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Influence of Age and Gender on Emotional Skin Responses

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The goal of the current study was to examine gender-and-age related differences in physiological responses to different emotions. Applying a random sampling method, 47 college students (31 females and 16 males in the age ranges of 19–22 and 22–25 years) were chosen to participate in the study. Pictorial stimuli were selected from the International Affective Picture System (IAPS) and categorized into four emotional classes, including fear, relaxation, happiness, and sadness, based on their valence and arousal scores. Galvanic Skin Response (GSR) was recorded using a 16-channel Power Lab (manufactured by AD Instruments) when subjects were watching the affective pictures. Afterwards, morphological analysis of GSR was implemented and the Wilcoxon test was performed to show significant differences between the groups. Evaluation of differences between each affective state and rest period showed that all morphological features of GSR were valid pointers of affective states for both genders and age ranges, except for the amplitude. The gender-wise differences between each pair of emotional states indicate that fear is a unique emotional state that can be distinctly specific for women and for subjects within the age range of 19 to 22. In addition, it was found that younger women could easily recognize fear from other affective states, while older men can only distinguish between fear and happiness. It can be concluded that males and females not only differ in terms of affective physiological responses; their reactions also differ depending on their age.

Keywords: age, emotions, galvanic skin response, gender, analysis

Previous studies indicate that men and women have different emotional responses. Biological and sociocultural factors have been considered as possible roots of gender difference in emotional responses (Bradley, Codispoti, Sabatinelli, & Lang, 2001).

Kring and Gordon (1998) evaluated the emotional responses of men and women while watching emotional films. Women were more expressive than men, in addition, different skin conductance patterns have also been observed. However, similar levels of emotion experience were reported. Applying self-report scales of expressivity, gender role characteristics, and family expressiveness, similar results were achieved. In addition, it was shown that there was a modulation between gender role characteristics and family expressiveness, and the relation between sex and expressivity: the greater gender role characteristics and family expressiveness, the greater expressiveness in the individual was observed (Kring & Gordon, 1998). Generally, women expressed their emotions readily, whereas men controlled their emotional exhibitions or disguised them (Buck, Miller, & Caul, 1974).

Some researchers believed that many sex differences are related to rules and social norms (socialized) and are context-dependent (Fischer, Rodriguez Mosquera, van Vianen, & Manstead, 2004). Others suggested that the anatomical and physiological differences between men and women are the reasons for these differences. Therefore, some scientists exclusively focused on the sex differences in brain structures. It has been documented that brain activations are sex dependent in emotion processing (Kesler-West et al., 2001; Williams et al., 2005). Higher brain activities in females compared to males have been found in some Electroencephalogram (EEG) studies. For example while watching emotional faces, higher beta responses were observed in women though it was independent of the nature of emotion (Guntekin & Basar, 2007). Regarding the anatomical differences in the brain, it has been shown that fearfulness in girls was positively associated with amygdala volume, which was not the case with boys (Van Der Plas et al., 2010). Aggression in boys was however correlated with decreased right anterior cingulate cortex volume (Boes, Tranel, Anderson, & Nopoulos, 2008). Higher activation of the amygdala has been regularly observed in men after emotional stimuli. Men also showed more right amygdala activity to angry faces (Schneider et al., 2011). Involvement of the specific coupling among cortical regions during different emotional valences was documented: upper alpha couplings between left anterior and posterior regions were higher during pleasant emotions for both men and women, while during unpleasant emotions, posterior midline coherences in right hemisphere and bilateral regions were augmented in men and women, respectively (Flores-Gutiérrez et al., 2009). By evaluating electrical potentials evoked by arousal of negative pictures, a sex-related hemispheric lateralization was found (Gasbarri et al., 2007). More robust P300 effects were observed in the left hemisphere in women and in the right hemisphere in men.

