Universidade de Aveiro
(2019/2020)

INÊS FILIPA MOREIRA FONTES

CRIAÇÃO DE UMA BASE DE DADOS DE EXPRESSÃO EMOCIONAL DINÂMICA

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Dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Psicologia da Saúde e Reabilitação Neuropsicológica, realizada sob a orientação científica da Doutora Sandra Cristina de Oliveira Soares, Professora Auxiliar do Departamento de Educação e Psicologia da Universidade de Aveiro, e coorientação do Doutor Samuel de Sousa Silva, Investigador do Instituto de Engenharia Eletrónica e Informática de Aveiro (IEETA) da Universidade de Aveiro.

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Palavras-chave

Emoções; Funções das Emoções; Expressão Facial Emocional; Dinâmica das Emoções; Bases de Dados de Emoções; Sistema de Codificação de Ação Facial; Emoções Básicas.

Resumo

A presente dissertação consistia originalmente num estudo experimental, com o intuito de construir uma base de dados dinâmica de emoções com utilidade para a área da investigação. Devido às restrições causadas pelo COVID-19, o propósito deste estudo foi adaptado, tornando-se numa proposta que apresenta uma metodologia e procedimentos; para além disso, este trabalho explora a literatura sobre as emoções, expressões emocionais faciais, bases de dados existentes, e outros temas relacionados, que dão suporte ao projeto proposto. Por que é a construção de uma base de dados de emoções dinâmica interessante? A construção de uma base de dados de emoções dinâmica interessa a investigadores das emoções do campo da psicologia, sendo o reconhecimento de emoções através de expressões faciais igualmente de grande interesse para a área da computação (por exemplo, na inteligência artificial) no âmbito do reconhecimento de padrões (Mao et al., 2015).

Esperávamos recolher vídeos emocionais representativos da realidade com quadros de qualidade, das emoções de medo, alegria e neutra, e recolher informação e dados psicofisiológicos, sociodemográficos e classificações para validar os vídeos de conteúdo emocional; por fim, pretendíamos analisar os dados de forma a retirar conclusões baseadas nos resultados dos dados recolhidos. Apresentamos, na presente dissertação, o racional teórico e protocolo experimental que servirá de base à implementação do projeto.

Keywords

Emotions; Functions of Emotions; Emotional Facial Expression; Emotion Dynamics; Emotion databases; Facial Action Coding System; Basic Emotions.

Abstract

Originally, this work intended to be an experimental study with the purpose of building a dynamic emotion database for investigation use purposes. Due to Covid-19 restrictions, the purpose of this study has been adapted into an investigation proposal, with suggested methods and procedures; furthermore, this work encompasses a literature review about emotions, facial emotional expression, existing databases and other related themes, which support the base of the proposed project. Why is creating this database of interest? The building of a dynamic emotion database interests the field of psychology emotion investigators, and the recognition of emotions through facial expression has been of great interest in technology (e.g., artificial intelligence) in the scope of pattern recognition (Mao et al., 2015). We expected to collect emotional realistic videos with good quality frames from the videos, of fear, happiness and neutral, psychophysiological information and data, sociodemographic data and the ratings to validate the videos emotional content, and to analyze and draw conclusions based on the data evidence. In the present work, we present the rationale and experimental protocol to serve the basis to the implementation of the project proposed herein.

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Literature Review

Studied and of great interest for the field of psychology, emotions, and their recognition through facial expression has been of great interest in technology (e.g., artificial intelligence) in the scope of pattern recognition (Mao et al., 2015). A great part of the existing studies resorted to static facial expressions in 2D and 3D models (Mao et al., 2015).

The expression of emotions are subserved by different means, such as subjective physiological and behavioural (Reeve, 2005). When an event is perceived by a subject, that event is interpreted (cognitions) in a conscious or unconscious manner (Miguel, 2015), and biological processes (e.g., heart rate variability[HRV]) are activated. Both biological and cognitive processes activate feelings, arousal, goal-directed purpose and expression (Reeve, 2005).

The Function And Expression Of Emotions

The human species has the need to constantly evaluate each other, and one way to do it, is through the assessment of the human emotional state with whom they interact. By doing so, humans are able to adjust their own behaviour and, henceforth, adapt social interaction. (Vaidya, Jin, & Fellows, 2014). To perform such evaluation, humans resort to information based on different inputs, ranging from the tone of voice, to the body language and facial expression (Vaidya, Jin, & Fellows, 2014; Miguel, 2015).

