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FACIAL EXPRESSION RECOGNITION ACCURACY OF VALENCE EMOTION AMONG HIGH AND LOW INDICATED PTSD

Introduction: Emotional experience of stressful event reflects itself in form of inability to start and maintain social contact, to cope with stress and sometimes distorted cognitive outages. Aim: To test hypothesis that facially expressed emotions were useful monitor in practice as mediator for understanding nature of emotionally difficulties of traumatized forty-two individuals are facing with. Primary task was assessed whether psychologically traumatized individuals differ in facial recognition accuracy, and secondary, accuracy positive versus negative emotions among two studied groups. Subject and methods: The total sample of participants were divided in two groups based on score results of DSM- IV Harvard Trauma Questionnaire, Bosnia and Herzegovina version which was expressed perception of their PTSD symptoms self- assessed used of the score results of DSM- IV Harvard Trauma Questionnaire– Bosnia and Herzegovina version (the experimental group with high indicative PTSD and control group without moderate PTSD). Accuracy of recognition of seven facially expressed emotions was investigated. The authors presented results of significantly lower (p<.05) recognition accuracy in experimental group for all studied emotions with exception of emotion of sadness. Also, recognition of negative emotions are more accurate (p<.05). These findings suggest that emotional stress leads to a less accurate recognition of facially expressed emotions especially positive valence emotions.

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Introduction

Exposure to active stress and catastrophic, traumatic experience overcomes ordinary human experience and causes anxious reaction in a healthy person. Traumatic experiences involve direct or potential threat to life or injury and witnessing death or injury or harm to a physical integrity of others (De Jong et al., 2001). Posttraumatic stress disorder (PTSD) is associated with interpersonal difficulties related to disorder of processing of affective facial expressions. Traumatized persons show cognitive dysfunction including processing and recognizing facial expressions of emotions (Kessels et al., 2007; McGrady, 2007; Gibb, Schofield, & Coles 2009). Not everyone experiences all symptoms. Each individual's reaction is unique in terms of how serious and disabling the symptoms are. Some reactions may be immediate; others delayed. Some people do not react at all or only briefly (De Jong et al., 2001). Exposure to catastrophic stress could lead changes in psychosocial functioning (Kessels et al., 2007; Gibb, Schofield, & Coles 2009). Normal psychophysiological reactions to acute and chronic stress are modified after trauma, and sensitization and exaggerated responses to even mild stressors could occur. Poorly forgotten memories of situations that were so stressful are overconsolidated, therefore, continuing to perturb internal environment. Consciously or unconsciously, effect of such memories constantly underlies the way person reacts to particular stimuli, usually devoid of insight or understanding (Ekman & Friesen 1976; Ekman, 2003; McGrady, 2007). Some stressful memories are seemingly engraved on a person's brain and are replayed repeatedly over subsequent months and years with some modifications. Those suffering from PTSD unconsciously modify the memories of the events up years afterward. These traumatic memories, although they change over time, remain connected with their emotional valence and sensory accompaniments, to the great distress of those who experienced the traumatic event. The expressive characteristics of emotion may enable emotional communication and coordinate social interactions. Various triggers activate anxious states and bring out inability to accurately appraise what is threatening. Facial expression of emotions is recognized on the basis of similarity with experience prototype, meaning recognition is more accurate when emotion is personally experienced. Decoding process has cognitive nature where facial expression is a stimulus and recognition comes as a result of associative recollection of personal experience (Mendolia, 2006). The mechanism that generates emotional experience functions on the evaluation of consistent environmental events with the experienced emotion for the purpose of its justification and retention. In many cases attention is focused and directed to making relevant decision for a concrete situation. On the other hand, mechanism can cause certain problems when it comes to unusual experiences such as traumatic events. In these circumstances the person is frozen by the emotion and ignores the facts leading to denying such emotion. Namely, the same mechanism that is used to focus and direct attention can distort the ability to