Bradley et al. (2001) claimed that different levels of defensive and appetitive activation cause different physiological responses. A higher defensive activity yielded a higher skin conductance response. Men were specifically more reactive to these types of emotional stimuli compared with women. Consequently, a greater physiological response in men was expected. It has been also demonstrated that female participants remembered fearful female faces better than male faces (but not neutral or happy faces); however, the comparison between this difference in male and female participants remained uncertain (Armony & Sergerie, 2007). Women reported more fear while dealing with threatening situations. The reason may be due to their physical weakness in context of self-defense ability (Gordon & Riger, 1991). Some studies have also found different emotional valence and arousal ratings between two genders: men reported a higher emotional arousal than women, whereas women showed higher valence ratings in response to affective pictorial stimuli (Murnen & Stockton, 1997). Compared to men, women reported higher electrodermal responses (Kring & Gordon, 1998), facial electromyographic reactions, and heart rates (Bradley, Codispoti, Sabatinelli, & Lang, 2001) to unpleasant stimuli. Therefore, not only different categories of emotional stimuli can evoke different emotional responses, but gender differences can also affect psychophysiological reactions.

To examine developmental sex differences in affective processing, Killgore et al. (2001) observed children and adolescent hemodynamic responses while viewing fearful faces. Through adolescent maturation, different amygdala vs. prefrontal activation was observed in men and women. A progressive rise in the prefrontal relative to amygdala activation in the left hemisphere was found in women, whereas there was no significant age related difference in men. Previous works in the field of emotion recognition suggested that anger, sadness, fear, happiness, and surprise were hardly identified in older adults compared to the younger participants (Isaacowitz et al., 2007; Ruffman, Henry, Livingstone, & Phillips, 2008). It has been revealed that negative stimuli not only easily distracted younger adults (not applicable in cases of positive or neutral stimuli), but younger adults more correctly recognize them (Thomas & Hasher, 2006). However, in older adults a reliable recognition was found only for the positive stimuli. Regarding dimensional model of emotion, Kessler and Staudinger (Kessler & Staudinger, 2009) reported higher low arousal positive affect and lower negative affect across both low- and high-arousal levels in older adults, as well as no age differences in high arousal positive affect. Different mechanisms were proposed to explain the reason of feeling more positive affect in older adults. The most important of them were as follows: changes in the functional organization of the brain (Todorov, Fiske, & Prentice, 2011), and different strategies for emotion regulation (Urry & Gross, 2010).

Although, many researchers focused on structures and functions of the brain in different genders and ages, fewer efforts have been made on other physiological responses. The physiological measurements allow us to determine whether sex and age differences can be marked in response to different emotional states. Therefore, in the current study, male and female affective reactions in two predefined age ranges were measured while pictorial stimuli with different emotional and neutral contents were presented. This was performed through GSR recording, a signal of heightened sympathetic nervous system involvement.

Method

A cross-sectional study was performed to understand the physiological fluctuations elicited by emotional images. Galvanic Skin Responses (GSR) of 47 college students, 31 females (mean age: 21.90±1.7 years) and 16 males (mean age: 21.1±1.48 years) were recorded. Participants were selected by random sampling method from the students of Sahand University of Technology. All participants were Iranian.

Selected images from the International Affective Picture System (IAPS) were used in the study (Lang, Bradley, & Cuthbert, 2005), which were emotionally evocative. The data set was assessed by some American participants on three dimensions (on a discrete 9-point scale): valence, arousal, and dominance. For all dimensions, the mean and variance of participant scores were calculated. Based on the two-dimensional model of emotion (valence/arousal), the IAPS pictures corresponding to four emotion classes were chosen: relaxation, happiness, sadness, and fear (Goshvarpour, Abbasi, & Goshvarpour, 2015). Figure 1 demonstrates the emotional load of the stimuli on a 2D emotion space using the valence and arousal axis.

Upon arrival at the laboratory, all participants were asked to read and sign a consent form, which they only signed if they agreed to take part in the experiment. The participants were also instructed to try and remain still during data recording. During the experimental procedure, the subject was sitting in front of the laptop screen (15.5-inch VAIO E Series) and the physiological responses (GSRs) were recorded. The whole procedure has been described in detail in Goshvarpour, Abbasi, & Goshvarpour, (2015).

