| Vol8 | Volunteer 08’s individual ratings |
| Vol9 | Volunteer 09’s individual ratings |
| Vol10 | Volunteer 10’s individual ratings |
| Vol11 | Volunteer 11’s individual ratings |
| Vol12 | Volunteer 12’s individual ratings |
| Mean | Mean of all volunteers’ ratings per parameter |
| SD | Standard deviation of all volunteers’ ratings per parameter |
| Min | Minimum rating value of all volunteer’s ratings per parameter |
| Max | Maximum rating value of all volunteer’s ratings per parameter |
| Count | Number of volunteers who rated this 360-VE |
| Decision | Researchers group decision on whether to include the 360-VE in the third round. |

# Final Videos’ Description

This document contains one sheet that describes the final 360-VEs used in the study:

|  |  |
| --- | --- |
| **Variable** | **Label** |
| Video\_ID | This is a unique ID assigned to each 360-VE |
| Brief\_Title | Brief title the researcher’s team used to describe the 360-VE |
| Brief\_Description | Textual description of the 360-VE |
| Quad\_Cat | Nominal Categorical Variable where 0= High Arousal High Valence, 1= Low Arousal High Valence, 2 = Low Arousal Low Valence, 3=High Arousal Low Valence |
| Arousal\_Cat | Nominal Categorical Variable where 0= Low Arousal, 1= High Arousal |
| Valence\_Cat | Nominal Categorical Variable where 0= Low Valence, 1= High Valence |
| Str\_Code | String code that refers to the 360-VE |
| Num\_Code | Numerical code that refers to the 360-VE |
| Channel/Artist | Name of the 360-VE’s channel/artist |
| Video\_Link | Link to where the 360-VE can be found and watched |
| Video\_Length | The length of the 360-VE described in min:ss:ms |
| Notes\_on\_Length | Textual notes relating to the length of the 360-VE |
| Emotion\_Parameter | Joy, Anger, Calmness, Sadness, Surprise, Disgust, Relaxation, Depression, Happiness, Fear, Excitement, Anxious, Valence, Arousal |
| Vol1 | Volunteer 01’s individual ratings |
| Vol2 | Volunteer 02’s individual ratings |
| Vol3 | Volunteer 03’s individual ratings |
| Vol4 | Volunteer 04’s individual ratings |
| Vol5 | Volunteer 05’s individual ratings |
| Vol6 | Volunteer 06’s individual ratings |
| Vol7 | Volunteer 07’s individual ratings |
| Vol8 | Volunteer 08’s individual ratings |
| Vol9 | Volunteer 09’s individual ratings |
| Vol10 | Volunteer 10’s individual ratings |
| Vol11 | Volunteer 11’s individual ratings |
| Vol12 | Volunteer 12’s individual ratings |
| Mean | Mean of all volunteers’ ratings per parameter |
| SD | Standard deviation of all volunteers’ ratings per parameter |
| Min | Minimum rating value of all volunteer’s ratings per parameter |
| Max | Maximum rating value of all volunteer’s ratings per parameter |
| Count | Number of volunteers who rated this 360-VE |

# Participants Profile & Pre-Exposure Ratings

Exclusion Criteria based on this questionnaire includes:

* Age\_Yrs: Users who their answer =<17 indicating they are less than 18 years of age are excluded from participation in this study.
* Eng\_Prof: Users who their answer =<3 indicating "limited working proficiency, or lower intermediate" or "elementary proficiency, or beginner" are excluded from participation in this study.
* VR\_Dizzy: Users who their answer=1 indicating having problems such as feeling dizzy after using VR previously are excluded from participation in this study.
* Mo\_Sick: Users who their answer =>5 indicating "get motion sickness very easily" are excluded from participation in this study.
* HealthQ1 through Q19 (except for Q11): Users who their answer =1 indicating "yes" are excluded from participation in this study.
* Q11: Users who their answer =3 indicating "wearing glasses or contacts, but even with them my vision is less than perfect" are excluded from participation in this study. Also, users wearing glasses could not participate in the study, especially that the Head Mounted Display (HMD) frame is rigid and cannot contain the glasses frames, but users wearing contact lenses were included.