The expression of emotions serves different purposes, with the most relevant to the present work being its pivotal role in communication (Reeve, 2005). In fact, emotions are a way of communication, both with ourselves and with others, the later representing the social dimension. In a simplistic way, emotions can be considered changes of action readiness to establish goals and priorities, with the acceptance in groups and affiliation being a relevant basis to functionally navigate in the social world (Oatley et al., 1992). Emotional signals reveal intentions and changes of intention, hence affecting the reaction of ourselves and the ones around us (Oatley et al., 1992). Moreover, emotions set priorities of goals, prepare us for readiness, in direction of that goal. For example, if a person is experiencing fear towards something, she/he will interrupt the current action and get ready to fight or flight, thus keeping the person focused on the environment for clues of what is making her/him afraid and react accordingly to promote survival (Oatley et al., 1992). Importantly, to use

information from previous encounters, emotional memory plays a relevant role to serve functional adaptations to the environment, namely the social environment. Emotions can be subject-elicited (Ekman et al., 1992) or event- elicited (Reeve, 2005).

Although highly functional, emotion dynamics are vulnerable to dysfunction. For instance, it may turn into excessive or deficit emotional reactivity, with this dysfunctional processing being one of the features of psychiatry disorders (depression and bipolar disorder, respectively) (Kuppens & Verduyn, 2017a). It is thus crucial to deepen our understanding of emotions and emotion dynamics as a way to inform us on new tools, diagnoses and treatments.

Basic Emotions

Despite the long tradition in studying emotions (Tracy & Randles, 2011), there is yet no consensus on the types of existing emotions (Ekman et al., 1992). However, one view has been supported by several authors, which is based on the Darwinian evolutionary approach (Darwin, 1872). According to the basic emotion's perspective, emotions have evolved to serve adaptive functions, capable of facilitating favorable interactions between the organism and its environment, with the ultimate goal of survival (Ekman et al., 1992). As such, humans are equipped with basic or universal emotions that are characterized by 1) having emerged early in ontogeny; 2) being present in non-human primates; 3) being expressed identically between cultures (e.g., by means of facial expressions); 4) eliciting automatic responses; and by 5) involving distinctive cognitive processes (e.g., hypervigilance patterns, in the case of fear) (Ekman et al., 1992).

The following emotions have been pointed as basic emotions: joy, fear, sadness, disgust and surprise anger(Ekman et al., 1992).

Fear

Fear is one prototypical basic emotion, given that it is highly shaped by evolution (Öhman et all., 2001). In a situation where a person predicts or is faced with a situation that is considered dangerous or threating (i.e., physical or psychological harm, or the thought of not being able to cope with a situation in the future), the experience of fear will emerge. Fear activates defense mechanisms and functions as a warning to upcoming events that can be harmful, by activating the autonomous nervous system on a flight or fight response with the intent of protecting the person's wellbeing (Reeve, 2005).

Anger and disgust are activated when a person tries to react (fight or reject) to what makes them afraid (a threat or possible harm). If the threatening or harmful event has already occurred, the person experiences sadness; if the event is occurring, fear can activate the avoidance defense mechanism to escape the threat (Reeve, 2005). For example, if I'm on the edge of a building, and I'm afraid to fall, my defense mechanism is to step away from de edge, protecting myself from falling that way.

So, the function of fear is to cope with survival threatening events enabling the perception and collection of information of the threatening event, creating a flight response towards the threat when it's imminent (e.g., a gun pointing at you) and act in a defensive way (e.g., the startle reflex), and just scan and analyze, when the threat is distant (Öhman & Wiens, 2012). It's claimed that fear responses have to be closely genetically regulated to create stable social signals, between inner species members (eg., in aggressive or sexual encounters). It is believed that the domains of fear are social fears, animal fears, and nature fears distant (Öhman & Wiens, 2012).

Anger

The essence of anger is the belief that the event/situation is not what it should be. Trust betrayal, lack of consideration from others, unfair criticism, or being rejected are examples which are likely to trigger the emotion of anger. Also, when one faces a situation where her/his plans or well-being are put at risk, e.g., because of an obstacle, he/she will likely experience anger. Experiencing anger, makes the person feel stronger and more energized, with an enhanced sense of control and justice that aims to overcome or amend the illegitimate/unfair situation. It has the important function of alerting people to take you seriously, and gives others understanding of what the anger-causing situation is. Anger is positive when it leads to strength, and aids our efforts to cope effectively as we change different unfair/negative situations around us to what they should be (Reeve, 2005).

Disgust

Disgust is a further basic emotion, which is experienced when you are faced with something contaminated, deteriorated or spoiled. E.g., disgust will prompt an individual to reject spoiled food by its smell, avoid eating food that has fallen into the dirt, or sleep in a hotel bed with non-changed linens. It also plays a positive motivational role, given that it makes people avoid putting themselves into situations that can be harmful to them, i.e., making them wash their hands more often, taking showers, wash their dirty clothes and sanitize their surrounding (Reeve, 2005).

