

## **Factor Structures of the Emotional Contagion Scale (ECS) across the United States and India**

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**ABSTRACT** - The factor structure of the Emotional Contagion Scale (ECS) was assessed across two cultures- US and India. ECS completed by American ( $N=124$ ) and Indian ( $N=113$ ) college students was subjected to principal component analyses (PCA) with promax rotations and 1-, 2- and 5-factor solutions were examined. One-dimensional factor structure of ECS was not supported in either the American or the Indian sample. A 2-factor solution of ECS showed separate loadings of positive and negative emotions together in both cultures for most, but not all of the items of ECS. A 5-factor solution in both American and Indian sample showed loading of love items together onto a single factor. The other items of the ECS designed for happiness, anger, fear and sadness did not load clearly onto these basic emotions. Implications of these mixed findings are discussed.

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Emotional contagion refers to the tendency of humans to “catch” other individual’s emotions (Hatfield, Cacioppo, & Rapson, 1993, 1994). Emotions are not just transmitted through words but also through non-verbal expressions including body language, tone, posture and facial expressions. This mimicry is believed to be automatic and unconscious (Hatfield et al., 1994). The susceptibility to emotional contagion in individuals has been measured by an Emotional Contagion Scale (ECS) developed by Doherty (1997) and it is based on a self-report scale including examples to assess five emotions of happiness, love, anger, fear and sadness. The ECS has been mostly used in US and Western countries, which are predominantly higher on individualism. India scores lower on the individualism scale (ranked 21<sup>st</sup>) with US as the top-ranked nation on the same scale (Hofstede, 2001). This study used the principal component analysis (PCA) of the ECS to assess the structure of this scale in both American and Indian context, specifically its construct validity in the two cultures. Before comparing the susceptibility to emotional contagion based on the EC Scale across the two cultures, it is imperative to compare the structure of the scale in the two cultures. Do the items of EC Scale measure the similar underlying construct of emotional contagion for happiness, love, anger, sadness and fear in the two cultures?

Susceptibility to emotional contagion can be influenced by multiple factors including closeness of relationship, attention, mood and self-construal (Hatfield et al., 1994).

Hatfield and colleagues hypothesized that construal of inter-relatedness of self with others is likely to make an individual more susceptible to emotional contagion compared to a more independent construal of self. This would imply that individuals in a collectivistic cultural context with greater emphasis on the collective self are more interdependent with their inner group (e.g. family, nation) and likely to behave in a communal way (Triandis, 1989, 2001) and possibly more susceptible to emotional contagion. On the other hand, individuals in an individualistic context with a greater emphasis on autonomy of the self might be less susceptible to emotional contagion. The interdependent view is common in countries like Japan, China, India and other Asian nations as well as African and Latin-American countries and the independent view more prevalent in US and Western European nations. There is some evidence to suggest that individuals in a collectivistic context are more vulnerable to emotions of others and emotional contagion (Markus & Kitayama, 1991). This is not surprising considering the emphasis on group harmony and closeness in collectivistic cultures. Convergence of emotions, both positive and negative, might be one of the major goals of interpersonal interaction, even to the point of suppression of individual and independent expression of emotions. Individual susceptibility to emotional contagion has been measured using the Emotional Contagion Scale (ECS).

### ***Emotional Contagion Scale (ECS)***

The ECS was first developed by Doherty and colleagues (Doherty, 1997; Doherty, Orimoto, Singelis, Hatfield, & Hebb, 1995). It underwent two revisions from a 38-item measure to a 20-item measure (Doherty et al., 1995) to the current 15-item version (Doherty, 1997). Factor analysis of the ECS was carried out by Doherty and principal components analysis (PCA) revealed a unidimensional measure (1-factor solution) with factor loadings ranging from .46 to .69. A 2-factor solution with a positive subscale (happiness, love) and a negative subscale (fear, anger and sadness) was also found with this analysis but it was not considered as a better fit than the 1-factor solution. This finding has not been replicated in other research studies. It was acknowledged by the author that even though some of its items of the ECS were 'more relevant to modern and developed cultural contexts', the measured emotions were believed to be basic and relevant across cultures (Doherty, 1997).