This document contains one sheet that describes the results of the participant profile and pre-exposure questionnaire:

|  |  |  |
| --- | --- | --- |
| **Variable** | **Label** | **Scale Type & Values** |
| ID | This is a unique ID assigned to each participant randomly. | Continuous numerical variable |
| Sex | What is you biological sex? | Nominal categorical variable where 0=female, 1=male |
| Sex\_Orient | What is your sexual orientation? | Nominal categorical variable where 0=bisexual, 1=gay, 2=heterosexual, 3=lesbian, 4=others, 5=prefer not to disclose |
| Hand\_Dom | Which hand do you consider your dominant hand (which hand do you use to write with)? | Nominal categorical variable where 0=right, 1=left |
| Hand\_Mouse | Which hand do you use to navigate using a mouse? | Nominal categorical variable where 0=right, 1=left |
| Age\_Yrs | How old are you? | Continuous numerical variable where the integer represents age in years |
| Age\_Eng | At what age did you learn English? | Continuous numerical variable where the integer represents the age of when the participant started learning English and the value 0=native. |
| Eng\_Prof | How do you assess your English language proficiency? | Ordinal variable where 0=Native or bilingual proficiency, 1=Full professional proficiency, or fluent, 2=Professional working proficiency, or intermediate, 3= Limited working proficiency, or lower intermediate, and 4=Elementary proficiency, or beginner. |
| Ethnic\_Grp | Using the British government's survey categories from the 2001 census, which ethnic origin or descent describes you best? Please choose one of the following: | Nominal categorical variable where 0=Indian, 1=Pakistani, 2=Bangladeshi, 3=Chinese, 4=Asian-Other, 5=Black-Caribbean, 6=Black-African, 7=Black-Other, 8=Mixed Race, 9=White-European, 10=White-UK/Irish, 11=White-Other, 12=Prefer not to disclose |
| VR\_Ever | Have you ever worn a virtual reality headset? | Nominal categorical variable where 0=Yes, 1=No |
| VR\_Dizzy | If yes, did you have any problems (nausea, dizziness, etc.) - Please select "Not Applicable" if you have never worn a virtual reality headset before. | Nominal categorical variable where 0=Yes, 1=No, 2=Not Applicable. |
| Mo\_Sick | How easily do you get motion or carsick? | Ordinal variable on a likert Scale where 0=Never been motion sick and 6=Get motion sick very easily |
| Health\_Q01 | Do you now or have you ever had a seizure disorder or epilepsy? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q02 | Have you had a seizure? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q03 | Do you have a heart condition? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q04 | Do you have heart arrhythmias? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q05 | Do you suffer from hypertension? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q06 | Do you suffer from vestibular (balance) disorder? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q07 | Do you have any medication conditions affecting balance? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q08 | Do you frequently experience headaches, lightheartedness, or dizziness? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q09 | Are you hearing impaired? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q10 | Are you visually impaired? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q11 | Since you are not visually impaired, how do you describe your eyes health? | 0=I have perfect or close-to-perfect vision, 1= I sometimes wear glasses or contacts, but I don’t have to wear them all the time and I see okay without them, 3= I must wear glasses or contacts to correct my vision to perfect or close-to-perfect, 4= I wear glasses or contacts, but even with them my vision is less than perfect. |
| Health\_Q12 | Do you have any medication condition or are you taking any medication that would make you susceptible to experiencing dizziness, disorientation, or nausea? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q13 | Have you had a head injury in the past year? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q14 | Do you have a neurological disease? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q15 | Do you have a learning disability? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q16 | Do you suffer from any psychological disorders? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q17 | Are you diagnosed with clinical depression? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q18 | Do you use any medication for psychological or emotional problems? | Nominal categorical variable where 0=Yes, 1=No |
| Health\_Q19 | Do you get skin rash from wearing non-precious metal or rubbing alcohol? | Nominal categorical variable where 0=Yes, 1=No |