Sadness

Sadness is considered the most negative and aversive emotion, as it appears from situations that make people experience separation and failure. Sadness is considered aversive because it makes people initiate avoidance behaviours, that are necessary to ease distress. It gives purpose to restore the environment to the way it was before the distress-causing situation (Reeve, 2005). This particular emotion enables the cohesiveness of social groups, given that separation from significant others is so uncomfortable emotionally. Its anticipations makes people stay cohesive with their love ones (Reeve, 2005). For instance, the suffering from missing someone, motivates people to see each other more regularly. What would happen without the motivation of feeling sad for missing someone, is that people would be less present and would not be engaged in their loved one's lives. So, because it makes people feel bad, sadness motivates people to act (e.g., arrange gatherings), in a way that prevents them from feeling terrible. Sadness is then an action motivator (Reeve, 2005).

Joy

Joy is an emotion that seems to emerge when the outcome of an event is desirable – e.g.,a personal achievement, progress towards a goal, gaining respect or receiving love (Reeve, 2005). When a person is experiencing joy, he/she feels enthusiastic, outgoing and turns more optimistic. One of the functions of joy is to facilitate our willingness to engage in social activities, given that few experiences are as rewarding as the smile and social inclusion (Reeve, 2005). It is then fair to say that joy works as a glue in the creation of social bonds and relationships, such as lovers, coworkers, teammates, and mother and child. It is accountable for the preservation of our well-being, and it has a soothing effect on the aversive emotions (Reeve, 2005).

Surprise

The emotion of surprise is considered meagerly a negative emotion, given people rather predictability, consistency and structure in their lives, they usually tend to not like surprises (Noordewier & Breugelmans, 2013). Different from other emotions that have a defined valence as positive or negative, surprise is described as an "emotional chameleon" given its valence depends on the surprising event. For example, if the surprising event is a gift, the valence of surprise is positive. If the surprising event is a traffic ticket, than the valence of surprise is negative (Noordewier & Breugelmans, 2013). Charles Darwin (1887) said ''Attention, if sudden and close, graduates into surprise…"(Darwin, 1887).

Surprise occurs when an unpredictable event appears, and the mechanisms of attention amplify suddenly, then person experiences the emotion of surprise. The amplification of the mechanisms of attention, means more information of the surrounding environment is captured for analysis, to provide some insight about what is happening on the surprising event. Based on the evaluation of that information, a positive or negative valence to the emotion of surprise is attributed. In a way, the emotion of surprise amplifies our attention, so we understand whether the event is a danger in any way or not.

Emotional Facial Expressions

Faces represent the most powerful way to express and transmit emotions and intentions. Emotions expressed in faces are, therefore, a powerful tool of social communication. Given the central role of emotions in a variety of psychological phenomena (from adaptive to dysfunctional behaviour), emotional facial expressions are commonly used to study emotion perception and categorization empirically (Vaidya, Jin, & Fellows, 2014). Emotions expressed via facial expressions are transmitted through dynamic changes in facial features, such as the opening of the eyes and the curvature of the lip, and distinct patterns are created by these features in each emotional expression (Vaidya, Jin, & Fellows, 2014). It is also known that the face is one of the richest sources of emotional expression, given that important muscles are involved in emotional expression, e.g., the muscles of the oral region, eyebrow muscles, forehead, eyelid and neck (Vaidya, Jin, & Fellows, 2014; Miguel, 2015).

Facial expressions are considered manifestations of positive and negative emotions that are instinctively organized in relation to the person goals (Oatley et al., 1992). Below, a Table (Table 1) retrieved from Gunes & Piccardi (2005), depicts the changes in the face and the corresponding basic emotions.

Table 1-List of the facial emotions recognized by our system and the changes that occur on the face when they are displayed (Gunes & Piccardi, 2005)

Emotion • **Changes that occur on the face**	
Surprise • brows raised • skin below brow stretched, not wrinkled • horizontal wrinkles across forehead • eyelids opened • jaw drops open or stretching of the mouth	Fear • brows raised and drawn together • forehead wrinkles drawn to the center • upper eyelid is raised and lower eyelid is drawn up • mouth is open • lips are slightly tense or stretched and drawn back
Anger • brows lowered and drawn together • lines appear between brows • lower lid is tensed and may or may not be raised • upper lid is tense and may or may not be lowered due to brows' action • lips are either pressed firmly together with corners straight or down or open	Happiness • corners of lips are drawn back and up • mouth may or may not be parted with teeth exposed or not • cheeks are raised • lower eyelid shows wrinkles below it, and may be raised but not tense • wrinkles around the outer corners of the eyes
Disgust • upper lip is raised • lower lip is raised and pushed up to upper lip or it is lowered • nose is wrinkled • cheeks are raised • brows are lowered	Sadness • inner corners of eyebrows are drawn up • upper lid inner corner is raised • corners of the lips are drawn downwards Uncertainty • Other movements than the ones mentioned above