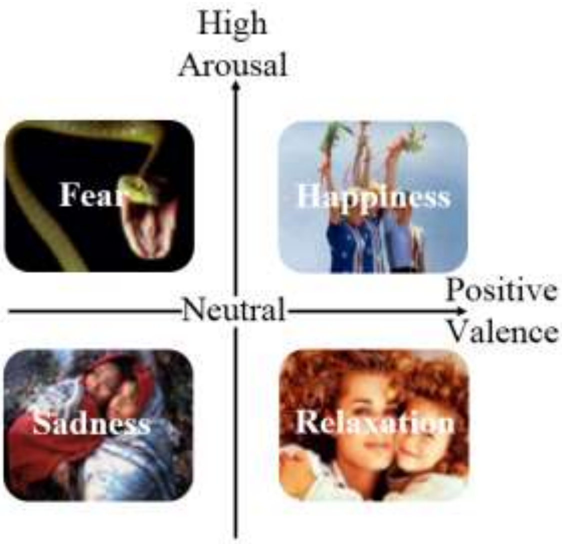

Figure 1. **Dimensional Structure of the Emotional Space**

Morphological Analysis of GSR

To characterize emotional responses, some morphological features of GSR were extracted, including the peak, valley, the times of peak and valley manifestation, slope, amplitude, and rising time of the signal. Detecting the onset and the peak of signals, the time course between the occurrence of the onset and the peak was calculated as a rise time. It refers to the mean temporal interval between Skin Conductance Response (SCR) initiation and SCR peak. SCR amplitude is the mean amplitude of the SCR occurrences. Figure 2 exemplifies these measurements.

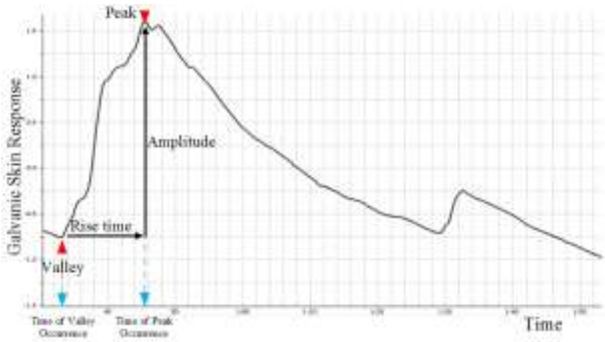

Figure 2. **Galvanic skin response. The detected peak and valley are marked with red '∇' and red 'Δ', respectively. Time of valley and peak occurrences is determined with blue '∇'.**

Results

To reduce the computational time, data was downsampled to 100 Hz. Then, the GSR time series were filtered using a low pass Butterworth filter with a cutoff frequency of 10 Hz. Next, the morphological features of GSR signals were calculated. Statistical analysis was performed by means of the Wilcoxon test to show significant differences between emotional states and rest period, and between each pair of emotive parameters. Table 1 and Table 2 illustrate statistical differences in the two genders.

Table 1
Comparison between Emotional States and Rest Period of GSR Measures by Means of Wilcoxon Test in Different Genders