| ITQ01 | Do you easily become deeply involved in movies or tv dramas? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ02 | Do you ever become so involved in a television program or book that people have problems getting your attention? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ03 | How mentally alert do you feel at the present time? | Ordinal variable on a likert scale where 0=Not Alert, 3=Moderately, 6=Fully Alert |
| ITQ04 | Do you ever become so involved in a movie that you are not aware of things happening around you? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ05 | How frequently do you find yourself closely identifying with the characters in a story line? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ06 | Do you ever become so involved in a video game that it is as if you are inside the game rather than moving a joysick and watching the screen? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ07 | How physically fit do you feel today? | Ordinal variable on a likert scale where 0=Not Fit, 3=Moderately Fit, 6=Extremely Fit |
| ITQ08 | How good are you at blocking out external distractions when you are involved in something? | Ordinal variable on a likert scale where 0=Not Very Good, 3=Somewhat Good, 6=Very Good |
| ITQ09 | When watching sports, do you ever become so involved in the game that you react as if you were one of the players? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ10 | Do you ever become so involved in a daydream that you are not aware of things happening around you? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ11 | Do you ever have dreams that are so real that you feel disoriented when you awake? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ12 | When playing sports, do you become so involved in the game that you lose track of time? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ13 | How well do you concentrate on enjoyable activities? | Ordinal variable on a likert scale where 0=Not At All, 3=Moderately Well, 6=Very Well |
| ITQ14 | How often do you play arcade or video games? (OFTEN should be taken to mean every day or every two days, on average.) | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ15 | Have you ever gotten excited during a chase or fight scene on TV or in the movies? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ16 | Have you ever gotten scared by something happening on a TV show or in a movie? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ17 | Have you ever remained apprehensive or fearful long after watching a scary movie? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| ITQ18 | Do you ever become so involved in doing something that you lose all track of time? | Ordinal variable on a likert scale where 0=Never, 3=Occasionally, 6=Often |
| PRE\_Joy | To what extent do you feel joyful right now? | Continuous numerical variable (0-100) where 0=Not joyful at all, 100 = As joyful as I can be |
| PRE\_Anger | To what extent do you feel angry right now? | Continuous numerical variable (0-100) where 0=Not angry at all, 100 = As angry as I can be |
| PRE\_Calmness | To what extent do you feel calm right now? | Continuous numerical variable (0-100) where 0=Not calm at all, 100 = As calm as I can be |
| PRE\_Sadness | To what extent do you feel sad right now? | Continuous numerical variable (0-100) where 0=Not sad at all, 100 = As sad as I can be |
| PRE\_Disgust | To what extent do you feel disgusted right now? | Continuous numerical variable (0-100) where 0=Not disgusted at all, 100 = As disgusted as I can be |
| PRE\_Relaxation | To what extent do you feel relaxed right now? | Continuous numerical variable (0-100) where 0=Not relaxed at all, 100 = As relaxed as I can be |
| PRE\_Happiness | To what extent do you feel happy right now? | Continuous numerical variable (0-100) where 0=Not happy at all, 100 = As happy as I can be |
| PRE\_Fear | To what extent do you feel fearful right now? | Continuous numerical variable (0-100) where 0=Not fearful at all, 100 = As fearful as I can be |
| PRE\_Anxiousness | To what extent do you feel anxious right now? | Continuous numerical variable (0-100) where 0=Not anxious at all, 100 = As anxious as I can be |
| PRE\_Arousal | Using the excited vs calm SAM, please rate your emotions based on how you ACTUALLY FEEL RIGHT NOW, AT THIS MOMENT | Ordinal variable on a picture-based likert Scale where 0=calm and 6=excited |
| PRE\_Valence | Using the happy vs unhappy SAM, please rate your emotions based on how you ACTUALLY FEEL RIGHT NOW, AT THIS MOMENT | Ordinal variable on a picture-based likert Scale where 0=sad and 6=happy |