In order to catalogue the facial muscle activity corresponding to emotional facial expressions, Ekman and colleagues (Ekman & Friesen, 1978) proposed the Facial Action Coding System (FACS). Specific movements in facial muscles are referred to as "action units" (AUs) and the different combinations of AUs are supposed to represent the prototypical emotional facial expression. There are 30 AUs (12 for the upper face; 18 for the lower face) related to the activation of specific facial muscles. Below, two images retrieved from Tian and collaborators (2000) are presented as an example, showing upper (image 1) and lower face (image 2) muscles that are activated in emotion display through action units (Tian et al., 2000).

Image 1: Upper face Action Units (Tian et al., 2000)

NEUTRAL	AU 1	AU 2	AU 4	AU 5
				
Eyes, brow, and cheek are relaxed.	Inner portion of the brows is raised.	Outer portion of the brows is raised.	Brows lowered and drawn together	Upper eyelids are raised.
AU 6	AU 7	AU 1+2	AU 1+4	AU 4+5
				
Cheeks are raised.	Lower eyelids are raised.	Inner and outer portions of the brows are raised.	Medial portion of the brows is raised and pulled together.	Brows lowered and drawn together and upper eyelids are raised.
AU 1+2+4	AU 1+2+5	AU 1+6	AU 6+7	AU 1+2+5+6+7
				
Brows are pulled together and upward.	Brows and upper eyelids are raised.	Inner portion of brows and cheeks are raised.	Lower eyelids cheeks are raised.	Brows, eyelids, and cheeks are raised.

Image 2: Lower face Action Units (Tian et al., 2000)

NEUTRAL	AU 9	AU 10	AU 12	AU 20
				
Lips relaxed and closed.	The infraorbital triangle and center of the upper lip are pulled upwards. Nasal root wrinkling is present.	The infraorbital triangle is pushed upwards. Upper lip is raised. Causes angular bend in shape of upper lip. Nasal root wrinkle is absent.	Lip corners are pulled obliquely.	The lips and the lower portion of the nasolabial furrow are pulled pulled back laterally. The mouth is elongated.
AU15	AU 17	AU 25	AU 26	AU 27
				
The corners of the lips are pulled down.	The chin boss is pushed upwards.	Lips are relaxed and parted.	Lips are relaxed and parted; mandible is lowered.	Mouth stretched open and the mandible pulled downwards.
AU 23+24	AU 9+17	AU9+25	AU9+17+23+24	AU10+17
				
Lips tightened, narrowed, and pressed together.				
AU 10+25	AU 10+15+17	AU 12+25	AU12+26	AU 15+17
				
AU 17+23+24	AU 20+25			
				

Studying Emotional Facial Expressions

Emotion research has been exponentially growing and facial expression databases have been therefore extensively used in empirical studies (J. J. Lien, T. Kanade, J. F. Cohn, Ching-Chung Li, 1998). Most studies resort to databases built with static images because most databases are made with static pictures (Kuppens & Verduyn, 2017b). Given that using FACS is costly and time consuming, computer science researchers have developed automated recognition programs to aid emotional facial expression recognition (J. J. Lien, T. Kanade, J. F. Cohn, Ching-Chung Li, 1998).

To study the changes displayed in facial movement as a means to express emotions, there must be an understanding of the movement made by the activated facial muscles, its repetitions and regularities over time (Kuppens & Verduyn, 2017b). Hence, research on emotion dynamics focusses on the understanding of the nature, causes, and consequences of emotions, taking explicitly into account the dimension of time (Kuppens & Verduyn, 2017b).

Because emotions can be expressed through facial expressions through the creation of algorithms in applications, computers, tablets, and smartphones with cameras can do Facial Recognition (FR) to identify emotions (Egger et al., 2019). Thought the detailed understanding in the changes of facial features that occurs during the development of the different emotions, emotions can be analyzed and classified into each specific emotion. Even though facial expressions can be manipulated, we also have the physiologic measures, so we can compare facial recognition data with psychophysiological data, making sure the emotion is spontaneous and not fake (Egger et al., 2019).

