CoVidAffect: Real-time Monitoring of Mood Variations Following the COVID-19 Outbreak

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Abstract

The COVID-19 outbreak and the ensuing confinement measures are expected to bear a significant psychological impact on the affected populations. Here, we publish a dataset from CoVidAffect, a citizen science project that was launched to provide direct, geolocalized data of changes in subjective feeling and physical arousal following the COVID-19 crisis. These publicly available data are continuously updated and visual summaries are displayed on the project website. The data can be further analyzed to identify affected geographical regions, quantify emotional responses to specific measures and policies, and to understand the effect of context variables, such as living space, socioeconomic status, and practice of physical exercise, on emotional regulation and psychological resilience. Our goal is to offer a resource that will help to anticipate the needs for psychosocial support and facilitate evidence-based policy making.

Background & Summary

On 11 March 2020, the World Health Organisation (WHO) characterised the new coronavirus disease called COVID-19 as a pandemic[1]. In an attempt to restrict the spread of the disease, governments around the world adopted unprecedented confinement measures that had an immediate effect on many people's usual activities, routines or livelihoods. The potential psychological impact of the COVID-19 sanitary crisis and the confinement measures was promptly recognised by the WHO and governments around the world. In public mental health terms, levels of anxiety, stress and depression are expected to rise[2]. Accurate information on the population's emotional response to ongoing events is important to best anticipate the needs for psychosocial support and for evidence-based policy making.

In order to provide direct, openly available, geolocalized data, we initiated a citizen science project that collects and curates a real-time database of individual changes in subjective feeling (valence) and physical arousal. These two fundamental dimensions of emotion are regularly registered online via the project's website or through a smartphone app developed specifically for this purpose. This project aims to offer longitudinal data to track mood dynamics during the COVID-19 crisis and its different stages, instead of a static report provided by one-shot questionnaires.

The data provided can be used to investigate aspects of the psychological impact of the COVID-19 crisis on the affected populations. Interested researchers, organisations and authorities may explore various ways to exploit these data to identify affected geographical regions, quantify the population's emotional response to specific measures and policies, and to understand the effect of certain context variables, such as living space, socioeconomic status, and practice of physical exercise, on emotional regulation and psychological resilience.

The project currently monitors mood variations mostly in Spain, which, to date, is among the top affected countries with one of the most restrictive lockdowns worldwide. However, a plan for launching international versions is being developed.

All data are continuously updated and can be downloaded from the Zenodo repository (http://doi.org/10.5281/zenodo.3774527) and our GitHub page (https://github.com/perakakis/CoVidAffect). We also invite interested researchers and groups to join the project's OSF page (https://osf.io/5cqzk) to contribute their analyses and insights.

Methods

Participants

Since its official release on March 28th 2020, the project has been broadcasted in social media and the Spanish press. Volunteer participants join by accessing our website (https://covidaffect.info), which explains the scope of the project, offers information about privacy policy, and displays a regularly updated summary of the data. No exclusion criteria are applied. Participants are required to fill an initial questionnaire on demographic and COVID19-related data, and to sign an informed consent with detailed information about their privacy and participation rights. Upon completion of the questionnaire and signature of the informed consent, they receive a unique identification number, which is used as the only means of identification in the subsequent mood assessments. Following the registration process, participants complete their first mood rating and are encouraged to return and update their mood state frequently. They are also offered the option to download an Android app that helps to automatize notifications and data entry. The project was approved by the Human Research Ethics Committee of the University of Granada.

Data collection

Participants can access the project website and use their identification number to rate their subjective feeling and physical arousal as often as they consider necessary and up to 6 times per day. In addition, Android smartphone users can download the CoVidAffect smartphone app, available on the website. The app has been deployed using a smartphone-based platform aimed to leverage the use of Experience Sampling Methods (ESM) for providing a continuous monitoring of affective states during daily life[6]. The app triggers the assessment questions at a pseudo-random time during the following six evenly distributed 1-hr intervals: 07:00–08:00, 10:00–11:00, 13:00–14:00, 16:00–17:00, 19:00–20:00, and 22:00–23:00. Participants receive a notification indicating that a new questionnaire is available. When they tap the notification, the app triggers the questionnaire and submits the mood ratings, trigger and answer timestamps, completion time, and participant number to the data storage

server. The notifications persist during a time period of 1 hour, after which they are dismissed, in order to avoid the overlapping of questions. In addition, once a week, app users receive a battery of supplementary questions related to current health and lifestyle status, with the aim of gathering information about contextual changes during that week.