# Post Exposure Ratings

This document contains one sheet that describes the results of the repeated post-exposure questionnaire, where participants filled this questionnaire after engaging in each 360-VE:

|  |  |  |
| --- | --- | --- |
| **Variable** | **Label** | **Scale Type & Values** |
| ID | This is a unique ID assigned to each participant randomly. | Continuous numerical variable |
| Trial\_Num | Trial Number | Order to the 360-VE given per-participant. |
| Quad\_Cat | Quadrant Category | Nominal categorical variable where 0= High Arousal High Valence, 1= Low Arousal High Valence, 2 = Low Arousal Low Valence, 3=High Arousal Low Valence |
| Arousal\_Cat | Arousal Category | Nominal categorical variable where 0= Low Arousal, 1= High Arousal |
| Valence\_Cat | Valence Category | Nominal categorical variable where 0= Low Valence, 1= High Valence |
| Str\_Code | Strong Code | String code that refers to the 360-VE |
| Num\_Code | Numerical Code | Numerical code that refers to the 360-VE |
| POST\_Valence | Your rating of each video should reflect your immediate personal experience and no more. Using the happy vs unhappy SAM, please rate your emotions based on how you ACTUALLY FELT WHILE YOU WATCHED THE VIDEO | Ordinal variable on a picture-based likert Scale where 0=sad and 6=happy |
| POST\_Arousal | Your rating of each video should reflect your immediate personal experience and no more. Using the excited vs calm SAM, please rate your emotions based on how you ACTUALLY FELT WHILE YOU WATCHED THE VIDEO | Ordinal variable on a picture-based likert Scale where 0=calm and 6=excited |
| POST\_Joy | To what extent did you feel joyful while you watched the video? | Continuous numerical variable (0-100) where 0=Not joyful at all, 100 = As joyful as I can be |
| POST\_Anger | To what extent did you feel angry while you watched the video? | Continuous numerical variable (0-100) where 0=Not angry at all, 100 = As angry as I can be |
| POST\_Calmness | To what extent did you feel calm while you watched the video? | Continuous numerical variable (0-100) where 0=Not calm at all, 100 = As calm as I can be |
| POST\_Sadness | To what extent did you feel sad while you watched the video? | Continuous numerical variable (0-100) where 0=Not sad at all, 100 = As sad as I can be |
| POST\_Disgust | To what extent did you feel disgusted while you watched the video? | Continuous numerical variable (0-100) where 0=Not disgusted at all, 100 = As disgusted as I can be |
| POST\_Relaxation | To what extent did you feel relaxed while you watched the video? | Continuous numerical variable (0-100) where 0=Not relaxed at all, 100 = As relaxed as I can be |
| POST\_Happiness | To what extent did you feel happy while you watched the video? | Continuous numerical variable (0-100) where 0=Not happy at all, 100 = As happy as I can be |
| POST \_Fear | To what extent did you feel fearful while you watched the video? | Continuous numerical variable (0-100) where 0=Not fearful at all, 100 = As fearful as I can be |
| POST\_Anxiousness | To what extent did you feel anxious while you watched the video? | Continuous numerical variable (0-100) where 0=Not anxious at all, 100 = As anxious as I can be |
| POST\_Dizzy | To what extent did you feel dizzy while you watched the video? | Continuous numerical variable (0-100) where 0=Not dizzy at all, 100 = As dizzy as I can be |
| POST\_PQ1 | In the video, I had the sense of "being there"… | Ordinal variable on a likert scale where 0=Not at all, 7=Very much |
| POST\_PQ2 | During the video, how often did you think of the room you are in and your surroundings? | Ordinal variable on a likert scale where 0=Not at all, 7=All the time |
| POST\_PQ3 | How flat and missing in depth did the video appear? | Ordinal variable on a likert scale where 0=Not at all, 7=Very much |
| POST\_PQ4 | Do you think of the video as…? | Ordinal variable on a likert scale where 0=Something I saw, 7=Somewhere I visited |
| POST\_PQ5 | How disturbing was the lag or delay between the navigation and the response of the video? | Ordinal variable on a likert scale where 0=Didn’t notice it, 7=Completely putting off |
| POST\_PQ6 | Whilst you watched the video, music played in the background. How much attending did you pay to it? | Ordinal variable on a likert scale where 0=None at all, 7=A great deal |
| POST\_PQ7 | The video became more real or present to me compared to the 'real world' | Ordinal variable on a likert scale where 0=At no time, 7=All the time |
| POST\_PQ8 | How natural did your interactions with the environment seem? | Ordinal variable on a likert scale where 0=Not at all, 7=Very high degree |

# Eye Tracking Data (Pre-Processed)

Each file includes the pre-processed eye tracking data from a single participant and is organised as follows:

* .dat file = {'Labels': labels,'Data': Data}
* Labels (0=High Arousal High Valence, 1=Low Arousal High Valence, 2=Low Arousal Low Valence, 3=High Arousal Low Valence) = [1, 0, 0, 3, 1, 2, 2, 2, 0, 1, 3, 3]
* Data = [12, 7, ?]
* First dimension (12) = Number of videos
* Second dimension (7) = Number of Channels
* Channels = [Time stamp, Left X, Left Y, Left Blink, Right X, Right Y, Right Blink]
* Third dimension (?) = Length of video

Please note that eye tracking sample rate is at 60 Hz.