confront new information with already existing, disabling regular activity (Mendolia, 2006). Sympathetic nervous system, limbic-hypothalamic–pituitary-adrenal axis (LHPA) and *serotoenergic* system are the three crucial systems of reaction to stress and they cause dysfunction in behavioral and emotional regulation. Prefrontal gyrus cortex supports executive functions such as: making decisions, working memory and attention (Fox, Russo & Georgiou, 2005). Facial expressions of certain emotions (Ekman refers Basic emotions) are different from each other while recognition accuracy is universal for certain emotions (Ekman, 2003; Hart, 2009). Mendolia (2006) emphasizes that the process of recognition of basic emotions is carried out unconsciously and that it has its biological basis and anatomic specificity. Due to their intensity and consequences strong emotional experiences may interfere with the process of recognition of facial expressions of emotions and result in decreased ability of the recognition. War veterans with PTSD are slow to name colors of personally significant negative words that are associated with war experience (Clore & Huntsinger, 2007). Many studies came to the conclusion that past emotional experience, usually negative, can result with various difficulties regarding emotional processing, including facial recognition of emotions (Kessels et al., 2007, Masten et al., 2008; Fox, Russo, & Georgiou, 2005). Performances on tests of face quality recognition have be found to be either normal (Moritz, Gläscher, & Brassen, 2005), or if impaired, unrelated to emotion (Minzenberg, Fan, New, Tang, & Siever, 2007). Thus, problems processing affect cannot simply be attributed to visual perceptual impairments. The possibility of emotion recognition deficits may extend to the subjective experience of emotion (Compton, 2003).

The main question set in this study is related to the ability to recognize, process or direct attention to the observed stimuli of facial expressions of basic emotions selected from the matrix. Communicability of specific spontaneous facial expressions in traumatized persons is also considered. Do traumatize persons with high and low PTSD indications can make a distinction between seven basic emotions (sadness, anger, disgust, fear, surprise, contempt, and happiness) based on facial expressions and are they more accurate when it comes to positive or negative emotional valence?

Methods

Participants

The study sample included persons who were returned refugees. They represented "traumatized individuals" and candidates for the participation in this study. The study sample type was the intended. The candidates were asked to participate by mail (the list and address of registered returned refugees found in United Nations Sub-Office Northern Bosnia and Herzegovina Tuzla Office). All subjects were informed on the

purpose of the study (total of 90). There were 55 of those who provided a written informed consent; 37out of 92 did not provide their written informed consent.

The first exclusion criteria were subjects who were younger than 20 years of age and/ or who were treated over the 6 months period at the University Psychiatric Clinic in Tuzla for psychiatric disorders. After exclusion of 8 subjects who met the exclusion criteria, the total of 47 participants were considered to be possible candidates for this study. They were administered the Harvard Trauma Questionnaire (HTQ) as a first-line screening test. The second exclusion criteria were subjects who reported to have experienced strong emotional event but did not meet the criteria for PTSD indications were also excluded. The study group consisted of the participants with high indications for PTSD. Study group was formed based on the results of the Harvard Trauma Questionnaire (HTQ). The obtained total sample was made of 42 traumatized individuals. The median age of participants was 58 (range=27-65) years. The majority of participants, 25 out of 42 (59%), were married or cohabiting. The average formal education of the respondents was 12-16 years, that is, majority of the respondents, 38 out of 42, had secondary education (Table 1). Due to incomplete questionnaire 2 persons were excluded from the further study (additional effort was made to get persons participate again but no reply was received). Additionally, 3 individuals whose DSM-IV and/or total did not meet the second criteria were also excluded.

Participants who achieved DSM-IV and/or total result of >2.5, total of 20 participants predominantly 11 (55%) women, and 9 (45%) men formed experimental group referred as "high PTSD indications group". Those participants whose critical result was below criteria (<2.5) total of 22 individuals (14 women (70%) and 8 men (30%) formed "low PTSD indications group" used as a control sample.