Feature	Women				Men			
Rest Period with	Fear	Sadness	Relaxation	Happiness	Fear	Sadness	Relaxation	Happiness
Peak	$1.1\times10^{-75**}$	$4.1\times10^{-77**}$	$1.9\times10^{-76**}$	$3.5\times10^{-77**}$	$1.1\times10^{-56**}$	$9.1\times10^{-58**}$	$2.4\times10^{-57**}$	$4.1\times10^{-58**}$
Valley	$3.4\times10^{-75**}$	$1.3\times10^{-76**}$	$7.2\times10^{-76**}$	$9.1\times10^{-77**}$	$1.9\times10^{-56**}$	$1.4\times10^{-57**}$	$4.0\times10^{-57**}$	$6.9\times10^{-58**}$
The Time of Peak Manifestation	$1.1\times10^{-75**}$	$4.1\times10^{-77**}$	$1.9\times10^{-76**}$	$3.5\times10^{-77**}$	$1.1\times10^{-56**}$	$9.2\times10^{-58**}$	$2.4\times10^{-57**}$	$4.1\times10^{-58**}$
The Time of Valley Manifestation	$3.4\times10^{-75**}$	$1.3\times10^{-76**}$	$7.2\times10^{-76**}$	$9.1\times10^{-77**}$	$6.9\times10^{-58**}$	$4.0\times10^{-57**}$	$1.4\times10^{-57**}$	$1.9\times10^{-56**}$
Amplitude	$.0004^{*}$	$.0017^{*}$	$.0014^{*}$	$.0006^{*}$	.6371	.6318	.4306	.8223
Rise Time	$1.1\times10^{-75**}$	$4.1\times10^{-77**}$	$1.9\times10^{-76**}$	$3.5\times10^{-77**}$	$4.1\times10^{-58**}$	$2.4\times10^{-57**}$	$9.1\times10^{-58**}$	$1.1\times10^{-56**}$
Slope	$4.4\times10^{-51**}$	$1.1\times10^{-53**}$	$5.6\times10^{-53**}$	$1.2\times10^{-52**}$	$1.4\times10^{-52**}$	$1.0\times10^{-52**}$	$1.6\times10^{-52**}$	$1.2\times10^{-51**}$

Note: *p<.05; ** p<.00001

Comparison between emotional states and rest period revealed that all morphological features of GSR were valid markers of affective states in two genders, except for the amplitude in the men's group (Table 1). In contrast, none of these features could distinguish one emotional state from another. Carefully considering the results, one could conclude that women can successfully discriminate between fear and other emotional states; however, there were not any significant differences between each pair of emotional states for men (Table 2).

In the next stage, the effect of age on the emotional responses was examined. Precisely, it has been examined that whether the physiological responses to affective pictorial stimuli in the age range of 19— 22 was different from the responses in the range of 22—25, as provided in Table 3 and Table 4.

The results showed that applying GSR features, the distinction between emotional states and rest period can easily be made. All features showed significant differences between emotion categories and rest period in both age groups except for the amplitude (Table 3). However, the results were not compatible with pairs of emotions (Table 4). In this case, GSR characteristics did not show any significant differences between emotional classes. Only fear could be differentiated from the other states in the age range of 19—22. Specifically, significant differences between fear and sad stimuli were found for all GSR features.

Table 3
Comparison between Emotional States and Rest Period of GSR Measures by Means of Wilcoxon Test in Two Age Ranges

Feature	Age: 19-22				Age: 22-25			
	Fear	Sadness	Relaxation	Happiness	Fear	Sadness	Relaxation	Happiness
Rest Period with								
Peak	$5.0\times10^{-46**}$	$4.1\times10^{-48**}$	$6.4\times10^{-47**}$	$3.4\times10^{-48**}$	$1.8\times10^{-86**}$	$4.6\times10^{-87**}$	$3.4\times10^{-87**}$	$1.5\times10^{-87**}$
Valley	$1.8\times10^{-45**}$	$1.6\times10^{-47**}$	$2.4\times10^{-46**}$	$1.1\times10^{-47**}$	$2.4\times10^{-86**}$	$4.9\times10^{-87**}$	$5.0\times10^{-87**}$	$1.8\times10^{-87**}$
The Time of Peak Manifestation	$5.0\times10^{-46**}$	$4.2\times10^{-48**}$	$6.4\times10^{-47**}$	$3.4\times10^{-48**}$	$1.8\times10^{-86**}$	$4.6\times10^{-87**}$	$3.4\times10^{-87**}$	$1.5\times10^{-87**}$
The Time of Valley Manifestation	$1.8\times10^{-45**}$	$1.6\times10^{-47**}$	$2.4\times10^{-46**}$	$1.1\times10^{-47**}$	$2.4\times10^{-86**}$	$4.9\times10^{-87**}$	$5.0\times10^{-87**}$	$1.8\times10^{-87**}$
Amplitude	$.0007^{*}$	$.0019^{*}$	$.0019^{*}$	$.0008^{*}$	.7125	.8753	.9903	.6713
Rise Time	$5.0\times10^{-46**}$	$4.1\times10^{-48**}$	$6.3\times10^{-47**}$	$3.4\times10^{-48**}$	$1.8\times10^{-86**}$	$4.6\times10^{-87**}$	$3.4\times10^{-87**}$	$1.5\times10^{-87**}$
Slope	$3.9\times10^{-30**}$	$2.6\times10^{-32**}$	$2.9\times10^{-31**}$	$1.4\times10^{-31**}$	$7.6\times10^{-72**}$	$8.9\times10^{-73**}$	$8.4\times10^{-74**}$	$1.1\times10^{-72**}$