The present study on emotional contagion measures the structure of the ECS in both US and India and attempts to determine the best fit for a factor solution. A 2-factor model would suggest that the items on the ECS are located on two dimensions- Positive Affect Factor (PAF) including happiness and love and Negative Affect Factor (NAF) including anger, fear and sadness. A 5-factor model would suggest that out of the 15 items on the ECS, items 6, 9 and 12 correspond to love; items 2, 3 and 11 to happiness; items 8, 13 and 15 to fear; items 5, 7 and 10 to anger and items 1, 4 and 14 to sadness.

## **Method**

### ***Participants and Procedure***

One hundred and forty six students from two private colleges in North and South of India were recruited for this study. They ranged in age from 18 to 25 with average age being 19.7 years ( $SD = 1.3$ ). All of them had studied English for at least 10 years and

were proficient in it. One hundred and twenty four students were selected for the final sample because of incomplete surveys by the remaining 22 students. Students were given the Emotional Contagion Scale (ECS) in the classroom after obtaining the demographic information. One hundred and fifteen students from a private university in US were also recruited for this study. Two students did not complete the survey and therefore the final sample had 113 students. They ranged in age from 18 to 36 with the average being 19.95 ( $SD = 2.47$ ). They were also given the ECS in the classroom and demographic information was also obtained from them.

**Measurement Scale**

Test-retest reliability of the ECS with the Cronbach’s alpha is nearly .90. Construct validity for the ECS was found to be adequate, judging from significant positive correlations with scales measuring reactivity, emotionality, and empathy. Its content validity was also well established as it was found to be comparable to the judges’ rating of emotional contagion (Doherty, 1997).

**Results**

**Statistical Analysis**

Descriptive statistics and principal component analysis (PCA) were conducted using the SPSS 16.0. Regarding the appropriateness of the sample size for factor analyses, there are varying opinions. According to Hatcher (1994), the number of participants should be at least 5 times the number of variables or 100. In the present study, samples in both cultures were more than 100. The mean ECS scores for the individual items were obtained for both US and India (Tables 1 and 2). Mean scores for the PAF (Positive Affect Factor- happy and love subscales combined together), NAF (Negative Affect Factor- sadness, anger and fear subscales combined together) were also obtained along with the mean scores for separate subscales of happiness, love, sadness, anger and fear in both cultures as well as the individual internal consistencies (Tables 3 and 4).

**Table 1**  
***ECS Items in American Sample***

Emotion	Item	r <sup>ab</sup>	Factor Loading	M	SD
Love	6	.44	.49	3.94	.95
Love	9	.53	.58	3.97	1.06
Love	12	.51	.56	4.13	.88
Happiness	2	.34	.32	3.82	.91
Happiness	3	.39	.39	3.96	.84
Happiness	11	.62	.63	3.72	.99
Fear	8	.63	.65	3.26	1.08
Fear	13	.51	.47	3.0	1.9
Fear	15	.51	.47	2.66	1.25
Anger	5	.55	.60	1.87	.71
Anger	7	.32	.27	3.54	1.01
Anger	10	.43	.39	2.87	1.15
Sadness	1	.50	.48	2.96	1.04
Sadness	4	.53	.53	3.62	.97
Sadness	14	.59	.57	3.14	1.31

The initial description of the correlation matrix of the ECS from both the samples in the US and India demonstrated its suitability for factor analysis. The correlation matrices for both US and India consisted of several correlation coefficients higher than .3. Kaiser-Meyer-Olkin (KMO) value measure of sampling adequacy for the American sample was .69 and Bartlett's test of sphericity was significant ( $\chi^2 = 457.1$ ,  $df= 105$ ,  $p<.001$ ) The KMO value measure of sampling adequacy for the Indian sample was .67 and Bartlett's test of sphericity was significant ( $\chi^2 = 405.6$ ,  $df= 105$ ,  $p<.001$ ). These values indicate that both the samples were suitable for principal component analysis (PCA).