Symptoms of PTSD

People can be considered to have PTSD when they have been exposed to an extreme trauma, the symptoms last at least a month in duration, and the symptoms cause excessive distress so that social functioning and job performance are impaired. One sign of PTSD is that the traumatic event is relived repeatedly in the person s mind and this appears in the form of flashbacks, recurrent images, thoughts or dreams about the event and even nightmares. Reminders of the event can cause distress so many people go out of their way to avoid places and events that remind them of the catastrophic occurrence. Many people experience anxiety, restlessness, concentration difficulties, decreased memory, irritability, sleeplessness, hypervigilance, or an exaggerated startle response. Some people even experience what is called survivor s guilt because they survived and others did not or because of certain things they may have had to do in order to survive.

There are three main clusters of PTSD symptoms, and all three of these groupings must be present for a diagnosis of PTSD.

Intrusive Symptoms: Intrusive and repetitive memories which stir up negative feelings experienced during the trauma can overwhelm a person. These memories can appear in the form of:

- flashbacks (a feeling of reliving the trauma)
- frequent, distressing memories of the trauma
- nightmares
- emotional and physical distress when traumatic memories are triggered.

Arousal Symptoms: PTSD sufferers experience physiological reactions, which indicate that they don't feel safe and they are physically on the alert to deal with danger. These can include:

- being easily startled or feeling jumpy
- hypervigilance (feeling on guard even when the situation is safe)
- concentration difficulties
- outbursts of anger and irritability
- problems in falling asleep or staying asleep.

Avoidance Symptoms: People suffering from PTSD go out of their way to escape the overpowering memories and arousal symptoms. This pattern of behavior can include:

- avoiding places, people or situations that serve as reminders of the trauma
- avoiding thoughts or feelings associated with the trauma
- memory loss about some aspects of the traumatic event
- feeling emotionally numb
- feeling estranged or detached from other people
- feelings of hopelessness and helplessness about the future
- decreased interest in pleasurable activities.

It is important to remember that PTSD is a normal reaction to a very abnormal situation. There is no shame in experiencing these symptoms, nor is having these symptoms a sign of weakness. Help is available from trained professionals so that in most cases, with the appropriate effort and courage, the symptoms can disappear completely, or at least substantially decrease and become more manageable.

Harvard Trauma Questionnaire

Harvard Trauma Questionnaire- Bosnia and Herzegovina version (HTQ-BH) - the first and the fourth module of the HTQ-BH version was used to determine the level of reaction to exposure to trauma and presence of posttraumatic stress symptoms (Harvard Program in Refugee Trauma, 1998; Mollica et al., 1999). This instrument was developed in 1998 through cooperation between the Harvard Program in

Refugee Trauma, association for mental health protection, and experts from Bosnia and Herzegovina and Croatia. HTQ-BH is applied in the form of a structured interview. The introduction part of the questionnaire includes demographic data of respondents. The first module is a list of possible traumatic events and contains 46 optional (yes/no) questions about traumatic events and experiences to which the population of BH was exposed during and after the war (war period, refugee period, and postwar period). The first part of the questionnaire is not scored. The fourth module contains 40 statements on psychosocial problems caused by trauma. The first 16 statements are derived from the criteria for PTSD according to the fourth edition of the diagnostic and statistical manual for mental disorders (DSM-IV) (Matthews & Wells, 2000). The first 16 trauma symptom items, derived from the DSM-IV PTSD criteria, are the same in every versions of the HTQ. Section IV includes the 16 DSM-IV PTSD questions and 24 additional symptom items that focus on the impact of trauma on an individual's perception of his/her ability to function in everyday life. These symptoms are extremely important because traumatized people are usually more concerned about social functioning than about emotional distress.

Screening instruments were administered in Tuzla Department of Occupational Pathology and Toxicology under the supervision and support of a physician and nurse (rooms for psychological testing). Each statement is rated on a 4-point scale (1-not at all; 2-a little; 3- a lot; and 4- extremely). The total result is an average score on all 40 statements, whereas the PTSD score is an average score on the first 16 statements (DSM-IV score). The respondents whose total DSM-IV score or »PTSD« score was >2.5 were considered to have high indications for PTSD (we regarded the result of >2.5 as „high PTSD indications "(Matthews & Wells, 2000; Thayer & Lane, 2000). The reliability was in accordance with various studies (alpha for DSM-IV score was 0.79) (Thayer & Lane, 2000).