# Eye Tracking Data (Features Extracted)

Each file contains 312 samples of extracted features with their corresponding label. All datasets that include extracted features line up with each other. The table below describes the variables in the dataset:

|  |  |
| --- | --- |
| **Feature** | **Description** |
| Quad\_Cat | Quadrant Category is a nominal categorical variable where 0= High Arousal High Valence, 1= Low Arousal High Valence, 2 = Low Arousal Low Valence, 3=High Arousal Low Valence |
| Mean\_Saccade\_Amplitude | Mean Saccade Amplitude |
| SD\_Saccade\_Amplitude | Standard Deviation of Saccade Amplitude |
| Skew\_Saccade\_Amplitude | Maximum of Saccade Amplitude |
| Max\_Saccade\_Amplitude | Minimum of Saccade Amplitude |
| Mean\_Saccade\_Direction | Mean Saccade Direction |
| SD\_Saccade\_Direction | Standard Deviation of Saccade Direction |
| Skew\_Saccade\_Direction | Maximum of Saccade Direction |
| Max\_Saccade\_Direction | Minimum of Saccade Direction |
| Mean\_Saccade\_Length | Mean Saccade Length |
| SD\_Saccade\_Length | Standard Deviation of Saccade Length |
| Skew\_Saccade\_Length | Maximum of Saccade Length |
| Max\_Saccade\_Length | Minimum of Saccade Length |
| Num\_of\_Blink | Number if Blinks |
| Mean\_Blink\_Duration | Mean Blink Duration |
| SD\_Blink\_Duration | Standard Deviation of Blink Duration |
| Skew\_Blink\_Duration | Maximum of Blink Duration |
| Max\_Blink\_Duration | Minimum of Blink Duration |
| Num\_of\_Microsac | Number of Micro Saccades |
| Mean\_Microsac\_Peak\_Vel | Mean Micro-Saccade Peak Velocity |
| SD\_Microsac\_Peak\_Vel | Standard Deviation of Micro-Saccade Peak Velocity |
| Skew\_Microsac\_Peak\_Vel | Maximum of Micro-Saccade Peak Velocity |
| Max\_Microsac\_Peak\_Vel | Minimum of Micro-Saccade Peak Velocity |
| Mean\_Microsac\_Ampl | Mean Micro-Saccade Amplitude |
| SD\_Microsac\_Ampl | Standard Deviation of Micro-Saccade Amplitude |
| Skew\_Microsac\_Ampl | Maximum of Micro-Saccade Amplitude |
| Max\_Microsac\_Ampl | Minimum of Micro-Saccade Amplitude |
| Mean\_Microsac\_Dir | Mean Micro-Saccade Direction |
| SD\_Microsac\_Dir | Standard Deviation of Micro-Saccade Direction |
| Skew\_Microsac\_Dir | Maximum of Micro-Saccade Direction |
| Max\_Microsac\_Dir | Minimum of Micro-Saccade Direction |
| Mean\_Microsac\_H\_Amp | Mean Micro-Saccade Horizontal Amplitude |
| SD\_Microsac\_H\_Amp | Standard Deviation of Micro-Saccade Horizontal Amplitude |
| Skew\_Microsac\_H\_Amp | Maximum of Micro-Saccade Horizontal Amplitude |
| Max\_Microsac\_H\_Amp | Minimum of Micro-Saccade Horizontal Amplitude |
| Mean\_Microsac\_V\_Amp | Mean Micro-Saccade Vertical Amplitude |
| SD\_Microsac\_V\_Amp | Standard Deviation of Micro-Saccade Vertical Amplitude |
| Skew\_Microsac\_V\_Amp | Maximum of Micro-Saccade Vertical Amplitude |
| Max\_Microsac\_V\_Amp | Minimum of Micro-Saccade Vertical Amplitude |

# ECG & GSR Data (Pre-Processed)

Each file includes the pre-processed ECG and GSR data from a single participant and is organised as follows:

* .dat file = {'Labels': labels,'Data': Data}
* Labels (0=High Arousal High Valence, 1=Low Arousal High Valence, 2=Low Arousal Low Valence, 3=High Arousal Low Valence, 4=Baseline) = [4,1, 0, 0, 3, 1, 2, 2, 2, 0, 1, 3, 3]
* Data = [13, 2, ?]
* First dimension (12) = Number of videos
* Second dimension (2) = Number of Channels
* Channels = [GSR, ECG]
* Third dimension (?) = Length of Data

Please note that GSR sample rate is at 2000 Hz and ECG sample rate is at 1000 Hz.