**Table 2**  
***ECS Items in Indian Sample***

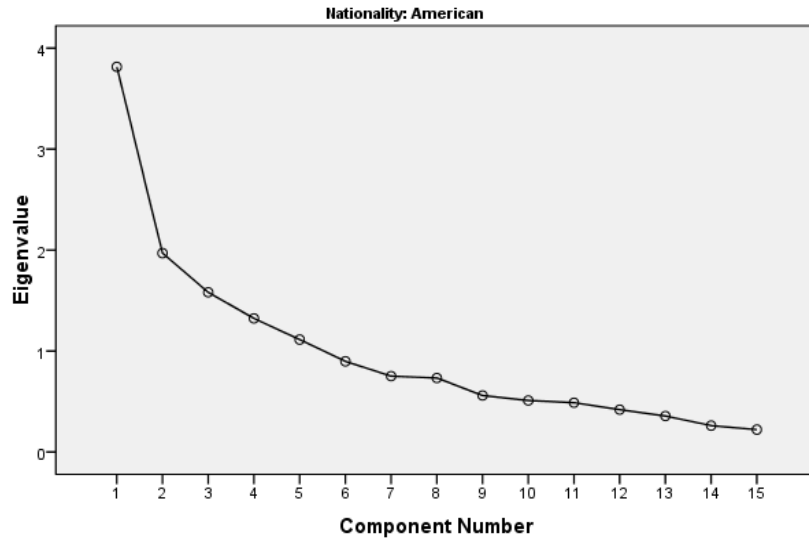
Emotion	Item	$r^{ab}$	Factor Loading	<i>M</i>	<i>SD</i>
Love	6	.42	.27	3.45	1.3
Love	9	.54	.45	3.8	1.29
Love	12	.31	.14	3.78	1.16
Happiness	2	.27	.19	3.66	1.08
Happiness	3	.39	.31	3.95	1.03
Happiness	11	.46	.39	4.17	1.05
Fear	8	.48	.55	3.32	1.08
Fear	13	.48	.53	3.11	1.2
Fear	15	.47	.54	2.59	1.42
Anger	5	.38	.41	2.18	.99
Anger	7	.39	.38	3.9	1.16
Anger	10	.46	.51	3.04	1.28
Sadness	1	.59	.68	2.45	1.21
Sadness	4	.48	.52	3.55	1.25
Sadness	14	.58	.68	3.05	1.51

Principal component analysis (PCA) and promax rotation were used to investigate the factor structure of the ECS for both the samples. The initial PCA solution was examined for the American sample and the scree plots indicated that two to five factor-models were possible (Figure 1) (Cattell, 1966) and five components had an eigenvalue greater than 1 (3.8, 1.9, 1.6, 1.3, 1.1) (Kaiser, 1960). These five components explained nearly 65% of the variance. Similarly, the initial PCA solution for the Indian sample also indicated the possibility of a two to five-factor model (Figure 2) and five components also had an eigenvalue greater than 1 (3.2, 2.3, 1.5, 1.3, 1.1). These five components explained about 62% of the variance.

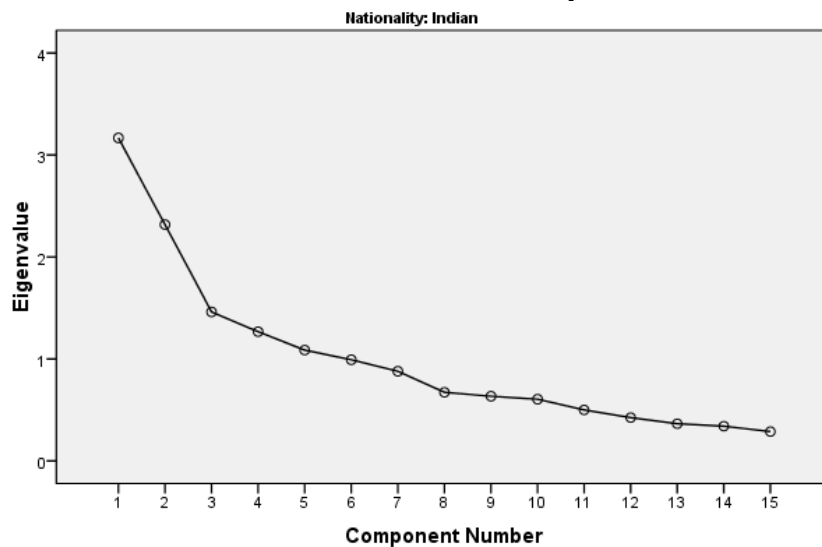
One, 2 and 5-component solutions were assessed in the samples from both countries. One-component solution was assessed to compare it with the original Doherty (1997) study where a one-dimensional solution was suggested. Further, the 2-factor solution was tested as it is theoretically based on the valence of the emotions involved (positive and negative). The 5-factor solution was tested because of the items used in the scale for each of the five emotions of happiness, love, anger, fear and sadness. The variance accounted by the one-component solution was 25.4% in the American sample and 21.1% in the Indian sample. The component loadings for the American sample in the current study ranged from .27 to .65 with a mean loading of .49. Four items had loading less than .4 out of which 2 items each was from happiness and anger (Table 1). The component loadings for the Indian sample in the current study ranged from .14 to .68 with a mean