Note: *p<.05; ** p<.00001

Table 4
Comparison between each Pairs of Emotional States of GSR Measures by Means of Wilcoxon Test in Two Age Ranges

Feature	Age: 19-22						Age: 22-25					
	Sadness vs. Fear	Happiness vs. Sadness	Happiness vs. Fear	Relaxation vs. Sadness	Relaxation vs. Happiness	Relaxation vs. Fear	Sadness vs. Fear	Happiness vs. Sadness	Happiness vs. Fear	Relaxation vs. Sadness	Relaxation vs. Happiness	Relaxation vs. Fear
Peak	.0018*	.9856	.0018*	.0734	.0735	.1768	.2187	.7655	.1288	.3102	.1915	.823
Valley	.0023*	.921	.0018*	.0757	0.0633	.198	.2271	.7338	.1242	.2868	.1626	.8789
The Time of Peak Manifestation	.0018*	.9856	.0018*	.0734	.0735	.1768	.2187	.7655	.1288	.3102	.1915	.823
The Time of Valley Manifestation	.0023*	.921	.0018*	.0757	.0633	.198	.2271	.7338	.1242	.2868	.1626	.8789
Amplitude	.0381*	.0838	.7367	.9902	.0911	.0402*	.1085	.0344*	.5948	.2305	.0008*	.0047*
Rise Time	.0018*	.9862	.0018*	.0733	.0736	.1765	.2186	.766	.1288	.3105	.1918	.8223
Slope	.0001*	.2042	.008*	.0477*	.4909	.0464*	.0251*	.5217	.114	.774	.7115	.0462*

Note: *p<.05

Finally, it was attempted to find whether the physiological responses of two genders are different in the predefined age ranges. Considering this hypothesis, comparisons between each affective state and rest period are demonstrated in Table 5 and Table 6 by means of statistical analysis. Identical analysis was performed for each pair of affective states. The results are shown in Table 7 and Table 8.

Considering the age range of 19—22, there were significant differences between each emotional state and rest period for both men's and women's groups and for all features, excluding the amplitude (Table 5).

Similar results were obtained for subjects within the age range of 22—25. In this case, all features were significantly different between each emotional state and rest period in two groups of men and women except for the amplitude (Table 6).

Table 5
Comparison between Emotional States and Rest Period of GSR Measures by Means of Wilcoxon Test in the Age Range of 19 to 22 for two Genders