Demographic and COVID19-related data

The initial participation questionnaire includes the following data: a) gender, b) age, c) postal code, d) number of house residents, e) age of the other residents, f) relationship with the other residents, g) type of residence, h) access to open spaces, i) employment status before the crisis, j) current employment status, k) net monthly income, l) presence of COVID-19 symptoms, m) presence of COVID-19 symptoms in other residents, n) hours of physical exercise practice before the crisis, o) valence assessment before the crisis onset.

The questions launched weekly by the smartphone app gather data on the following: a) diagnosis of COVID-19, b) diagnosis of COVID-19 in other residents, c) diagnosis of COVID-19 among relatives and close friends, d) current health status, e) changes in employment status, f) hours of physical exercise practice during the last week, g) frequency of social contacts, h) sleeping patterns.

The contextual information acquired by the initial questionnaire and the supplementary weekly questions is pertinent to the lockdown stage of the COVID-19 crisis. As we move to the gradual de-escalation of the confinement measures, this information will be adapted accordingly. The exact questions and response options are available at the Zenodo repository (http://doi.org/10.5281/zenodo.3774527).

Valence and Arousal data

Subjective feeling (valence) and physical arousal are assessed using two visual analogue scales. Valence is evaluated with a modified version of the Feeling Scale[3] ranging from -50 to +50, including anchors located at -50="Muy mal" (very bad) and +50="Muy bien" (very good). Arousal is evaluated with a modified version of the Felt Arousal Scale[4], ranging from 0 to +100 with anchors provided at 0="nada activado" (not active), and +100 ="muy activado" (very active). The question displayed for valence is: "¿Cómo te sientes ahora mismo?" (How do you feel right now?) and for arousal "¿Cómo de activado sientes tu cuerpo ahora mismo?" (How physically active do you feel right now?).

Data Records

All data are being regularly updated at the GitHub repository (https://github.com/perakakis/CoVidAffect), which is also mirrored at our OSF account (https://osf.io/5cqzk), and published at the ZENODO repository (http://doi.org/10.5281/zenodo.3774527), in line with FAIR principles and recent RDA guidelines for COVID19-related datasets[5]. The data are stored in three distinct files in CSV format.

participants.csv

The file **participants.csv** stores data from the initial participation questionnaire and includes the following variables:

id – Unique identifier for each participant. This variable is used to merge the three databases.

registered_date – Date of registration in the database in the form: DD/MM/YYYY HR:MM:SS.

sex – Gender of each participant. Possible values are: feminine, masculine and other.

age – Age of each participant ranging from 16 to 100+ years with all intermediate values possible.

country – The participant's country of residence.

postcode – The participant's postal code that is used for geolocation.

family – Numeric value that codes the number of people in the residence. Possible values are: 1 ("I live alone"), 2, 3, 4, 5, and 6+.

family_ages – Age of each one of the residents included in the variable **family**.

family_relation – The relationship between the participant and each one of the residents included in the variable **family**. Possible comma separated values are: parent, partner, child, sibling, grandparent, grandchild, other, any (=no family relation).

type_living – Housing type. Possible values are: study, apartment, house, residence, chalet, other.

living_rooms – When type_living is set to apartment, house, or chalet, this numeric variable codes the number of rooms (1, 2, or 3+).

open_spaces – Access to open spaces. Possible comma separated values are: balcony, garden, yard, other, no.

work_previous – Employment status before the crisis. Possible values are: employee, self (self-employed), unemployed, student, retired, other.

work_actual – Current employment status before the crisis. Possible values are: same, new, telework, erte (temporary employment suspension), fired, increased, reduced, other.

income – Net monthly income. Coded in 10 possible ranges (in Euros): 0-500, 500-1000, 1000-1500, 1500-2000, 2000-2500, 2500-3000, 3000-5000, 5000-7000, 7000-9000, 9000+.

negative_economy – Binary flag to code the participant's perception on whether the crisis has negatively affected their economic situation (0='no', 1='yes').