loading of .43. Six items had loadings less than .4 in the Indian sample including 3 items from the happiness subscale, 2 items from the love subscale and one from the anger subscale (Table 2). The component loadings in the study by Doherty in the US (1997) had ranged from .46 to .69 with a mean loading of .56. Hence, the factor loadings in both American and Indian samples in the present study were not fully concordant with the American ECS from the original study by Doherty.

**Figure 1**  
*Scree Plot in American Sample*



**Figure 2**  
*Scree Plot in Indian Sample*



**Table 3**  
***Subscale Items of ECS in American Sample***

Scales	Number of items	<i>M</i>	<i>SD</i>	Cronbach's alpha
Full ECS	15	3.34	.50	.78
NAF	9	2.98	.61	.72
Anger	3	2.76	.62	.42
Fear	3	2.97	.82	.54
Sadness	3	3.23	.85	.64
PAF	6	3.92	.61	.71
Happiness	3	3.84	.70	.64
Love	3	4.01	.83	.82

**Table 4**  
***Subscale Items of ECS in Indian Sample***

Scales	Number of items	<i>M</i>	<i>SD</i>	Cronbach's alpha
Full ECS	15	3.32	.54	.72
NAF	9	3.01	.69	.73
Anger	3	3.05	.77	.41
Fear	3	3.01	.88	.51
Sadness	3	3.02	.97	.57
PAF	6	3.80	.71	.68
Happiness	3	3.93	.77	.57
Love	3	3.67	1.04	.78

**Table 5**  
***US: 2-Factor Model (Promax Rotation)***

ECS items	Factor 1	Factor 2
8 (Fear)	<b>.66</b>	.33
13 (Fear)	<b>.65</b>	-.02
15 (Fear)	<b>.63</b>	.01
10 (Anger)	<b>.59</b>	-.07
5 (Anger)	<b>.58</b>	.34
11 (Happiness)	<b>.55</b>	.44
14 (Sadness)	<b>.55</b>	.32
4 (Sadness)	<b>.49</b>	.35
1 (Sadness)	<b>.43</b>	.31
3 (Happiness)	.35	.27
7 (Anger)	.34	.04
2 (Happiness)	.29	.21
12 (Love)	.19	<b>.84</b>
6 (Love)	.09	<b>.83</b>
9 (Love)	.23	<b>.80</b>

The variances accounted for by the two-factor to the five factor solutions in the American sample were 38.5%, 49.1%, 57.9% and 65.3% respectively. The variances accounted for by the two-component to the five-component solutions in the Indian sample were 36.6%, 46.3%, 54.8% and 62% respectively. In the 2-factor solution for the American sample (Table 5), all items of fear and sadness, 2 items of anger and 1 item of happiness loaded onto factor 1, whereas all of the three items for love loaded onto factor

2. The remaining two items for happiness and one item for anger showed a factor loading less than .4. In the 2-factor solution for the Indian sample (Table 6), all items for sadness and fear loaded onto factor 1 along with one item for anger whereas all the items for love loaded onto factor 2 along with 2 items for happiness. The remaining 2 items for happiness and one item for anger had factor loadings less than .4.