Feature	Age: 19-22							
	Women				Men			
Rest Period with	Fear	Sadness	Relaxation	Happiness	Fear	Sadness	Relaxation	Happiness
Peak	$2.1\times10^{-18**}$	$4.9\times10^{-20**}$	$1.8\times10^{-19**}$	$7.6\times10^{-20**}$	$3.2\times10^{-31**}$	$9.7\times10^{-32**}$	$3.0\times10^{-31**}$	$5.1\times10^{-32**}$
Valley	$4.4\times10^{-18**}$	$1.0\times10^{-19**}$	$3.8\times10^{-19**}$	$1.4\times10^{-19**}$	$5.1\times10^{-31**}$	$1.6\times10^{-31**}$	$5.0\times10^{-31**}$	$8.6\times10^{-32**}$
The Time of Peak Manifestation	$2.1\times10^{-18**}$	$4.9\times10^{-20**}$	$1.8\times10^{-19**}$	$7.6\times10^{-20**}$	$3.2\times10^{-31**}$	$9.7\times10^{-32**}$	$3.0\times10^{-31**}$	$5.1\times10^{-32**}$
The Time of Valley Manifestation	$4.4\times10^{-18**}$	$1.0\times10^{-19**}$	$3.8\times10^{-19**}$	$1.4\times10^{-19**}$	$5.1\times10^{-31**}$	$1.6\times10^{-31**}$	$5.0\times10^{-31**}$	$8.6\times10^{-32**}$
Amplitude	$4.6\times10^{-5**}$	$.0001^{*}$	$.0001^{*}$	$.0001^{*}$	.5556	.6439	.7408	.5377
Rise Time	$2.1\times10^{-18**}$	$4.8\times10^{-20**}$	$1.8\times10^{-19**}$	$7.6\times10^{-20**}$	$3.2\times10^{-31**}$	$9.7\times10^{-32**}$	$3.0\times10^{-31**}$	$5.2\times10^{-32**}$
Slope	$5.7\times10^{-9**}$	$2.0\times10^{-10**}$	$8.9\times10^{-10**}$	$8.5\times10^{-10**}$	$1.7\times10^{-27**}$	$4.8\times10^{-28**}$	$1.0\times10^{-27**}$	$3.3\times10^{-28**}$

Note: *p<.05; ** p<.00001

Table 6
Comparison between Emotional States and Rest Period of GSR Measures by Means of Wilcoxon Test in the Age Range of 22 to 25 for Two Genders

Feature	Age: 22-25							
	Women				Men			
Rest period with	Fear	Sadness	Relaxation	Happiness	Fear	Sadness	Relaxation	Happiness
Peak	$2.9\times10^{-61**}$	$3.6\times10^{-61**}$	$2.7\times10^{-61**}$	$1.3\times10^{-61**}$	$2.8\times10^{-27**}$	$7.5\times10^{-28**}$	$7.5\times10^{-28**}$	$7.4\times10^{-28**}$
Valley	$3.4\times10^{-61**}$	$4.1\times10^{-61**}$	$3.9\times10^{-61**}$	$1.6\times10^{-61**}$	$3.2\times10^{-27**}$	$6.9\times10^{-28**}$	$7.6\times10^{-28**}$	$7.3\times10^{-28**}$
The Time of Peak Manifestation	$2.9\times10^{-61**}$	$3.6\times10^{-61**}$	$2.7\times10^{-61**}$	$1.3\times10^{-61**}$	$2.8\times10^{-27**}$	$7.5\times10^{-28**}$	$7.5\times10^{-28**}$	$7.4\times10^{-28**}$
The Time of Valley Manifestation	$3.4\times10^{-61**}$	$4.1\times10^{-61**}$	$3.9\times10^{-61**}$	$1.6\times10^{-61**}$	$3.2\times10^{-27**}$	$6.9\times10^{-28**}$	$7.6\times10^{-28**}$	$7.3\times10^{-28**}$
Amplitude	.1934	.3164	.3284	.2312	.1636	.2106	.1116	.2918
Rise Time	$2.9\times10^{-61**}$	$3.6\times10^{-61**}$	$2.7\times10^{-61**}$	$1.3\times10^{-61**}$	$2.7\times10^{-27**}$	$7.5\times10^{-28**}$	$7.5\times10^{-28**}$	$7.4\times10^{-28**}$
Slope	$1.7\times10^{-48**}$	$4.8\times10^{-49**}$	$1.5\times10^{-49**}$	$4.4\times10^{-49**}$	$5.8\times10^{-26**}$	$2.2\times10^{-26**}$	$9.5\times10^{-27**}$	$4.0\times10^{-26**}$

Note: *p<.05; ** p<.00001

Table 7

Comparison between each Pairs of Emotional States of GSR Measures by Means of Wilcoxon Test in the Age Range of 19 to 22 for Two Genders