covid – Codes presence of COVID-19 symptoms. Possible values are: no, not_reported (symptomatic but not officially diagnosed), reported (officially diagnosed with COVID-19).

covid_family – Codes presence of COVID-19 symptoms in other residents. Possible values are: no, not_reported (symptomatic but not officially diagnosed), reported (officially diagnosed with COVID-19).

activity – Codes the number of hours dedicated to physical exercise before the crisis. Possible values are: 0-2, 2-4, 4-6, 6-8, 8+.

valence – Valence rating before the crisis in a scale from -50 (negative) to +50 (positive).

mood.csv

The file **mood.csv** stores data from each valence/arousal rating, recorded either on the web or via the smartphone app. It includes the following variables:

participant – Unique identifier for each participant. This variable coincides with the variable **id** in *participants.csv* and can be used to merge the two datasets.

timestamp – A timestamp (DD/MM/YYYY HR:MM:SS) identifying the exact date and time the notification was launched by the smartphone app.

answer_timestamp – A timestamp (DD/MM/YYYY HR:MM:SS) identifying the exact date and time the recording was registered by the participant. In case the recording was delivered online (not through the app), this variable coincides with the variable **timestamp**.

valence – Current valence rating in a scale from -50 (negative) to +50 (positive).

arousal – Current arousal rating in a scale from 0 (calm) to 100 (excited).

context.csv

The file **context.csv** stores data from the supplementary questions recorded once per week by the subsample of the participants using the smartphone app. It includes the following variables:

date – The date the questions were launched (always on Friday at 20:00, Madrid Time zone) in the form DD/MM/YY.

participant – The participant's unique identifier.

covid_diagnosed – Binary flag ('Yes' or 'No') to code whether the participant was diagnosed with COVID-19 during the past week.

covid_house_diagnosed – Binary flag ('Yes' or 'No') to code whether another resident was diagnosed with COVID-19 during the past week.

covid_family_diagnosed – Binary flag ('Yes' or 'No') to code whether another family member, or beloved person (not among the house residents) was diagnosed with COVID-19 during the past week.

perceived_health – The participant's perception on their general health status rated in a scale from 0 to 5.

work_changed – Codes changes in the participant's employment status. Possible values are: no, telework, reduce, increase, erte (temporary employment suspension), fired, new, other.

activity – Hours dedicated to physical activity during the past week: 0-2, 2-4, 4-6, 6-8, 8+.

social_contact – Codes social contact frequency in the past week compared with social contact before the crisis. Possible values are: same, less, more.

sleep – Codes sleep quantity in the past week compared to normal. Possible values are: lot_less, less, same, more, lot_more.

Technical Validation

To ensure data reliability, participants that submit mood data through the website are required to introduce their identification number and postal code, which are checked against the existing registers in the database. This step is not required when introducing data through the smartphone app.

The database is periodically checked to identify possible duplicate records. We consider answers by the same participant with the same notification launch timestamp as duplicates and keep only the first register.

Usage Notes

To demonstrate potential uses of the data, on the project's website we display territory maps showing the change of subjective feeling following the COVID-19 outbreak (Fig. 1). This is calculated by first estimating the average difference for each participant (average valence – pre-COVID19 valence recorded in the initial questionnaire) and then averaging across participants. The data on the maps can currently be calculated and displayed for any specific date and age range. More analysis and visualization options will be offered as they become relevant.

To stress the dynamical and longitudinal characteristics of the data, we also present linear graphs showing the dynamical pattern of subjective feeling (Fig. 2). Users can use the filter options to display the average pattern for any Spanish province and contrast it with their own data displayed when introducing their participant number in the corresponding box. Finally, although the main map uses Spanish provinces as a geographical unit, a finer spatial resolution is possible using the postal code provided by the participants. To demonstrate this possibility we also display a more detailed map of the Granada province with postal code areas used as geographical units (Fig. 3).