**Table 6**  
***India: 2-Factor Model (Promax Rotation)***

ECS items	Factor 1	Factor 2
1 (Sadness)	<b>.71</b>	.09
4 (Sadness)	<b>.66</b>	.12
15 (Fear)	<b>.62</b>	-.07
10 (Anger)	<b>.59</b>	-.06
8 (Fear)	<b>.59</b>	.05
13 (Fear)	<b>.58</b>	.04
4 (Sadness)	<b>.51</b>	.16
5 (Anger)	.38	.16
7 (Anger)	.37	.12
6 (Love)	-.03	<b>.81</b>
9 (Love)	.17	<b>.77</b>
12 (Love)	-.15	<b>.74</b>
3 (Happiness)	.12	<b>.53</b>
11 (Happiness)	.23	<b>.50</b>
2 (Happiness)	.12	.25

**Table 7**  
***US: 5-Factor Model (Promax Rotation)***

ECS items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
6 (Love)	<b>.85</b>	.10	.18	.14	.01
12 (Love)	<b>.85</b>	.12	.32	.07	.32
9 (Love)	<b>.84</b>	.26	.09	.32	.01
10 (Anger)	.03	<b>.78</b>	.01	.03	.14
5 (Anger)	.43	<b>.72</b>	.13	.16	.12
8 (Fear)	.34	<b>.66</b>	.38	.25	.24
15 (Fear)	.01	<b>.65</b>	.23	.36	.01
13 (Fear)	-.01	<b>.62</b>	.23	.26	.36
11 (Happiness)	.34	.32	<b>.76</b>	.22	.48
2 (Happiness)	.05	.01	<b>.75</b>	.21	.16
3 (Happiness)	.17	.22	<b>.69</b>	.11	-.01
1 (Sadness)	.19	.16	.22	<b>.89</b>	.15
14 (Sadness)	.21	.33	.25	<b>.86</b>	.16
7 (Anger)	.04	.16	.10	.08	<b>.89</b>
4 (Sadness)	.27	.24	.49	.36	.54

For the 5-factor solution in the American sample (Table 7), all of the three items of love loaded onto factor 1 together. Three items of fear and two items of anger loaded

together onto factor 2. The three items of happiness loaded together onto factor 3 and two items of sadness loaded together onto factor 4. Only item of anger and one item of sadness loaded together onto factor 5. In the Indian sample (Table 8), all of the three items of love loaded together onto factor 1; two items of fear and one item of anger and sadness each loaded together onto factor 2. Two items of sadness and one item of anger loaded together onto factor 3 and two items of happiness loaded together onto factor 4. One item each of anger, fear and happiness loaded together onto factor 5.

**Table 8**  
***India: 5-Factor Model (Promax Rotation)***

ECS items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
6 (Love)	<b>.83</b>	-.05	.04	.18	.12
9 (Love)	<b>.82</b>	.16	.19	.07	.16
12 (Love)	<b>.79</b>	.06	-.28	.14	.01
13 (Fear)	.03	<b>.76</b>	.13	.09	.09
14 (Sadness)	.09	<b>.71</b>	.23	.08	.35
15 (Fear)	-.05	<b>.69</b>	.39	-.04	-.02
7 (Anger)	.09	<b>.46</b>	-.09	.07	.41
4 (Sadness)	.13	.16	<b>.77</b>	.08	.19
1 (Sadness)	.06	.60	<b>.60</b>	.11	.17
10 (Anger)	-.10	.38	<b>.57</b>	.04	.25
11 (Happiness)	.29	.22	-.03	<b>.88</b>	.18
2 (Happiness)	.01	-.02	.07	<b>.87</b>	.11
5 (Anger)	.06	.09	.17	.11	<b>.79</b>
8 (Fear)	-.03	.29	.41	.04	<b>.69</b>
3 (Happiness)	.46	.19	-.28	.29	.48

### Discussion

This study measured susceptibility to emotional contagion in two different cultures-US and India- using the ECS. Principal component analysis (PCA) of the ECS was carried out in both cultures to assess the factor loadings within and across the two cultures. Based on the scree plots obtained from the data, 1-, 2-, and 5-factor solutions were compared. The items on the EC Scale are based on measurement of five emotions-happiness, love, anger, fear and sadness. The original study by Doherty (1997) suggested a one-dimensional model. This finding was not supported in the current study especially as the scree plot suggested more than one factor.