The information above highlights the importance of emotions and shows that the emotions field and its application go way further from the psychology field. However, most validated existing emotion databases were built with static images content, so it is crucial for the investigation field the building of a validated dynamic database, closer to what happens in reality, that can lead to stronger results and conclusions in future studies.

Existing Work

Next, we are going to talk about work done in emotion databases field we considered relevant. There are several emotion databases, we will present tree works done in this area, including relevant information and results. To support this work, we are also going to explore relevant information about work done in the emotion field.

Paul Ekman and collaborator' (1983) studied a sample of six emotions. The authors aimed at investigating if emotions impacted in the Autonomous Nervous System (ANS). One of the tasks consisted of telling the participants which facial muscles they should activate, instead of being told to express a certain emotion (Ekman et al., 1983). They resorted to professional actors (12), and scientists (4) as participants to minimize contaminating the sample with the emotions of shame on frustration. The other task was to express emotions through the reliving of a moment where they felt that emotion. The order of emotion expression was controlled with the intent of counterbalancing, within tasks. Both tasks included video recording of facial expression, and second by second averages of data were obtained from the five physiological measurements (Ekman et al., 1983).

We use acting with instruction in our proposed study because we found it interesting to analyze if there would be differences, and what does differences would be, between spontaneous acting (using video emotional stimuli) and acting with instruction on the psychophysical data. The results in the present study will be important because it shows evidence of differences between emotions through the analyses of ANS data, enhancing the relevance of the collection of this type of data for validation of the databases.

Other relevant information came from Ellen Goeleven and collaborators, which validated the Karolinska Directed Emotional Faces database (KDEF) designed by Lundqvist, Flykt, and Ohman in 1998, and enhanced the growth of the use of effective valanced stimuli in emotion research (Goeleven et al., 2008).

They alert that variety in methodology is accountable for discrepancies in the research findings on the emotional field, being the most problematic the affective stimuli used in this research (Goeleven et al., 2008).

Experimental studies in the emotion field depend on reliable stimuli that evoke psychological and physiological responses, systematically. The development and use of standardized sets of affective stimuli, like the one we want to build, is then of crucial importance.

KDEF is a set of 4900 static pictures of human facial expressions, each set of pictures contains 70 individuals displaying 7 different emotional expressions. The criteria for participant selection was ages between 20 and 30 years, no beards, mustaches, earrings or eyeglasses, and preferably no visible make-up during photo-session (Goeleven et al., 2008).

This article alerts for the importance of creating well validated databases and is very rich on detailing de procedures and cautions during the validation, that we had in consideration in this proposed method to building a dynamic database.

Nikolaas Oosterhof and Alexander Todorov made a work on the functional basis of face evaluation, and built a 2D facial assessment model, based on existing behavioral studies and computer models (Oosterhof & Todorov, 2008). The most important data from this study is from the database creation (Oosterhof & Todorov, 2008). According to this study, 300 caucasian faces (i.e., static images) were generated using Facegen Modeller program, based on male and female faces that were laser-scanned in 3D. They used Facegen's race controls to set the face to European and all the expressions of the randomly generated faces were set to neutral and were exported to a 400 x 400 pixels bitmap with black background (Oosterhof & Todorov, 2008).

Olga A. Korolkova (2018) explored the influence of simultaneous factors (realistic human faces or using linear morphing) and types of stimuli (order of presentation, normal or reversed presentation, normal presented vs dynamic linear morphing, reversed in time) in emotion recognition and dynamic transitions (Korolkova, 2018).

Significant differences occurred on the recognition of emotions, between emotions (normal, and time reversed) in the realistic series (it was very high), and the morphed series (Korolkova, 2018). To build the database they used an actor, who had to relive or imagine an event where he experienced two of the basic emotions, in sequence, and then express the transactions between both, with his face. He had to maintain a direct look and face orientation, the background of the scenario of the video recordings had a neutral background, and the video recording went from 37 to 84 frames, depending on the transition of emotions combinations. They ended with 21 videos, one for each pair of emotions (Korolkova, 2018).

This article results shows more evidence of the importance of the use moving rather than static faces and the use of realistic rather than artificial dynamic expressions.

Emotions have an impact on a person's health, being the negative ones, the main cause affecting human's health. They can lead to headaches, asthma, ulcers, and heart diseases. The techniques for emotion recognition can improve human-computer interaction

as well as psychological treatment to some extent, to social problems ~~for example~~ (Shu et al., 2020).

The of technology in emotion recognition has been used in people with depression or mentally handicaped as a means to survey their emotional state, allowing better mood predictions and consequently provide better interventions and prevention of the occurrence of a dangerous situation. Emotion recognition devices are also used in the gaming field, providing a sense of players immersion through the variation of their emotions allowing changes in the game contents for example, leading to better gaming experiences (Shu et al., 2020).