Psychological methods

A series of POFA constructed and validated by Ekman and Friesen was used (Ekman & Friesen, 1976). Series are part of Facial action coding system (FACS) used for describing and categorizing facial action by analyzing anatomic and muscular basis of the action. (Ekman, 1980). FACS operates with different action units which represent minimal activity of facial expressions of emotions that can anatomically and visually differ. Every facial action can be described with single activity unit of different intensity or with a combination of more activity units. The specific facial configuration corresponds to each emotion. Facial expressions of emotions differ in type and/or location of macular activity. From this series, a set of 4 (different facial intensity level: 40% and 70%) x 7 (emotions: anger, fear, sadness, surprise, contempt,

disgust and happiness) stimuli constituted the stimulus material forming two stimulus groups (positive and negative emotion valence). Each participant completed experimental task involving identification of facial images (Figure 1).
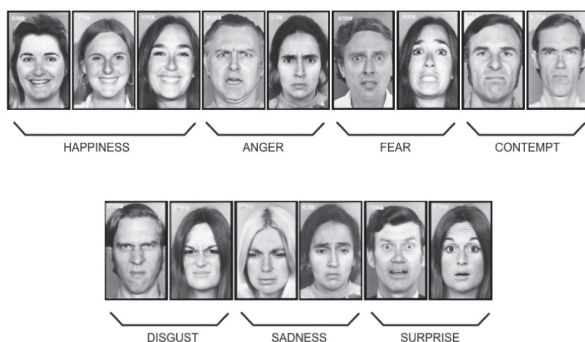

Figure 1. *Emotional stimulus sample from POFA set used for a categorical judgment; one photo represents one emotion (Photo reproduced by permission of Paul Ekman)*

Facial displays with 40% intensity are labeled as "emotional blend" meaning combination of facial signs of two emotions with mild domination of one. Total of 28 examples of expressions were presented one at the time in randomized order so that the same emotions being examined was not apparent to the subject (e.g., happy →anger →happy→ sad→ fear). In each trial, facial image remained in the view until a response was made. The participant's task was to decide which emotion the face most resembled by choosing one of seven categories (anger, fear, sadness, surprise, contempt, disgust, happiness).

Statistical methods

The results of the study were submitted to the statistical analysis by the use of the Windows SPSS program Package for Social Sciences 12.0. In the statistical analysis of our data we used descriptive statistics to describe analyzed variables in both groups of traumatized subjects, with high PTSD indications and low PTSD indications. The parametric variables were described as average values and standard deviations (age, marital status, level of education, DSM-IV score of HTQ, functioning score of HTQ, number of positive answers concerning the recognition of facial expression of emotions) and particular basic expressions of emotions were described by the use of the statistical error of mean (SM). Non-numeric variables were described as frequencies and percentages from the total number of participants in each group of

the subjects tested. Non-parametric methods were used to compare gender varia-
bles (*Chi-square test*) and differences of using particular results of basic expressions
of emotions (*Mann-Whitney U Test*). The accuracy of recognizing each emotion
is expressed with total percentage for the study and control group. Before calcula-
ting the statistical significance of the differences observed for parametric variables
(age), normality of distribution in both groups had been determined by means of
Kolmogoroff-Smirnoff test. The statistical significance for the differences of variables
described above was determined by means of *Student t-test*. The statistical signifi-
cance was set to 5% (p = 0.05).

Results

Descriptive statistics for the full sample for variables "individual characteristics" as
well as "HTQ score" are presented in Table 1 and Table 2. We found no significant
differ upon individual characteristics between two studied groups (Table 1).

Table 1.
Individual characteristics of the total sample (n=42)

Individual characteristics of the respondents	Age (years) Mean ±SD*	No. of respondents (%)	p
Gender:			
male	58,5 ± 2.8	17 (41.00)	
female	54.8 ±1.9	25 (59.00)	0.25 †
Marital status:			
single	30.5 ± 2.7	7 (16.66)	
married or cohabiting	56.5 ± 3.0	25 (59.52)	
widowed	62.0 ± 2.5	10 (23.81)	0.081‡
Level of education:			
Formal or not formal education	65 ± 0.5	2 (4.76)	
Secondary education	56.7 ± 1.5	38 (90.48)	
Higher education	31.80 ± 0.6	2 (4.76)	0.073‡

* *SD- standard deviation*
† *Kolmogoroff-Smirnoff test*
‡ *Mann-Whitney U Test*

On contrary, between-group comparison regarding PTSD indication score presented as DSM-IV score and social functioning score, showed significant difference (Table 2).