The 2-factor solution in both the American and Indian sample was not unequivocal with the PAF (positive affect factor- including happiness, love) and NAF (negative affect factor) items together. Still, most of the positive affect items loaded together and the negative items loaded together in both cultures (with the exception of happiness loading onto the factor 1 in the American sample along with the negative emotion items). There were more than a few items on the emotion subscales in both cultures which had a factor loading less than .4 and could not load clearly onto a single factor. On closer examination of the 5-factor solutions for the EC Scale in the two cultures, it was observed that the picture was not clear-cut even though most of the negative items (fear, anger and sadness) tended to load together onto one or more factors and the positive items (happiness and love) loaded together onto one or more factors. The items for fear, anger and sadness subscales did not consistently load together in either American or Indian

samples. Similarly, items for happiness subscales sometimes loaded together and sometimes they did not.

One major consistent theme observed throughout all of the models in both American and Indian samples in the present study was the loading of the three items of love together onto a single factor. None of the items for the other subscales of happiness, anger, sadness and fear were as consistently loading onto a single factor. There is some evidence for the experience of mixed emotions concurrently within the same individuals, including happiness and sadness (Larsen, McGraw, & Cacciopo, 2001). Diener and Iran-Najad (1986) asked participants in their study to complete emotion ratings during emotional moments in their lives for 6 weeks and they found that even though positive and negative emotions were often mutually exclusive, the co-occurrence of positive and negative emotions was also prevalent. Prevalence of mixed emotions has also been observed across cultures, both individualistic and collectivistic (Miyamoto, Uchida, & Ellsworth, 2010). The evidence of mixed emotions might be associated with the lack of clear loading of the emotions (except love) onto separate factors in the current study across both cultures. However, most of this literature on mixed emotions has not focused on love as one of the emotions (e.g. Larsen & McGraw, 2011).

This consistency and separate loading of the love subscale might be an indication of the relatively easier recognition of love as a discrete emotion in both cultures. Several types of love have been identified including maternal love, platonic love, spiritual love and romantic love (Fehr & Russell, 1991). The items of the love subscale on the ECS (e.g. *'I sense my body responding when the one I love touches me'*; *'When I look into the eyes of the one I love, my mind is filled with thoughts of romance'*) seems to be a measurement of passionate and romantic love. Cross-cultural research has demonstrated the universality of passionate love across most cultures and historical eras (e.g. Hatfield, Rapson & Martel, 2007). Anthropologists have also obtained extensive evidence for the prevalence of romantic love across several tribal societies (Jankowiak & Fischer, 1992). At the same time, expressions of love are found to be more frequent in individualistic than collectivistic cultures as members of the latter cultures are less demonstrative with opinions or feelings (Mesquite, 2001; Ting-Toomey, 1991). However, in the present study, the emphasis of the items of the love sub-scale was on *experience* and not on expression of emotions. The similarity in the loadings of love items together onto a single factor in different models across the two cultures, vastly different on the individualism scale, is probably an indicator of recognition of the emotion of love across these cultures.

One of the limitations of the present study is the inclusion of only young adults in both cultures. The factor loadings for the EC scale could be different with middle-aged or the elderly population in either or both cultures. There is evidence to suggest that older individuals are more likely to pay attention to positive emotions than negative emotions than the younger ones and this is referred to as the positivity effect. It has been observed in both individualistic cultures (e.g. Mather & Carstensen, 2005) and collectivistic cultures (e.g. Ko, Lee, Yoon, Kwon, & Mather, 2011). Hence, there is also the possibility of greater susceptibility of contagion for happiness and love in both of these cultural contexts as measured by the EC Scale for the older individuals. But first it would be important to compare the susceptibility to emotions for the older individuals in both individualistic and collectivistic contexts using the same ECS. The degree of

susceptibility to emotional contagion for happiness, love, anger, sadness and fear may or may not be tapped by the present items of the EC scale.

Further, confirmatory factor analysis (CFA) should be used to establish equivalence for this scale between the two cultures for better cross-cultural generalizability for the construct of emotional contagion. More statistical analyses are needed to compare the factor structure of the ECS in other individualistic and collectivistic cultures.

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