Aim of The Current Study

This study was meant to be an experimental study resorting to participant data collection with the intent of building a dynamic emotion database for investigation use purposes. Due to COVID-19 we will present the procedures and methods we propose, for future use and approach more literature about emotions, facial expression, databases and other related themes.

A high-quality database is important to evoke emotions on the participants and to generate comparable results (Ekman et al., 1992).

The aim of this study was initially to build a reliable database with videos of facial expression for naturalistic, acted and instructed conditions given that most databases are built with static pictures, therefore creating a strong (with results closer to realistic situations), more versatile and complete database when compared to existing ones. It had the intent to support the study of dynamic aspects of facial dynamic aspects of facial emotion expression both in naturalistic and acting context.

To create this database, we were going to get a set of quantitative measures, describing facial muscle activity, using action units. Also, we would collect psychophysiological measures during de recording of the emotion expression. The facial emotional expression would be our marker, based on the participants' emotional experience, given its multidimensional nature. As physiological response measurements we will use the HRV, EDA and FR having in consideration the resources we have access and what makes sense for us to use in future analyses. We excluded EEG and EMG because the electrodes would show in the videos affecting their usability for the database we want to create. We

also excluded temperature, respiratory patterns, SR and VR for lack of resources and because we didn't find them as relevant.

Physiological Measurements

We resorted to physiological measurements because it is known lip and eye tracking are not reliable due to aperture problem and when features undergo a large amount of change in appearance (Tian et al., 2000).

Emotions causes physiological responses that take place because emotions influence the activity of the Autonomous Nervous System (ANS) and cause changes in the Heart Rate Variability (HRV), Electrodermal Activity (EDA), temperature and respiration patterns. As previously mentioned, emotions cause changes of action readiness to establish goals and priorities. As such, physiological correlates of emotion are of great relevance to study emotions. There are instruments that can also be used to study emotions, like the Electroencephalography (EEG), the Facial Recognition (FR), the Electromyography (EMG), the Speech Recognition (SR) and Voice Recognition (VR) (Egger et al., 2019).

The use of physiological measurements leads to more reliable and accurate results and data given they cannot be manipulated by the person (Shu et al., 2020).

The table below, retrieved from a work done by Shu and collaborators (2020) shows results of works done in emotions recognition, using different types of signals and the accuracy results of emotion recognition. (Shu et al., 2020).

Table 2- Work done in Emotion Recognition (Shu et al., 2020).

Related Work	Signal Type	Subject Number	Stimulation Materials	Accuracy
Quiroz, J.C., Geangu, E., & Yong, M.H. (2018)	Walking sensor data and heart rate data	50	Audio-visual and audio	Higher than 78% (happiness vs. sadness)
David Pollreisz and Nima Taheri Nejad (2008)	EDA, SKT, HR	10	Emotion video	64.66% (simpler)
Zhan Zhang et al. (2016)	Walking data	123	Film chip	91.3% (neutral vs. angry), 88.5% (neutral vs. happy), 88.5% (happy vs. angry)
Xu Ya (2010)	ECG, HR	300	Video	Happy (80.38%)
Tengfei Song et al. (2019)	ECG	23	Video	Joy, sad, neutral (50.66%)

Expected Results

We expected to collect emotional realistic videos with good quality frames from the videos on the target emotions (happiness, fear and neutral), collect psychophysiological information, sociodemographic data, and ratings before and after the tasks. The data would be used to build a dynamic emotional database for investigation purposes, being of added value to the scientific community and researchers.

Methods

Tree sets of videos would be used - neutral and happiness, neutral and fear and neutral and neutral. The videos are twenty minutes long, cut from a total thirty-minute videos to turn the experiment less extensive and fatiguing for the participant. The videos are the ones used by Pinto and collaborators (2020), one for eliciting the emotion of happiness, and one to elicit the emotion of fear and one with neutral content (five minutes).

In data analysis we are going to focus on HRV data. HRV detects changes in the heart rate, and a reduced HRV is associated with psychiatric illness like depression or anxiety (and this fact is a reason to exclude psychologic disorders). HRV features can be used to recognize emotions like fear and happiness (Ekman et al., 1992).

There is empirical evidence for the use of HRV in the emotion investigation field. The-ANS is responsable for the reaction of freezing in response to threat and the sympathetic nervous system (SNS) is responsabel for the fight of flight reaction. These mechanisms allow us to rapidly respond apropriately to our enviroment (Appelhans & Luecken, 2006).