	Age: 19-22											
	Women						**Men**					
Feature	Sadness vs. Fear	Happiness vs. Sadness	Happiness vs. Fear	Relaxation vs. Sadness	Relaxation vs. Happiness	Relaxation vs. Fear	Sadness vs. Fear	Happiness vs. Sadness	Happiness vs. Fear	Relaxation vs. Sadness	Relaxation vs. Happiness	Relaxation vs. Fear
Peak	.0005*	.7031	.0021*	.2294	.4203	.0206*	.4254	.6478	.2153	.1692	.0698	.5795
Valley	.0007*	.7783	.002*	.2399	.3789	.0244*	.4325	.6408	.2176	.1669	.0675	.5646
The Time of Peak Manifestation	.0005*	.7031	.0021*	.2294	.4203	.0206*	.4254	.6478	.2153	.1692	.0698	.5795
The time of Valley Manifestation	.0007*	.7783	.002*	.2399	.3789	.0244*	.4325	.6408	.2176	.1669	.0675	.5646
Amplitude	.0463*	.1724	.5253	.3842	.6246	.2692	.3998	.2801	.8048	.3873	.0559	.0873
Rise Time	.0005*	.7023	.0021*	.2292	.4208	.0205*	.4253	.648	.2154	.1694	.0698	.5799
Slope	**	.11	.0111*	.0784	.9004	.0153*	.1949	.8952	.2527	.269	.3334	.8384

Note: *p<.05; ** p<.00001

On the other hand, comparing GSR measures for the pairs of emotional states revealed that there were no significant differences between the groups. Only, younger women could easily recognize fear from other affective states and older men could distinguish fear from happiness (Table 7 and Table 8).

Discussion

The aim of the current study was to examine the answer of the following questions: 1) Do morphological analysis of GSR have a capability to reveal physiological changes associated with affective responses to pictorial stimuli? 2) Is there any difference between male and female affective reactions? 3) Whether the emotional and physiological responses depend upon the age range of the participants? 4) Is there any difference between male and female affective reactions in two predefined age ranges?

A comparison between affective states and rest period revealed that all morphological features of GSR were significantly different for two genders and two age ranges, and the specified age ranges of male and female groups, except for the amplitude (Table 1, Table 3, Table 5, and Table 6). In contrast, none of these features could differentiate between pairs of emotional states. However, fear was an emotional state, which could be distinguished from other states by women (age range 19—22). It was also found that younger women could easily recognize fear from other affective states, while older men could only discriminate fear from happiness. These findings are in conformity with the results obtained in previous studies.

Table 8
Comparison between each Pairs of Emotional States of GSR Measures by Means of Wilcoxon Test in the Age Range of 22 to 25 for Two Genders

	Age: 22-25											
	Women						Men					
Feature	Sadness vs. Fear	Happiness vs. Sadness	Happiness vs. Fear	Relaxation vs. Sadness	Relaxation vs. Happiness	Relaxation vs. Fear	Sadness vs. Fear	Happiness vs. Sadness	Happiness vs. Fear	Relaxation vs. Sadness	Relaxation vs. Happiness	Relaxation vs. Fear
Peak	.7967	.7881	.6004	.3009	.1989	.4406	.057	.8884	.0424*	.7923	.69	.0971
Valley	.8199	.768	.6039	.2882	.1807	.4077	.0559	.859	.0382*	.7533	.628	.1057
The Time of Peak Manifestation	.7967	.7881	.6004	.3009	.1989	.4406	.057	.8884	.0424*	.7923	.69	.0971
The Time of Valley Manifestation	.8199	.768	.6039	.2882	.1807	.4077	.0559	.859	.0382*	.7533	.628	.1057
Amplitude	.0167*	.1086	.439	.9094	.0828	.0115*	.3508	.1714	.0192*	.0278*	.0003*	.2002
Rise Time	.7965	.7883	.6005	.3009	.1991	.4411	.057	.8888	.0425*	.793	.6908	.0971
Slope	.074	.4994	.2711	.3086	.7485	.4208	.1941	.9176	.2417	.2549	.2027	.0133*

Note: *p<.05.