Table 2.

The DSM- IV and functioning score according to the Harvard Trauma Questionnaire results for each group obtained from the sample (n=42)

	Score (mean± standard deviation)		
	High PTSD indications	Low PTSD indications	p*
DSM-IV score of HTQ	2.8±0.2	1.83±0.5	0.030
Functioning score of HTQ	2.1±0.8	1.25±0.9	0.005
Total score	2.5±0.6	1.5±0.4	0.002

*t test.

†Mean score (± standard deviation) of 40 items from the Harvard Trauma Questionnaire, each on a scale from 1(not at all) to 4 (very much).

To test whether the recognition accuracy per emotion in both studied groups were different, chi-square test was conducted (Table 3). We found that participants with high PTSD indications (experimental group) are less accurate in indentifying emotions of five of seven studied basic emotions anger, fear, surprise, contempt and happiness (fear: $\chi2(1, N=105) =13.733$, $p<.05$; anger: $\chi2 (1, N=90) =27.927$, $p<.05$; disgust $\chi2(1, N=96) =38.522$, $p<.05$; contempt $\chi2(1, N=64) =4.205$, $p<.05$; surprise $\chi2(1,N=126) =20.574$, $p<.05$; happiness: $\chi2 (1, N=177) =41.071$, $p<.05$), compared to participant with low PTSD indications (control group). Data for emotion of sadness suggest that experimental group tended to overidentified sadness in compare to other studied emotions but we found no significant difference to control ($\chi2 (1, N =143) =2.36$, $p= 0.121$) regarding this emotion.

Table 3.

Frequency and Percent of judgments of each emotion for emotional photograph (experiment) between two groups (based on 10 second exposure)

Emotion	No of correct judgments for each photograph		Mean percent (%) of correct judgments for each emotion		p*
	High PTSD indications	Low PTSD indications	High PTSD indications	Low PTSD indications	
Anger	32	58	38.0	70.0	0.041
Fear	43	62	52.0	75.0	0.023
Sadness	78	65	94.0	80.0	0.121
Surprise	56	70	68.0	85.0	0.035
Disgust	31	65	38.0	79.0	0.080
Contempt	23	41	28.0	50.0	0.044
Happiness	67	110	53.0	88.0	0.011

* Chi-square test

We hypothesized that participants with high PTSD indications were more sensitive for negative (anger, fear, sadness, contempt, disgust) due to positive (happiness) emotions. Paired two sample t-test was significant for negative emotions $t(207) = 3.883$, $p<.05$. (Table 4). Partial eta square showed strong effect for negative valence emotion (0.71) consisted with our hypothesis of stronger bias to negative valence emotion of participants with high PTSD indications more then to positive.

Table 4.

Mean and standard deviation of judgments of emotion valence between two groups

Emotion valence	Mean ± Standard deviation		P‡
	High PTSD indications	Low PTSD indications	
Positive valence	0.62 (0.60)	1.58 (0.90)	0.032
Negative valence	4.30 (1.48)	1.49 (0.50)	0.043
Positive vs. negative	0.56 (0.50)	1.69 (0.72)	0.233
Negative vs. positive	1.28 (0.92)	0.62 (0.60)	0.013