All maps and figures displayed at the project's website were created using the Tableau Public software (https://public.tableau.com). Geolocalisation was accomplished using the participants' postal codes and Tableau's built-in databases.
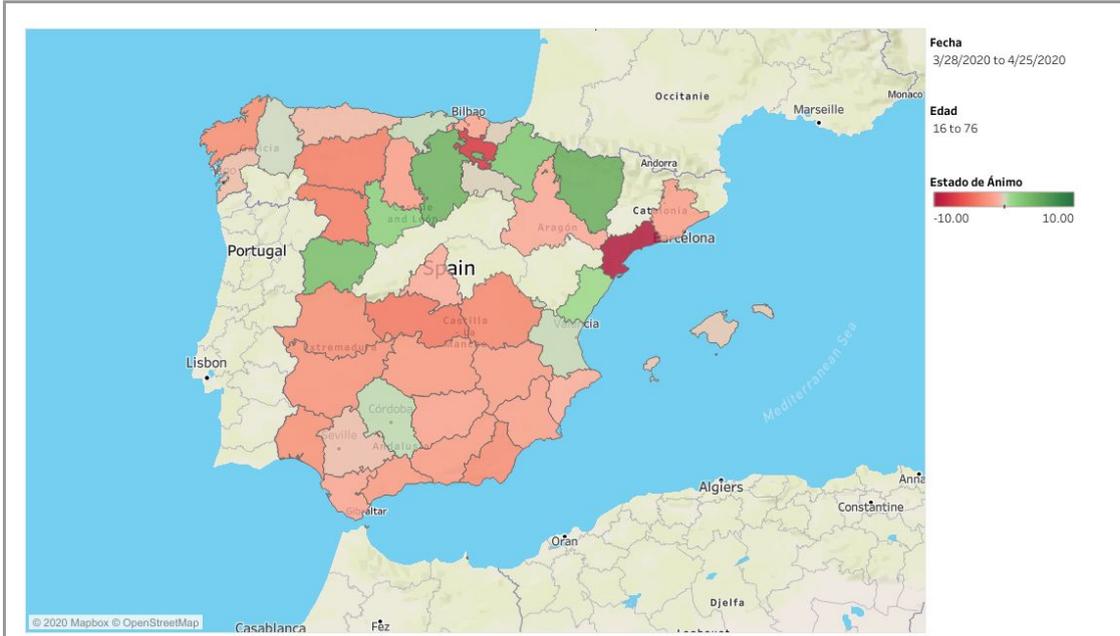
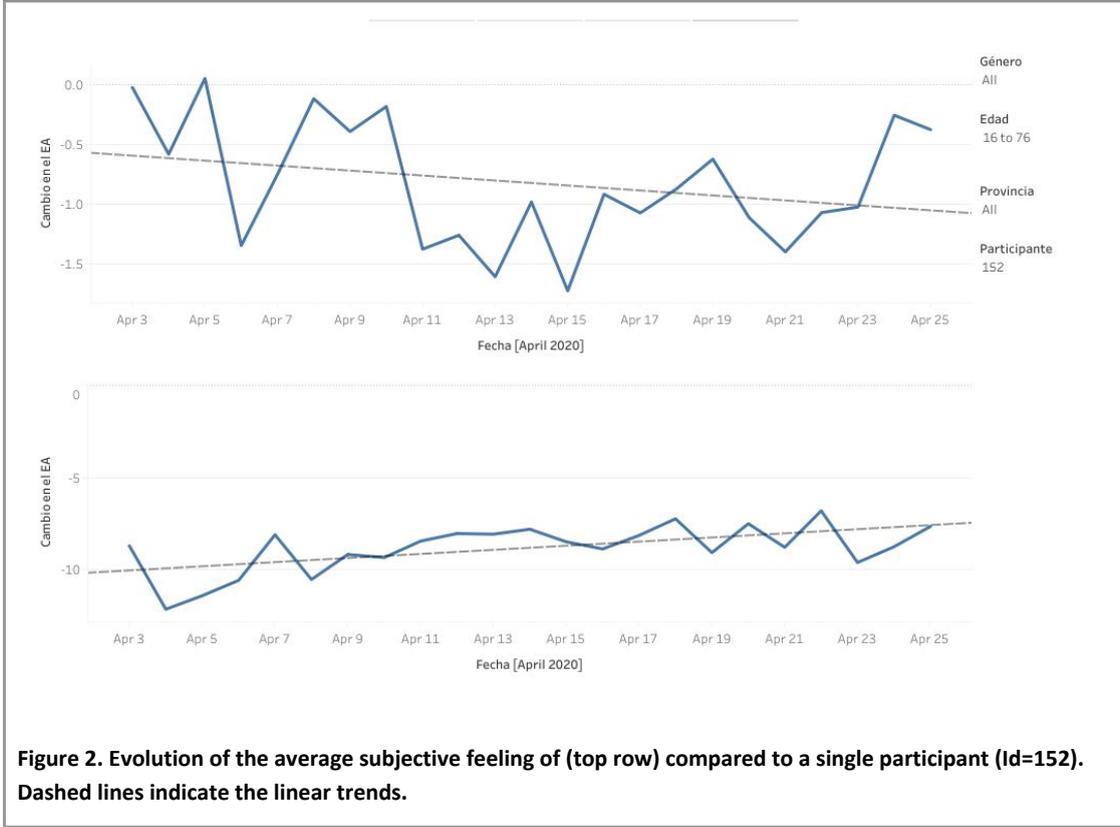**Figure 1. Changes in subjective feeling following the COVID-19 outbreak.**
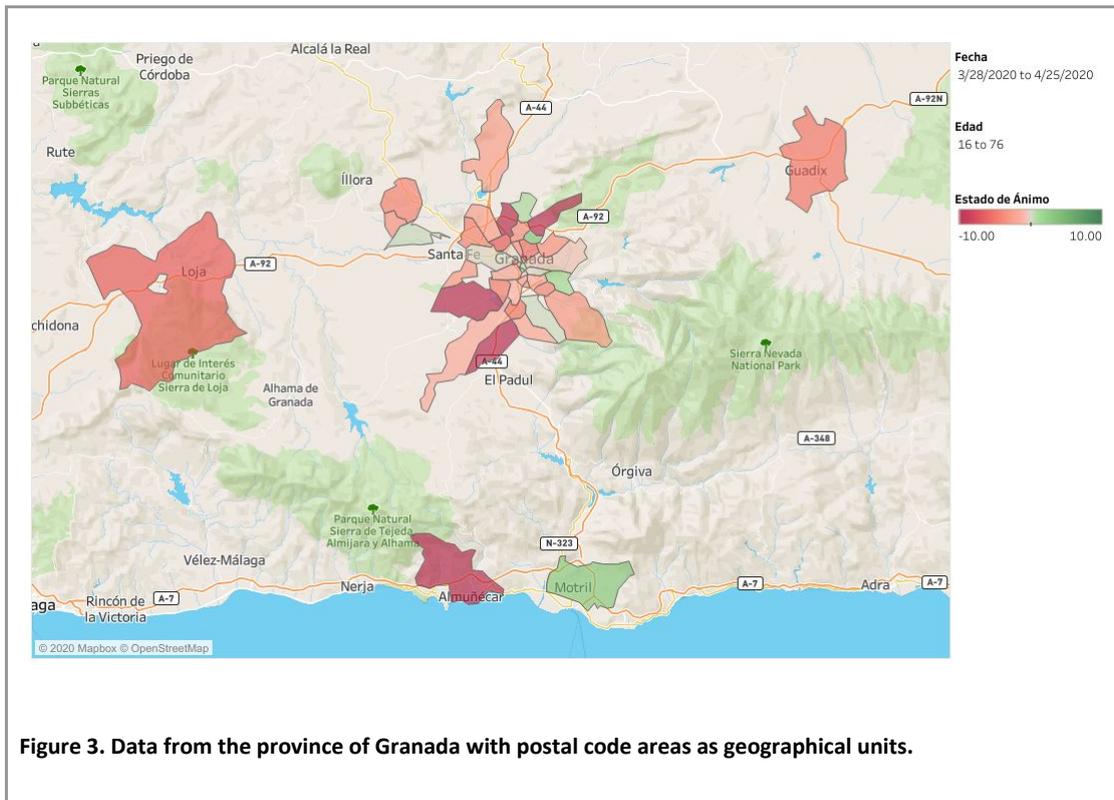

Figure 2. Evolution of the average subjective feeling of (top row) compared to a single participant (Id=152). Dashed lines indicate the linear trends.

Figure 3. Data from the province of Granada with postal code areas as geographical units.

Author contributions

Data curation and technical validation: CB.

All authors contributed in designing the study, writing and editing the manuscript.

Competing interests

None declared

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