In order to examine the relationship between male and female affective reactions, statistical tests were performed (Table 1 and Table 2). Considering the results obtained, it was shown that physiological responses of two genders were related to the affective stimuli. Our results were consistent with the findings of previous researchers. Evaluating the electrodermal reactivity, it has been shown that women were more emotionally sensitive than men (Chentsova-Dutton & Tsai, 2007). Kret and De Gelder (2012) showed that not only women were better at recognizing emotions, but also they could express themselves more effortlessly. Finally, they concluded that behavioral response inclinations were different between two genders. Some evidence suggested that negative stimuli, particularly fear, claim the attention of young adults more readily than neutral or happiness (Thomas & Hasher, 2006; Palermo & Rhodes, 2007) and they more correctly recognized negative stimuli than positive (Thomas & Hasher, 2006).

The results of this study also confirmed our third hypothesis. Along with the previous findings, the role of age differences in emotional responses has been confirmed in this study. Earlier, it has been shown that compared with younger adults, older participants had greater emotional control (Gross et al., 1997). Similar results were obtained in the current study. Younger women could easily recognize fear from other affective states better than the older group. The current investigation signified the gender role on physiological responses. It was shown that different strategies may be observed in male and female reactions: in males, differentiation between fear and happiness was manifested in older participants, compared to younger adults; whereas, in females, younger subjects could readily recognize fear from the other affective states, which was not the case with older subjects. Previous studies have supported heterogeneous aging; the earliest and most rapid decline in normal adult aging has been appeared in the frontal and medial temporal lobes. Therefore, poorer recognition of certain emotions might be in relation with faster degradation in some brain areas (Petit-Taboue et al., 1998; Sowell et al., 2003).

In this study, we achieved some valuable findings: 1) our results showed that the amplitude of GSR is not a significant marker for affective states. The reason could be due to a huge amount of variability in GSR amplitude among different subjects that occurs when encountering affective stimuli. Neither GSR baseline nor its variation was the same among participants. Furthermore, GSR variations were more pronounced in men rather than women (Table 1). It is suggested that the number of participants should be increased in future studies to evaluate if this variation is diminished. 2) The results confirmed that morphological GSR features could successfully discriminate between each affective state and rest period; however, none of them could differentiate between pairs of emotional states. As mentioned before, GSR heightened sympathetic nervous system involvement; therefore, it seems that it has the potential to show only the sympathetic nervous system activity during affective states. However, GSR indices cannot handle differences in sympathetic nervous system activities between two different affective states. Therefore, even having GSR parameters, one cannot state which affective stimuli has been presented. 3) The results of this study showed that fear is an emotional state more likely to be distinguished from other stimuli. Fear is considered as a basic emotion that involves activation of the "flight or fight" response of the ANS. Experiencing fear, the sympathetic nervous system is activated, which can be shown by GSR. Appropriate and fast response to threatening stimuli is essential for survival and much of its development appears to be innate and evident within the first months of human life. Therefore, it is expected that this kind of stimuli have a great impact on physiological responses. In the line with this study, other researchers emphasized on the role of fear processing on the other bio signals (cardiac signals) (Garfinkel & Critchley, 2016). Taken together, it can be concluded that males and females not only differ in their affective physiological responses, but their reactions are varied in different age ranges.

There are some limitations that need to be considered in future studies—for instance, the limited age range should be considered in the analysis. This can be expanded over the human life span. Another issue is the sample size. More data should be examined to generalize the findings. In the current study, four target emotions (happiness, relaxation, sadness, and fear) were examined by means of physiological measurements. Further investigations should consider more emotional categories as well.

List of Abbreviations

GSR	Galvanic Skin Response
EEG	Electroencephalogram
IAPS	International Affective Picture System
SCR	Skin Conductance Response

Conflict of Interest

'The author(s) declare that they have no conflict of interest'.

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