# ECG & GSR Data (Features Extracted)

Each file contains 312 samples of extracted features with their corresponding label. All datasets that include extracted features line up with each other. The table below describes the variables in the dataset:

|  |  |
| --- | --- |
| **Feature** | **Description** |
| **ECG** | |
| Quad\_Cat | Quadrant Category is a nominal categorical variable where 0= High Arousal High Valence, 1= Low Arousal High Valence, 2 = Low Arousal Low Valence, 3=High Arousal Low Valence |
| Mean | Mean Signal Amplitude |
| Min | Minimum Signal Amplitude |
| Max | Maximum Signal Amplitude |
| MeanRR | Mean of R-R Intervals |
| MedianRR | Median of R-R Intervals |
| MinRR | Minimum R-R Intervals |
| MaxRR | Maximum R-R Intervals |
| LF | Absolute power of the low-frequency band (0.04–0.15 Hz) |
| HF | Absolute power of the high-frequency band (0.15–0.4 Hz) |
| VLF | Absolute power of the very-low-frequency band (0.0033–0.04 Hz) |
| Ibi | Inter-beat interval |
| bpm | Beats per minute |
| Sdnn | Standard Deviation R-R Intervals |
| Sdsd | Standard deviation of successive RR interval differences |
| Rmssd | Root mean square of successive RR interval differences |
| pnn50 | Percentage of successive RR intervals that differ by more than 50ms |
| pnn20 | Percentage of successive RR intervals that differ by more than 20ms |
| pnn50pnn20 | Ratio of pnn50 and pnn20 |
| **GSR** | |
| Quad\_Cat | Quadrant Category is a nominal categorical variable where 0= High Arousal High Valence, 1= Low Arousal High Valence, 2 = Low Arousal Low Valence, 3=High Arousal Low Valence |
| Mean | Mean of Skin Conductance level |
| SD | Standard Deviation of Skin Conductance level |
| Variance | Variance of Skin Conductance level |
| Minimum | Minimum value of Skin Conductance level |
| Maximum | Maximum value of Skin Conductance level |
| Number of Peaks | Number of local maxima per second |
| Number of Valleys | Number of local minima per second |
| Ratio | Ratio of peaks and time |

# Contact

If you have any questions about the dataset that are not covered in the dataset summary description or the published paper, please feel free to email Dr Luma Tabbaa (L.A.Tabbaa(@)Kent(dot)ac(dot)uk) with your query.

# References

[1] J. A. Russell, M. Lewicka, and T. Niit, “A Cross-Cultural Study of a Circumplex Model of Affect,” *J. Pers. Soc. Psychol.*, vol. 57, no. 5, pp. 848–856, 1989, doi: 10.1037/0022-3514.57.5.848.

[2] M. M. Bradley and P. J. Lang, “Measuring Emotion: The Self-Assessment Manikin and the Semantic Differential,” *J. Behav. Ther. Exp. Psychiatry*, vol. 25, no. 1, pp. 49–59, Mar. 1994, doi: 10.1016/0005-7916(94)90063-9.

[3] G. A. Hawker, S. Mian, T. Kendzerska, and M. French, “Measures of Adult Pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF,” *Arthritis Care Res. (Hoboken).*, vol. 63, no. S11, pp. S240–S252, Nov. 2011, doi: 10.1002/acr.20543.

[4] S. Nichols, C. Haldane, and J. R. Wilson, “Measurement of Presence and its Consequences in Virtual Environments,” *Int. J. Hum. Comput. Stud.*, vol. 52, no. 3, pp. 471–491, 2000, doi: 10.1006/ijhc.1999.0343.

[5] B. G. Witmer and M. J. Singer, “Measuring Presence in Virtual Environments: A Presence Questionnaire,” *Presence*, vol. 7, no. 3, pp. 225–240, 1998, doi: 10.1162/105474698565686.