‡Student paired simple t-test

Discussion

Experienced emotions tell us the wroth of things. According to Jung (Compton, 2003) perception tells you that something exists; thinking tells you what it is; feeling tells you whether it is agreeable or not. Robbins and Ehrman (2004) reported in their study a significant correlation in naming colors for those words that are of personal importance. They used the „Emotional Stroop Effect", which consists of attaching selected terms to certain emotions (Matthews & Wells, 2000). The study was carried out among sub-population of mentally disordered persons: depression, generalized anxiety disorder, panic disorder, phobias, eating disorder, obsessive-compulsive disorder and PTSD. Solving the task was clearly defined and time limited, which additionally created anxiety for the respondents. During the study, certain respondents showed increased interference only for words that were relevant (emotionally colored) for their disorder. Unblocked „stroop format" have confirmed the conclusion that the task "experience-word" puts examinees into emotional and cognitive states that generally reduce their ability of task performing (Thayer & Lane, 2000). Based on the information of negative context, persons with affective disorders are usually characterized as having bias. It is assumed that the basis for bias is disorder in attention selectivity, that is, there is a tendency to focus on negative information that are of personal significance. It is typical for these patients to be slow with tasks such as "color-name" which are congruent with their disorder. (Clore, 2007).

By studying the accuracy of recognition of facial expression of emotions Melfsen and Florin came to conclusion that very anxious persons, due to their tendency towards threatening stimuli, scan facial signs more attentively and thus intend to interpreter even the smallest facial signs with emotion terms (Melfsen & Florin, 2002). This is under normal circumstances assessed as completely irrelevant. False recognition of facial expressions made by anxious people can be a consequence of reflexive cognitive style. Reflexive cognitive style is defined as a tendency to react over an extended period of time during which a sequence of errors occurs. Therefore, anxious persons show a tendency to place significant focus on stimuli that they assess as threatening rather than on those that do not have threatening nature (Mendolia, 2006). The results of our study are in support of this attitude.

Development of normal ability to process emotional faces depends to a large extent on normal emotional experiences in everyday social interaction. Traumatized persons have atypical range of emotional experiences, including less positive as well. This is why atypical relationships are more likely to form between different emotion types during the process of facial expressions recognition. The studies suggest that atypical processing of emotions is associated with PTSD symptomatology. Traumatized persons show increased sensitivity to negative faces (McGrady, 2007). This was also observed in our respondents with high PTSD indications (experimental group). Emotionally significant stimuli may affect attention selectivity. Anxious persons in relation to control group will probably pay attention to negative information

(Leventhal, 1980). The studies of emotional/behavioral disorders such as anxiety, depression, phobia, PTSD and eating disorder show that these persons pay greater attention to events that are associated with their specific traumas.

Testing the success of recognizing facial expression of emotions shows that the experimental group is less successful in recognizing facial expressions of emotions. Participants with high PTSD indications made less accurate categorization of almost all examined emotions except for sadness. According to Leventhal (1980) affective disorder is associated with abnormalities of relatively primitive, even sub-cortical circles for analysis of motivationally significant stimuli. Attention selectivity bias can be a consequence of self-knowledge, which influences the highest level of planning and strategy for collecting information (Leventhal, 1980). The person can be motivated in that way to search for threatening information or those containing negative self-concept. In support of the mentioned theory is the hypothesis on automatic attentional bias, through which the effect on a person would be reflected in their wrong perception of reality in a way that the presence of the smallest vulnerability is amplified, leading to perception of delusional danger (Owens & Chard, 2001), and potential consequence of the false recognition of facial expression of emotions.

Difference in recognition accuracy between two studied groups regarding emotion of sadness was not found ($\chi2$ (1, N =143) =2.36, p= 0.121). Both, participants with low and high PTSD indications were equally categorized emotion of sadness. High recognition accuracy of sadness (as dominant emotion regarding traumatized individuals) may presumably be result of Mood congruent effect when traumatized persons can connect certain expressions of emotions with traumatic experience and in that way influence the meaning they attribute to expressions of emotions. Those persons show increased sensitivity to negative facial expressions, including tendency to classify all emotions as negative. Such patterns of processing of facial expressions are most likely associated with atypical personal experience that involves increased exposure to negative emotions (Christodoulou, 2008).

Further studies in this particular subject could yield possible use of recognition accuracy as additional symptom in diagnosis of affective disorders, in future.

Limitations of study are inability to overcome language barriers to use original software tools for measuring recognition of facial expression of emotions, poor response for participation in study, as well.

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