HRV is a non-invasive and objective index of the brain's ability to organize regulated emotional responses through the ANS and as a important marker of emotion regulatory ability. Allowing the making of inferences about the inibitory and excitatory processes in emotional regulation (Appelhans & Luecken, 2006).

Sample

Participants

Participants would be mainly students from Aveiro University, aged between 18 and 30 years old, in a total sample of 20 participants, ten females and ten males. Participants would be instructed to come with no makeup, glasses, beard or jewelry. All the participants

had to wear clothing provided by the experimenters (Goeleven et al., 2008). The point is to eliminate distractive elements that can influence a person emotionally and to have a more homogeneous recording from the participants to the data base.

Emotion dysregulation plays an essential role in various forms of psychopathology (Kuppens & Verduyn, 2017b). Therefore, individuals with any current form of psychopathology will be excluded, given the potential confound in emotional expression.

We would exclude people that are not of Caucasian ethnicity, in order to create a homogeneous sample. Also, people with alexithymia, being unable to identify affective states and to reflect about emotions and regulate their own emotions (Fernandes & Tomé, 2001; Freire, 2010) are not fit to participate. To exclude people with alexithymia we will apply the Toronto Alexithymia Scale developed by Bagby, Parker e Taylor (Praceres et al., 2000).

Variables

Independent Variable

This study has two independent variables, one is the type of induced emotions (fear, happiness and neutral, and the other the type of emotional face elicitation - spontaneous emotion (elicited by video), acting without instruction and acting with instruction).

Dependent Variable

The dependent variables are the psychophysiological measures (Heart Rate Variability and Skin Conductance), the facial muscle activation through action units, thought the Kinect recordings, and the ratings of the perceived performance and felt emotion in a 0 to 8 Likert Scale.

Setting and Materials

The experiment would occur in a laboratory setting with two computers, two monitors (one to run the program and video display and the other to the investigators for trial control), a BIOPAC machine for biophysiological data collection, silver electrodes, and a Kinect v2 (we will use a depth sensor for profundity and RGB camera) for video recording the facial emotional expression of the participants. The software we would use would be Windows and Microsoft Kinect SDK, to control the saving of the video recorded by the

Kinect. The system would be programed in C# on Visual Studio along with ambient.NET. Light regulation conditions were controlled with placed artificial light.

Videos with emotional content (happiness, fear or neutral) were presented to the participant with the intent of creating emotional elicitation. The videos were to be presented on a screen in front of the participant. The videos of joy and fear were to be presented in counterbalanced orders between participants.

Procedure

Description Of The Experiment

An informed written consent (appendix 1) was elaborated and was to be provided to every participant. The consent explained the purpose of the experiment, the data protection ethic issues were to discuss, and it was explained that it was a volunteer, non-harmful experiment and that they could leave at any time.

Participants were to perform two sessions, with one week distancing to prevent emotional contagion between sessions. The order of the eliciting videos and emotion display in spontaneous acting and acting with instruction was counterbalanced.

The participants should be asked to seat as comfortably as possible and are placed in the right position resorting to a chin rest. They should also be asked to pay as much attention to the task as possible.

Before and after each task, the participants would assess, using a rating scale, the level of happiness and fear perceived.

After the placing of the participant on the seat and the placement of the electrodes for the ECG, they would have a pause of ten minutes for the physiological signals get to the baseline, and only then the task would begin.

The participants were also to be asked to maintain the seating position as still as possible and to be as quiet as possible to avoid signal interference.

At the end of the first session instructions (appendix 2), are given and explained do the participants for the second session.

The first session would comprehend emotional spontaneous elicitation and spontaneous acting, and the second would comprehend the acting with instruction condition.

Emotional Spontaneous Elicitation

The participants were to be properly allocated to the right place and positioned. A written Informed Consent was provided, where the main aim of the experiment, and the use of video recording and the anonymity of data treatment was explained, and it was given the opportunity to make questions in case of any doubt and to sing the consent.

The participant were to be informed that the experiment has two trials, and that instructions will be given along the experiment by the program, on the screen, or by the experimenter. They fill in a questionnaire of social-demographic data on the computer program, and the electrodes are applied. When the participant finishes, he/she is shown on the screen a Likert Rating Scale for the evaluation of the intensity of the perceived emotional experience and/or performance, the Toronto Alexithymia Scale (TAS-20) and the Hospital Anxiety and Depression Scale (HADS).

After that, the participants should move on to the next phase, spontaneous acting. A neutral video with 5 minutes is presented, followed by an emotional video with happiness content or fear content (in counterbalanced orders), with the aim of eliciting the emotional content of the video on the participant. In the end the viewing of the videos, the participants fill a Rating Scale for the intensity of the perceived emotional experience provided by the viewing of the video. Then followed the neutral-neutral videos, and the neutral- happiness or fear videos.

Emotion Acting With Instructions

The participants were to be asked to perform the emotion that would appear on the screen (the order of the emotions appearing on the screen were randomized, by the computer program and in counterbalanced order) according to the instructions that would be previously given to them~~,~~ At the end of performing each emotion, it's presented on the screen a Likert Rating Scale for the intensity of the perceived emotional experience and/or performance (if the score was 4 of less, the participants would have to repeat the performance of that emotion).

Spontaneous Acting

The participants were to express the target emotions. They would be instructed to firstly evoke the target emotion, through the memory of a moment of the past, where they have felt that emotion strongly, and had to express the emotion as strongly and clearly as possible (Ekman, Levenson, & Friesen, 1992; Goeleven et al., 2008).

This imagery task of reliving an emotional event of the past occurs for 60 seconds, and after that the participant performs the emotion. It is to explained to the participants that they should try to evoke the emotion that was to be expressed, and that the expression of the emotion should fell natural to them (Goeleven et al., 2008). After each emotional display, subjects rated the intensity of the performed emotion on a Likert scale from 0 to 8 . If the participant gave a score equal or less than 4 (median of the scale), at the end of the task that emotion will be repeated (Ekman et al., 1992).

Acting with Instructions

In the second session we would use instructions base on what was done on Karolinska Directed Emotional Faces Database. The participants were to be given oral instructions by the experimenter and written instructions so he/she could take home and practice them for the first session. The instructions were to be given to the participants, with a description of the facial expression (facial musculature involved), for each of the target emotions, to practice and rehearse the expressions in front a mirror at home. The instructions were to be given only at the end of the first session.

After each emotional display, subjects would rate the intensity of the performed emotion on a Likert scale from 0 to 8. If the participant gave a score equal or less than 4 (median of the scale), at the end of the task that emotion will be repeated (Ekman et al., 1992).

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Appendix

Appendix 1:

DATABASE BUILDING OF DYNAMIC EMOTIONAL EXPRESSIONS

Consentimento Informado

A participação neste estudo é de caris voluntário, sendo que pode desistir a qualquer momento, sem nenhum tipo de consequência. A realização desta experiência não acarreta nenhum tipo de dano físico ou psicológico para o participante. Este estudo tem dois momentos de recolha de dados, com a duração de mais ou menos sessenta minutos cada. Serão recolhidos dados em forma de vídeo e dados psicofisiológicos (variabilidade do batimento cardíaco e condutância da pele). Todos os dados recolhidos serão devidamente protegidos e guardados, para além disso serão utilizados e processados unicamente para fins de investigação. Para a realização desta experiência serão dadas instruções providenciadas pelos investigadores ou pelo programa, no ecrã no computador.

Esta experiência vai ser realizada no âmbito da realização do Mestrado em Psicologia da Saúde e Reabilitação Neuropsicológica e Mestrado em 2019/2020 na Universidade de Aveiro, e é uma experiência que visa providenciar meios de inovar a investigação da área das emoções e do estudo de dinâmicos de expressão de emoções. Desejamos-lhe boa sorte, e agradecemos desde já a sua colaboração.

Eu _____ li a informação presente no consentimento informado, e aceito participar de forma voluntária na experiência: "*Database building of dynamic emotional expressions"*.

Assinaturas

Participante: _____

Investigadores

Inês Fontes: _____

Marco Macedo: _____

Appendix 2:

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Construção de uma base de dados de expressão de emocional dinâmica

Instruções para o Segundo Ensaio

Para o segundo ensaio pedimos que leias a informação sobre os músculos envolvidos em cada uma das seis emoções básicas, e que em casa treines em frente a um espelho, a expressão de cada uma das emoções, tendo em consideração os músculos que nela estão envolvidos. Um bom treino e obrigada.

Alegria: Levantamento do músculo do músculo zigomático maior, que vai dos lábios até as bochechas, resultando na elevação típica do sorriso. A expressão autêntica da alegria ainda implica na contração de um músculo orbital que resulta no rebaixamento da pele entre as pálpebras e a sobrancelha. Exemplo: a

Medo: A expressão facial típica do medo é a abertura das pálpebras superiores e tensão leve das pálpebras inferiores, abertura da mandíbula, estiramento horizontal dos lábios e levantamento das sobrancelhas. Exemplo: b

Neutro: Tenta o mais possível relaxar todos os músculos faciais da forma mais natural possível.

Exemplos: