

A SHORT SCALE OF TRAFFIC CLIMATE ACROSS FIVE COUNTRIES

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A Short Scale of Traffic Climate Across Five Countries

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Abstract

The Traffic Climate Scale (TCS) measures the perceptions and attitudes of road users about the given traffic context with three dimensions: external affective demands, functionality, and internal requirements. The TCS was developed in Turkish

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and then translated into several languages. The main aim of the current study was to develop a shorter version of the TCS and to test the factor structures cross-culturally (i.e. Estonia, Greece, Kosovo, Russia, and Turkey). In addition, the five countries were compared in terms of their perceived traffic climate. Confirmatory factor analysis was used to test the fit of the models. The results yielded two different Mini-TCS versions that were developed based on the previous longer versions. The two Mini-TCS versions included 22 items and 16 items respectively. The goodness of fit findings showed that both versions of the Mini-TCS are useful short measures of the TCS in Estonia, Greece, Kosovo, Russia and Turkey. The comparison analyses showed that five countries had both similarities and differences in terms of their traffic climate. To illustrate, Turkey, Greece, and Kosovo had the highest scores in external affective demands and internal requirements dimensions; whereas Kosovo, Russia, and Estonia had the highest scores in functionality dimension in both long and short versions. The findings suggested that both versions of Mini-TCS are effective tools that can be used to understand how road users conceptualize traffic context in these five countries.

Keywords: Traffic Climate Scale, Traffic climate, Road users, Traffic safety

BEŞ ÜLKEDE TRAFİK İKLİMİ İÇİN KISA BİR ÖLÇEK

Öz

Trafik iklim Ölçeği (TİÖ), karayolu kullanıcılarının verilen trafik bağlamına ilişkin algı ve tutumlarını üç boyutta ölçmektedir: dışsal duygusal talepleri, işlevsellik ve iç gereksinimler. TİÖ Türkçe olarak geliştirilmiştir ve farklı dillere çevrilmiştir. Bu çalışmanın temel amacı, TİÖ'nin daha kısa bir versiyonunun geliştirilmesi ve faktör yapılarının kültürlerarası olarak test edilmesidir (Estonya, Yunanistan, Kosova, Rusya ve Türkiye). Ayrıca, beş ülke algılanan trafik iklimi açısından karşılaştırılmıştır. Modellerin uygunluğunu test etmek amacıyla doğrulayıcı faktör analizi kullanılmıştır. Sonuçlar daha önce kullanılan uzun versiyonlar temel alınarak geliştirilen iki farklı Kısa-TİÖ versiyonu önermiştir. İki Kısa-TİÖ versiyonu sırasıyla 22 ve 16 maddeden oluşmaktadır. Uyum dereceleri Kısa-TİÖ'nün her iki versiyonunun da Estonya, Yunanistan, Kosova, Rusya ve Türkiye'de TİÖ'nin kısa etkili bir ölçüm yöntemi olduğunu göstermiştir. Karşılaştırma analizleri, beş ülkenin trafik iklimi açısından hem benzerlik hem de farklılıklara sahip olduğuna işaret etmektedir. Açıklamak gerekirse, Türkiye, Yunanistan ve Kosova dışsal duygu talepleri ve iç gereksinimler boyutlarında en yüksek puanlara sahiptir; Kosova, Rusya ve Estonya, hem uzun hem de kısa versiyonlarında işlevsellik boyutunda en yüksek puanlara sahiptir. Bulgular, Kısa-TİÖ'nin her iki versiyonunun da, karayolu kullanıcılarının bu beş ülkede trafik bağlamını nasıl kavramsallaştırdıklarını anlamak için kullanılacak etkili bir araç olduğunu ortaya koymaktadır.

Anahtar Kelimeler: Trafik İklım Ölçeği, Trafik iklimi, Yol kullanıcıları, Trafik güvenliği

1. Introduction

Each year, 1.25 million people die on the roads due to road traffic injuries and road traffic accidents cost approximately 3% of Gross Domestic Product for governments (World Health Organization [WHO], 2015). When the leading causes of fatalities are listed, road traffic injuries are the ninth cause. Based on the estimations, it will be the seventh leading cause of fatalities by 2030 (WHO, 2015).

Road traffic injuries and fatalities show variances among countries and regions (see Figure 1; WHO, 2016). The findings in the literature support the differences among countries in traffic context (e.g. Lajunen, Parker, & Summala, 2004; Özkan, Lajunen, Chliaoutakis, Parker, & Summala, 2006; Solmazer et al., under review; Warner, Özkan, Lajunen, & Tzamalouka, 2011). Traffic context that a road user mostly uses and is exposed to might have a close relationship with his/her behaviors in traffic. Different research illustrate that driver behaviors show variances among different countries/cultures (e.g. Lajunen et al., 2004; Özkan et al., 2006; Warner et al., 2011). In addition to drivers, pedestrian behaviors (Solmazer et al., under review) and bicyclist behaviors (Osberg, Stiles, & Asare, 1998) also show differences between countries. One of the possible explanations for the differences among road users' (e.g. bicyclists, drivers, and pedestrian) behaviors across countries might be about the existence of differences in perceived traffic climate of their countries. Traffic climate is described as "the road users' (e.g. drivers') attitudes and perceptions of the traffic in a context (e.g. country) at a given point in time" (Özkan & Lajunen, 2015). Hence, traffic climate is not only about perceptions of drivers, but it is about the perceptions of all road users (e.g. passengers, bicyclists, pedestrians, motorcyclists).

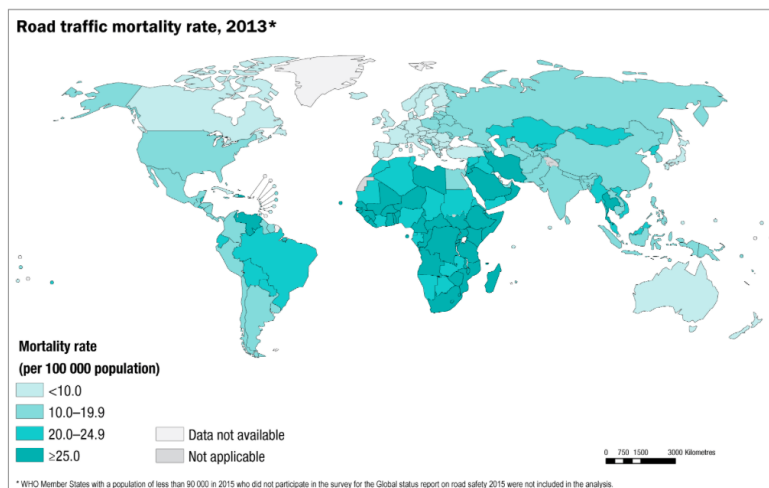


Figure 1.1 World map in road traffic injury mortality rates (WHO, 2016)

Authorities of different countries all over the world make a lot of attempts to improve road safety, such like interventions, education programs, campaigns, enforcements, etc. In addition to the stated attempts, the inclusion of traffic safety climate into agenda can be considered as a need to improve road safety (Gehlert, Hagemester, & Özkan, 2014). Traffic Climate Scale (TCS) is important to focus on traffic climate of countries. Related with the topic, studies have started to focus on the relationship between traffic climate and traffic related outcomes (e.g. driver behaviors, number of accidents) (Özkan & Lajunen, 2015).

The TCS was developed in Turkish, and then translated into several languages to be used in different countries. The TCS was translated into German (Gehlert et al., 2014), by using forward and back-translation. The factor analysis results also provided same three-factor structure with remaining 41 items: external affective demands, functionality, and internal requirements. External affective demands dimension is about emotional engagement that is required by road users. Internal requirements include skills and abilities of road users that are required while participating in traffic. Functionality dimension includes characteristics of safety and mobility as well as requirements for a functional traffic system (Gehlert et al., 2014). The TCS was also translated into Chinese (Chu, Wu, Atombo, Zhang, & Özkan, 2018) by using forward and back-translation procedure. The scale included 44 items adapted from the scales in Gehlert et al. (2014). Similar to the previous studies, the factor analysis results yielded the same three-factor structure.

When the item loadings of the factors were compared, it was seen that some items loaded on different factors, whereas there were also stable ones across different cultures. Based on the both stable items and different item loadings, it can be suggested that, country-specific solutions have been developed for the TCS. The 44 items might be helpful to describe the traffic climate in a given country. However, it must be mentioned that the differences in items of the factors might show that road users perceive some adjectives and/or statements differently across different cultures. Additionally, although the items of the TCS are not too long, it might be difficult to answer them since the items include both adjectives and statements, which requires an evaluation about the traffic context. Taking into account all above-mentioned, a shorter version of TCS might be helpful to compare traffic climate of different cultures with a more stable factor structure with similar items.

In the literature, studies focused on the relationships between traffic climate and driver behaviors (Chu et al., 2018; Gehlert et al., 2014), and also risk perception of pedestrians and cyclists (Gehlert et al., 2014). Taken together, it might be inferred that traffic climate and road user behaviors are related. Higher external demands, less functionality, and less internal requirements were related to higher numbers of aberrant driver behaviors (Chu et al., 2018; Gehlert et al., 2014). Similar relationships were reported for cyclists and pedestrians; suggesting that, as traffic climate was perceived more emotionally demanding and less functional, road users perceived

traffic context riskier (Gehlert et al., 2014). In another study that was conducted in both Turkey and China, results suggested that perceived traffic climate and driver behaviors had relationships in both similar and different patterns. In both cultures, as traffic climate was perceived more externally demanding, the frequency of aberrant driver behaviors (i.e. violations and errors) increased and the frequency of positive driver behaviors decreased. Functionality was negatively related to violations only in Turkey and internal requirements dimension was negatively related to violations in China (Üzümcüoğlu, Özkan, Hu, & Zhang, 2019).

The main aim of the current study was to develop a more stable and shorter version of the TCS and to test the factor structures cross-culturally, because it gives an opportunity to compare results from different countries and also to combine the TCS with other measures. Five countries took place in this study: Estonia, Greece, Kosovo, Russia, and Turkey. The road traffic fatality rates per 100 000 population was 7 for Estonia (WHO, 2015), 9.1 for Greece (WHO, 2015), 7.4 for Kosovo (Ramadani, 2017), 18.9 for Russia (WHO, 2015), and 8.9 for Turkey (WHO, 2015). Since the TCS is for all road user groups, the analyses were conducted with samples including different road user groups (i.e. bicyclists, car drivers, car passengers, public transportation users, motorcyclists, and pedestrians). The other aim of the current study was to examine the similarities and differences in the traffic climate perceptions of road users across the stated five countries.

2. Method

2.1. Procedure

The data was collected as a part of Traffic Safety Culture (TraSaCu: <http://www.trasacu.eu>) project, which aims to improve the cultural approach in road traffic safety research. Before the data collection procedure, ethical permission was taken from Middle East Technical University Ethics Committee. After the approval, the questionnaire package was distributed to the partners. Partners were responsible for the translation of the questionnaire package into their own languages and data collection in their countries. For all the translations, forward and back translation method was used.

2.2. Participants

There were participants from five different countries (i.e. Estonia, Greece, Kosovo, Russia, and Turkey). The numbers of participants were 155, 336, 163, 204, and 179 for Estonia, Greece, Kosovo, Russia, and Turkey, respectively. In Estonia and Turkey, the percentage of male and female participants was almost equal; whereas in other countries male participants were dominant. The details of the demographic information of participants for each country were presented in Table 2.1.

Table 2.1. Demographic Characteristics of the Participants

		Estonia	Greece	Kosovo	Russia	Turkey
Total		155	336	163	204	179
Female						
	N	81	128	47	53	95
	%	52.3	38.1	28.8	26	53.1
Male						
	N	74	208	116	151	84
	%	47.7	61.9	71.2	74	46.9
Age						
	M	47.39	41.96	34.90	22.31	27.77
	SD	13.63	10.25	11.71	6.27	8.64
	Min-Max	24-76	18-72	18-72	17-57	19-64

The sample consisted of all road user groups, including public transportation users, pedestrians, car drivers, car passengers, cyclists, and motorcyclists. The participants were assigned to road users groups based on the information of how frequently they use the stated transportation types. The participants who declared that they use the stated travel mode choice at least once in a week were assigned to that road user group. The distributions of road user types among countries were presented in Table 2.2. The descriptive results of travel mode choices show that being pedestrian and car driver were the most frequently used travel mode in majority of the five countries. It should be noted that one participant might be assigned to more than one group based on how frequently they use the travel modes. In Table 2.3, the correlations between the frequencies of travel mode choices for five countries were presented separately.

2.3. Measurements

2.3.1. Demographic information

The participants answered questions about their age, gender, and the frequency of their travel mode choices. The travel mode choices included public transportation user, pedestrian, car driver, car passenger, cyclist and motorcyclist. They answered the items on a scale from 1 to 5 (1 = never; 2 = once in a week; 3 = 2-3 times in a week; 4 = 4-5 times in a week; 5 = everyday).

2.3.2. Traffic Climate Scale

The Traffic Climate Scale (TCS) was developed by Özkan and Lajunen (2011). The original scale is consisted of 44 items including adjectives or statements, which characterize traffic context. The scale was translated into Estonian, Greek, Albanian, and Russian using forward and back-translation by different translators. The participants responded to items on a 6-point Likert type scale (1= does not describe at all to 6 = described it fully).

Table 2.2. Frequency of Travel Mode Choice for Countries

	Estonia		Greece		Kosovo		Russia		Turkey	
	Non user	User	Non user	User	Non user	User	Non user	User	Non user	User
Public transportation										
N	35	120	191	145	82	81	53	131	38	141
%	22.6	77.4	56.8	43.2	50.3	49.7	26	74	21.2	78.8
Pedestrian										
N	6	149	37	299	12	151	15	189	16	163
%	3.9	96.1	11	89	7.4	92.6	7.4	92.6	8.9	91.1
Car driver										
N	17	138	15	321	19	144	64	140	73	106
%	11	89	4.5	95.5	11.7	88.3	31.4	68.6	40.8	59.2
Car passenger										
N	49	106	96	240	32	131	22	182	38	141
%	31.6	68.4	28.6	71.4	19.6	80.4	10.8	89.2	21.2	78.8
Cyclist										
N	93	62	230	106	111	52	126	78	134	45
%	60	40	68.5	31.5	68.1	31.9	61.8	38.2	74.9	25.1
Motorcyclist										
N	147	8	235	101	140	23	162	42	167	12
%	94.8	5.2	69.9	30.1	85.9	14.1	79.4	20.6	93.3	6.7

In the literature, there are two different factor structure types of the same TCS, provided by Gehlert et al (2014) and Chu et al. (2018). Although the number of factors and their contents are the same, the number of items under the factors shows differences. In the German sample (Gehlert et al, 2014), external affective demands factor has 12 items, functionality factor has 8 items, and internal requirements factor has 10 items. In total, this version has 38 items. In the Chinese sample (Chu et al., 2018), external affective demands factor has 17 items, functionality factor has 12 items, and internal requirements factor has 9 items. In total, this version has 30 items.

2.4. Statistical analyses

The Estonian, Greek, Kosovar, Russian, and Turkish samples were used for Confirmatory Factor Analyses (CFA) and Analysis of Covariance (ANCOVA). CFA were

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conducted by using EQS and ANCOVA were conducted by using SPSS. The CFA was carried out to test the fitness of the two different factor structure types of the TCS (taken from Chu et al, 2018 and Gehlert et al, 2014) in the five countries. In

Table 2.3. Correlations between the Frequencies of Travel Mode Choices

	1	2	3	4	5
Estonia					
1. Public transportation	1				
2. Pedestrian	.28**	1			
3. Car driver	-.68**	-.30**	1		
4. Car passenger	.16*	.15	-.07	1	
5. Cyclist	.00	.15	-.06	.02	1
6. Motorcyclist	.04	.06	.10	-.02	.28**
Greece					
1. Public transportation	1				
2. Pedestrian	.40**	1			
3. Car driver	-.27**	-.13*	1		
4. Car passenger	.08	.10	-.09	1	
5. Cyclist	.03	.07	-.19**	-.03	1
6. Motorcyclist	-.18**	-.20**	-.25**	-.10	.23**
Kosovo					
1. Public transportation	1				
2. Pedestrian	.33**	1			
3. Car driver	-.40**	-.22**	1		
4. Car passenger	.25**	.23**	.03	1	
5. Cyclist	.11	.09	-.08	.08	1
6. Motorcyclist	-.02	-.11	-.03	-.00	.15
Russia					
1. Public transportation	1				
2. Pedestrian	.54**	1			
3. Car driver	-.47**	-.32**	1		
4. Car passenger	.49**	.45**	-.15*	1	
5. Cyclist	.27**	.13	-.09	.25**	1
6. Motorcyclist	.20**	.08	.21**	.27**	.49**
Turkey					
1. Public transportation	1				
2. Pedestrian	.40**	1			
3. Car driver	-.60**	-.53**	1		
4. Car passenger	.19*	.15*	-.10	1	
5. Cyclist	-.01	.03	-.14	-.02	1
6. Motorcyclist	.04	-.02	.07	.12	.26**

Note: ** p<.01; * p<.05

order to test the fitness of the models, several fit indexes were evaluated: χ^2 /degree of freedom ratio, root mean square error of approximation (RMSEA), comparative fit index (CFI), and standardized root mean square residual (SRMR). Based on the literature, a model with a good fit should have 2:1 or 5:1 χ^2 /degree of freedom ratio, RMSEA <.08 or .10, CFI >.90, and SRMR <.08 or .10 (Hu & Bentler, 1999; Russel, 2002; Schermelleh-Engel, Moosbrugger & Müller, 2003). After conducting CFA for the two different factor structures of TCS, the items with highest loading in five different countries were selected to develop a mini-TCS. To test the fitness of the new model (i.e. mini-TCS), the same fit indexes were used. Cronbach's alpha reliability coefficients were also calculated to examine the internal consistency of the TCS subscale scores for each model. ANCOVA was conducted to test the differences between countries on the TCS items, and subscales of the four versions of the TCS. Hence, all items and subscales of TCS were compared among the five countries. In all analyses, the effects of age and gender were controlled.

3. Results

The aim of the current study was to develop a shorter version of the TCS by reducing the 44-item original TCS (Özkan & Lajunen, 2011) to a Mini-TCS with as few items as possible. In the literature, there are two validated versions of the TCS. Both studies (Chu et al., 2018; Gehlert et al., 2014) used the same scale; however, the number of items under three factors showed differences. The Chinese version has 38 items (after the factor analysis) and the German version has 30 items (after the factor analysis). Mini-TCS of both 38 item and 30 item versions (22 item and 16 item, respectively) were tested in the scope of the present study.

3.1. Development of Mini-TCS

3.1.1 Confirmatory factor analysis – 38 items

A set of CFAs was carried out to test the fit of 38-item three-factor model of TCS (Chu et al., 2018) in the five countries. The model used in CFA was shown schematically for the Turkish sample (see Figure 3.1). The same 38-item model was conducted for the other four countries (i.e. Estonia, Greece, Kosovo, and Russia). As presented in Figure 3.1, traffic climate can be explained by three inter-correlated factors including 38 items. Each observed variable loaded only on one of the factors. Item 1, 4, 5, 7, 8, 9, 11, 17, 18, 19, 25, 28, 29, 31, 35, 36, and 43 loaded on external affective demands factor (17 items). Item 20, 21, 22, 23, 24, 26, 27, 34, 37, 38, 39, and 40 loaded on functionality factor (12 items). Items 10, 12, 13, 14, 16, 30, 32, 33, and 42 loaded on internal requirements factor (9 items). Measurement errors related to each observed variable were uncorrelated in the model (see Figure 3.1). The item loadings of 38 items for five countries and the fit indices were presented in Table 3.1. To illustrate, in the Turkish sample, the item loadings for the 17 items on the external affective demands factor ranged from .08 to .91. The item loadings for the 12 items on the functionality factor ranged from .48 to .87. The item loadings for the nine items on the internal requirements factor ranged from .06 to .84 (see Table 3.1 for the factor loadings of all samples). As presented in Table 3.1, all fit indexes

were acceptable except for CFI. The results from Turkish and Greek sample had relatively better goodness of fit scores than Estonian, Kosovar, and Russian samples. The results indicated that item 31 (making irritated) in external affective demands factors, item 39 (functional) in functionality, and item 12 (requiring cautiousness) in internal requirements were among the items with highest loadings in all five countries.

3.1.2. Confirmatory factor analysis – 30 items

A series of CFAs was run to test the fit of the 30-item three-factor model of the TCS (Gehlert et al., 2014). The model used in CFA is shown schematically for the Turkish sample (see Figure 3.2). The same 30-item model was conducted for the other four countries (i.e. Estonia, Greece, Kosovo, and Russia). As presented in Figure 3.2, traffic climate can be explained by three inter-correlated factors including 30 items. Each observed variable loaded only on one of the factors. Item 4, 5, 7, 8, 9, 11, 17, 25, 29, 31, 35, and 36 loaded on external affective demands factor (12 items). Item 20, 24, 26, 34, 37, 38, 39, and 40 loaded on functionality factor (8 items). Items 10, 12, 14, 15, 16, 18, 23, 32, 41, and 42 loaded on internal requirements factor (10 items). Measurement errors related to each observed variable were uncorrelated in the model (see Figure 3.2). The item loadings of 30 items for five countries and the fit indices are presented in Table 3.2. To illustrate, in the Turkish sample, the item loadings for the 12 items on the external affective demands factor ranged from .08 to .88. The item loadings for the eight items on the functionality factor ranged from .47 to .86. The item loadings for the 10 items on the internal requirements factor ranged from .03 to .81 (see Table 3.2 for the factor loadings of all samples). As presented in Table 3.2, RMSEA and χ^2 /degree of freedom ratio showed good fit indexes; however, the values of CFI were lower and SRMR were higher than the cut-off values.

Table 3.1. *The Results of Confirmatory Factor Analyses of 38-Item Three Factor Solution: Item Loadings, Alpha Values, Fit Indexes, Chi Square, and Degree of Freedom Values Across the Five Countries*

Item No. and factor	Estonia	Greece	Kosovo	Russia	Turkey
<i>External affective demands (EAD)</i>					
TCS1	.71	.63	.73	.59	.85
TCS4	.78	.67	.77	.76	.84
TCS5	.19	-.06	.57	.81	.15
TCS7	.77	.64	.75	.81	.82
TCS8	-.09	.15	.42	.45	-.08
TCS9	.37	.54	.44	.48	.63
TCS11	.48	.36	.39	.55	.46
TCS17	.44	.49	.38	.55	.65
TCS18	.22	-.29	.27	.66	.52
TCS19	.82	.77	.78	.73	.82

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TCS25	.59	.75	.73	.60	.64
TCS28	.84	.80	.72	.75	.91
TCS29	.75	.82	.76	.67	.85
TCS31	.88	.84	.83	.76	.90
TCS35	.38	.57	.69	.60	.66
TCS36	.77	.75	.64	.63	.85
TCS43	.73	.71	.56	.67	.80
Cronbach alpha	.90	.87	.91	.93	.92
<i>Functionality (FUNC)</i>					
TCS20	.45	.51	.64	.14	.66
TCS21	-.04	.53	.60	.14	.64
TCS22	.33	.56	.68	.57	.63
TCS23	.68	.68	.61	.47	.85
TCS24	.62	.73	.77	.66	.87
TCS26	.32	.29	.53	.32	.63
TCS27	.26	.55	.67	.11	.62
TCS34	.56	.63	.60	.51	.48
TCS37	.50	.68	.23	.66	.71
TCS38	.76	.58	.68	.75	.75
TCS39	.74	.70	.76	.80	.75
TCS40	.75	.57	.76	.68	.58
Cronbach alpha	.79	.86	.89	.81	.91
<i>Internal requirements (IR)</i>					
TCS10	.72	.74	.74	.77	.82
TCS12	.78	.70	.72	.83	.83
TCS13	.83	.65	.78	.77	.78
TCS14	.83	.31	.28	.81	.58
TCS16	.41	.18	.24	.31	.58
TCS30	.68	.72	.75	.69	.77
TCS32	.78	.87	.81	.76	.84
TCS33	.76	.73	.80	.81	.68
TCS42	.14	.13	.29	.54	.06
Cronbach alpha	.86	.75	.82	.89	.84
χ^2 (df=662)	1577.71	1781.56	1847.22	2125.64	1276.48
RMSEA	.09	.07	.10	.10	.07
CFI	.71	.80	.68	.68	.87
SRMR	.12	.08	.13	.15	.08
<i>Correlations</i>					
EAD-FUNC	-.26	-.34	-.01	.19	-.68
EAD-IR	.70	.81	.77	.72	.84
FUNC-IR	.05	-.19	.27	.50	-.49

Note: A good fit model in general should have: 2:1 or 5:1 χ^2 /degree of freedom ratio, RMSEA <.10, CFI >.90, SRMR <.10.

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Similar to the first version of the TCS, in the second version, the results from Turkish and Greek sample had relatively better goodness of fit scores than Estonian, Kosovar, and Russian samples. The results indicated that item 31 (making irritated) in external affective demands factors, item 38 (safe) and item 39 (functional) in functionality, and item 10 (requiring you on the alert), item 12 (requiring cautiousness), and item 32 (requiring vigilance) in internal requirements were among the items with highest loadings in all five countries.

3.1.3. Confirmatory factor analysis – Mini TCS – 22 items

After conducting CFA for 38 items version of TCS for the five countries, the items with highest loadings (loadings higher than .40 in all of the five countries) on the factors were taken to develop a mini-TCS. The mini-TCS based on 38-item version includes 22 items. The model used in CFA was shown schematically for the Turkish sample (see Figure 3.3). The same 22-item model was conducted for the other four countries (i.e. Estonia, Greece, Kosovo, and Russia). As presented in Figure 3.3, traffic climate can be explained by three inter-correlated factors including 22 items. Each observed variable loaded only on one of the factors. Item 1, 4, 7, 19, 25, 28, 29, 31, 36, and 43 loaded on external affective demands factor (10 items). Item 23, 24, 34, 38, 39, and 40 loaded on functionality factor (6 items). Items 10, 12, 13, 30, 32, and 33 loaded on internal requirements factor (6 items). Measurement errors related to each observed variable were uncorrelated in the model (see Figure 3.3). The CFA results showed acceptable fit indexes. The item loadings of 22 items for five countries and the fit indexes were presented in Table 3.3. To illustrate, in the Turkish sample, the item loadings for the 10 items on the external affective demands factor ranged from .64 to .91. The item loadings for the six items on the functionality factor ranged from .46 to .89. The item loadings for the six items on the internal requirements factor ranged from .67 to .84 (see Table 3.3 for the factor loadings of all samples). The results indicated that item 29 (chaotic) and item 31 (making irritated) in external affective demands factors, item 39 (functional) in functionality, and item 32 (requiring vigilance) in internal requirements were among the items with highest loadings in all five countries.

3.1.4. Confirmatory factor analysis – Mini TCS – 16 items

After conducting CFA for 30 items version of TCS for the five countries, the items with highest loadings (loadings higher than .40 in all five countries) on the factors were identified to develop a mini-TCS. The mini-TCS based on 38-item version includes 16 items. The model used in CFA was shown schematically for the Turkish sample (see Figure 3.4). The same 16-item model was conducted for the other four countries (i.e. Estonia, Greece, Kosovo, and Russia). As presented in Figure 3.4, traffic climate can be explained by three inter-correlated factors including 16 items. Each observed variable loaded only on one of the factors. Item 4, 7, 9, 25, 29, 31, 35, and 36 loaded on external affective demands factor (8 items). Item 24, 34, 38, 39, and 40 loaded on functionality factor (5 items). Items 10, 12, and 32 loaded on internal requirements factor (3 items). Measurement errors related to each observed

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variable were uncorrelated in the model (see Figure 3.4). The CFA results showed acceptable fitness indexes. The item loadings of 16 items for five countries and the fit indexes were presented in Table 3.4. To illustrate, in the Turkish sample, the item loadings for the eight items on the external affective demands factor ranged from .62 to .88. The item loadings for the five items on the functionality factor ranged from .45 to .84. The item loadings for the three items on the internal requirements factor ranged from .81 to .87 (see Table 3.4 for the factor loadings of all samples). The results indicated that item 31 (making irritated) in external affective demands factors, item 39 (functional) in functionality, and all items of internal requirements, namely item 10 (requiring you on the alert), item 12 (requiring cautiousness) and item 32 (requiring vigilance) were among the items with highest loadings in all five countries.

Table 3.2. *The Results of Confirmatory Factor Analyses of 30-Item Three Factor Solution: Item Loadings, Alpha Values, Fit Indexes, Chi Square, and Degree of Freedom Values Across the Five Countries*

Item No. and factor	Estonia	Greece	Kosovo	Russia	Turkey
<i>External affective demands</i>					
TCS4	.76	.65	.75	.79	.83
TCS5	.23	-.06	.56	.84	.14
TCS7	.75	.66	.76	.85	.82
TCS8	-.06	.17	.45	.49	-.08
TCS9	.41	.55	.45	.48	.64
TCS11	.52	.38	.40	.57	.48
TCS17	.49	.49	.38	.50	.65
TCS25	.60	.75	.73	.56	.65
TCS29	.74	.80	.76	.61	.85
TCS31	.88	.85	.83	.72	.88
TCS35	.40	.58	.71	.59	.66
TCS36	.75	.76	.70	.59	.85
Cronbach alpha	.85	.83	.88	.89	.87
<i>Functionality</i>					
TCS20	.43	.46	.53	.10	.59
TCS24	.56	.62	.67	.63	.86
TCS26	.27	.25	.41	.30	.62
TCS34	.55	.60	.49	.49	.47
TCS37	.46	.62	.13	.67	.74
TCS38	.77	.67	.78	.79	.79
TCS39	.78	.82	.90	.82	.78
TCS40	.79	.67	.87	.70	.61
Cronbach alpha	.81	.80	.83	.79	.87
<i>Internal requirements</i>					

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TCS10	.75	.78	.72	.80	.81
TCS12	.86	.71	.68	.85	.80
TCS14	.80	.30	.32	.79	.54
TCS15	.51	.11	.49	.71	-.03
TCS16	.34	.17	.24	.27	.65
TCS18	.32	-.18	.47	.42	.49
TCS23	.09	-.19	.47	.63	-.58
TCS32	.73	.84	.76	.74	.79
TCS41	.53	.24	.48	.69	-.05
TCS42	.23	.13	.39	.58	.03
Cronbach alpha	.78	.61	.76	.88	.61
χ^2 (df=402)	1059.47	1457.32	1277.50	1189.38	1044.71
RMSEA	.10	.09	.12	.10	.10
CFI	.67	.72	.64	.75	.79
SRMR	.14	.11	.14	.13	.11
<i>Correlations</i>					
EAD-FUNC	-.24	-.30	-.17	.12	-.70
EAD-IR	.54	.77	.67	.67	.92
FUNC-IR	.21	-.20	.28	.45	-.62

Note: A good fit model in general should have: 2:1 or 5:1 χ^2 /degree of freedom ratio, RMSEA < .10, CFI > .90, SRMR < .10.

Table 3.3. The Results of Confirmatory Factor Analyses of 22-Item Three Factor Solution: Item Loadings, Alpha Values, Fit Indexes, Chi Square, and Degree of Freedom Values Across the Five Countries

Item No. and factor	Estonia	Greece	Kosovo	Russia	Turkey
<i>External affective demands</i>					
TCS1	.85	.63	.74	.58	.84
TCS4	.85	.68	.78	.71	.84
TCS7	.84	.64	.75	.78	.83
TCS19	.82	.78	.78	.74	.83
TCS25	.63	.75	.75	.61	.64
TCS28	.92	.80	.73	.78	.91
TCS29	.85	.81	.76	.71	.84
TCS31	.91	.85	.83	.79	.89
TCS36	.85	.74	.61	.65	.85
TCS43	.79	.71	.53	.66	.79
Cronbach alpha	.93	.92	.92	.91	.96
<i>Functionality</i>					
TCS23	.83	.56	.36	.42	.84
TCS24	.91	.62	.65	.64	.89
TCS34	.44	.56	.47	.49	.46

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TCS38	.77	.71	.78	.74	.76
TCS39	.74	.84	.92	.85	.76
TCS40	.58	.65	.87	.71	.58
Cronbach alpha	.84	.82	.85	.80	.86
<i>Internal requirements</i>					
TCS10	.83	.73	.76	.76	.84
TCS12	.83	.70	.73	.81	.84
TCS13	.76	.64	.78	.73	.78
TCS30	.74	.73	.75	.70	.76
TCS32	.84	.87	.81	.78	.84
TCS33	.65	.72	.80	.84	.67
Cronbach alpha	.89	.87	.90	.90	.91
χ^2 (df=206)	373.80	608.92	476.60	574.08	382.99
RMSEA	.07	.08	.09	.09	.07
CFI	.94	.90	.88	.85	.94
SRMR	.05	.05	.09	.10	.05
<i>Correlations</i>					
EAD-FUNC	-.74	-.32	-.24	.12	-.72
EAD-IR	.82	.82	.75	.68	.83
FUNC-IR	-.55	-.21	.06	.48	-.52

Note: A good fit model in general should have: 2:1 or 5:1 χ^2 /degree of freedom ratio, RMSEA <.10, CFI > .90, SRMR <.10.

3.2. Comparison of the five countries on the TCS items and sub-scales

In order to examine the differences between the five countries (i.e. Estonia, Greece, Kosovo, Russia, and Turkey), a series of ANCOVA was conducted for the items of the original 44-item version of the TCS (see Table 3.5). The results of ANCOVA showed that there are significant differences between countries on 44 items of the TCS. The seven items with highest partial Eta square are item 1 (dangerous), item 3 (complicated), item 7 (stressful), item 19 (causing tension), item 25 (putting pressure on you), item 29 (chaotic), and item 31 (making irritated). In the stated seven items, Estonia and/or Russia had the lowest scores, and Greece and/or Turkey had the highest scores. When the patterns among countries for all items of the scale were evaluated, three important points might be suggested. Firstly, in 31 items Estonian and Russian samples did not show significant differences in their traffic climate. Secondly, in 27 items Greek and Turkish samples did not show significant differences in their traffic climate. Lastly, in 24 items, Kosovar sample showed significant differences from the other four samples.

Additionally, the differences between the five countries on the subscales of the four versions were also examined. The first and second versions were longer scales with 38 and 30 items, respectively. The third and fourth versions were the Mini-TCS newly developed based on the previous versions, including 22 and 16 items, respectively.

Table 3.4. The Results of Confirmatory Factor Analyses of 16-Item Three Factor Solution: Item Loadings, Alpha Values, Fit Indexes, Chi Square, and Degree of Freedom Values Across the Five Countries

Item No. and factor	Estonia	Greece	Kosovo	Russia	Turkey
<i>External affective demands</i>					
TCS4	.77	.64	.75	.73	.83
TCS7	.78	.66	.76	.82	.83
TCS9	.37	.54	.41	.45	.62
TCS25	.58	.75	.73	.61	.65
TCS29	.72	.80	.76	.65	.85
TCS31	.88	.86	.84	.77	.88
TCS35	.39	.58	.71	.62	.66
TCS36	.75	.76	.66	.64	.85
Cronbach alpha	.86	.88	.89	.86	.92
<i>Functionality</i>					
TCS24	.53	.55	.63	.62	.84
TCS34	.52	.52	.45	.47	.45
TCS38	.78	.71	.78	.75	.78
TCS39	.81	.90	.93	.85	.82
TCS40	.79	.66	.87	.72	.64
Cronbach alpha	.81	.80	.86	.81	.83
<i>Internal requirements</i>					
TCS10	.78	.78	.82	.82	.87
TCS12	.80	.71	.73	.83	.87
TCS32	.78	.85	.77	.75	.81
Cronbach alpha	.83	.83	.81	.81	.88
χ^2 (df=101)	253.51	292.29	235.87	254.45	190.36
RMSEA	.10	.08	.09	.09	.07
CFI	.87	.92	.90	.89	.95
SRMR	.08	.05	.08	.07	.05
<i>Correlations</i>					
EAD-FUNC	-.26	-.29	-.25	.10	-.68
EAD-IR	.61	.78	.74	.63	.82
FUNC-IR	.10	-.18	-.01	.40	-.51

Note: A good fit model in general should have: 2:1 or 5:1 χ^2 /degree of freedom ratio, RMSEA <.10, CFI >.90, SRMR <.10.

The ANCOVA results of the four versions (i.e. 38 item, 30 item, 22 item, and 16 item versions) yielded that Estonia and/or Russia had the lowest scores for external affective demands score, whereas Greece and/or Turkey had the highest scores. In the functionality factor, Greece and/or Turkey had the lowest scores; whereas Estonia, Kosovo, and/or Russia had the highest scores. In the internal requirements factor, Estonia and Russia had the lowest scores; whereas Greece and Turkey had the highest scores. When the patterns in differences for the three factors

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were investigated, the rankings in external affective demands and internal requirements were similar, and in the functionality dimension, it was in the opposite direction. The results were presented in Table 3.6, 3.7, 3.8, and 3.9.

Table 3.5. *The Means of the TCS Items After Controlling for the Effects of Age and Gender, and ANCOVA Results in the Five Countries*

		Estoni a	Greec e	Kosov o	Russi a	Turke y	F	η^2 p
1	Dangerous	3.14 ^a	5.14 ^b	4.21 ^c	3.37 ^a	5.19 ^b	130.11** *	.34
2	Dynamic	3.61 ^a	4.01 ^b	4.56 ^c	3.36 ^a	4.66 ^c	31.37***	.11
3	Complicated	2.96 ^a	4.57 ^b	4.41 ^b	2.94 ^a	5.27 ^c	118.96** *	.32
4	Aggressive	3.51 ^a	5.22 ^b	4.30 ^c	3.40 ^a	5.16 ^b	104.04** *	.29
5	Exciting	2.46 ^a	2.44 ^a	3.65 ^b	3.37 ^b	3.30 ^b	25.84***	.09
6	Fast	3.35 ^a	4.20 ^b	4.16 ^b	3.48 ^a	4.56 ^b	25.18***	.09
7	Stressful	3.63 ^a	5.12 ^b	4.56 ^c	3.17 ^d	5.57 ^e	132.95** *	.34
8	Monotonous	2.91 ^a	2.76 ^a	3.68 ^b	2.78 ^a	2.70 ^a	16.26***	.06
9	Depend on luck	2.37 ^a	4.21 ^b	3.59 ^c	2.54 ^a	4.52 ^b	95.08***	.27
10	Requiring you on the alert	4.47 ^a	5.55 ^b	4.97 ^c	4.43 ^a	5.52 ^b	51.29***	.17
11	Depends on fate	2.02 ^a	3.28 ^b	3.50 ^b	3.69 ^b	4.30 ^c	28.96***	.10
12	Requiring cautiousness	4.23 ^a	5.65 ^b	4.89 ^c	4.33 ^a	5.65 ^b	72.29***	.22
13	Requiring experience	4.25 ^a	5.25 ^b	4.81 ^c	4.35 ^a	5.49 ^b	43.41***	.14
14	Requiring quickness	4.16 ^{ab}	3.82 ^a	3.05 ^c	4.36 ^b	5.18 ^d	47.29***	.16
15	Requiring you obey rules	4.77 ^a	4.03 ^b	4.53 ^{ac}	4.59 ^a	4.11 ^{bc}	9.68***	.04
16	What you done becomes a benefit to you	3.10 ^{ab}	3.65 ^c	3.47 ^{ac}	2.99 ^b	4.68 ^d	27.56***	.10

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17	Giving a feeling that you are worthless	2.61 ^a	3.88 ^b	3.33 ^c	2.68 ^a	4.50 ^d	49.00 ^{***}	.16
18	Mobile	3.35 ^a	2.36 ^b	3.95 ^c	3.15 ^a	4.85 ^d	97.33 ^{***}	.27
19	Causing tension	3.55 ^a	4.95 ^b	4.31 ^c	3.06 ^d	5.49 ^e	120.42 ^{**}	.32
20	Including preventive measures	3.10 ^{ab}	2.46 ^c	3.53 ^a	3.05 ^b	3.07 ^b	19.61 ^{***}	.07
21	Under enforcement	2.59 ^{ab}	2.36 ^a	3.59 ^c	2.30 ^b	2.66 ^{ab}	26.68 ^{***}	.09
22	Travel easily from place to place	2.98 ^a	3.23 ^{ab}	3.44 ^{bc}	3.69 ^c	2.92 ^a	8.67 ^{***}	.03
23	Depend on mutual consideration	2.97 ^a	2.02 ^b	3.51 ^c	3.94 ^d	2.23 ^b	85.01 ^{***}	.25
24	Planned	3.42 ^a	2.36 ^b	3.06 ^a	3.42 ^a	2.36 ^b	38.39 ^{***}	.13
25	Putting pressure on you	3.03 ^a	4.77 ^b	4.04 ^c	2.80 ^a	4.88 ^b	112.37 ^{**}	.30
26	Directed to compensate the things that happened	2.95 ^a	2.69 ^a	3.45 ^b	2.86 ^a	2.67 ^a	10.61 ^{***}	.04
27	Including deterring rules	3.79 ^a	2.56 ^b	3.84 ^a	2.80 ^b	2.51 ^b	47.87 ^{***}	.16
28	Risky	3.10 ^a	4.86 ^b	4.22 ^c	3.58 ^d	5.23 ^b	86.21 ^{***}	.25
29	Chaotic	2.58 ^a	4.73 ^b	4.27 ^c	3.18 ^d	5.01 ^b	109.05 ^{**}	.30
30	Requiring patience	3.61 ^a	5.19 ^b	4.51 ^c	3.65 ^a	5.48 ^b	98.19 ^{***}	.28
31	Making irritated	3.13 ^a	5.06 ^b	4.23 ^c	3.25 ^a	5.27 ^b	118.54 ^{**}	.32
32	Requiring vigilance	4.08 ^a	5.25 ^b	4.72 ^c	4.10 ^a	5.42 ^b	63.13 ^{***}	.20
33	Requiring skillfulness	4.01 ^a	4.94 ^{bc}	4.74 ^b	4.13 ^a	5.27 ^c	33.08 ^{***}	.11
34	Harmonious	2.69 ^a	1.92 ^b	3.46 ^c	3.41 ^c	2.86 ^a	55.70 ^{***}	.18

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35	Time consuming	3.24 ^a	4.52 ^{bc}	4.32 ^b	3.52 ^a	4.91 ^c	46.98 ^{***}	.15
36	Annoying	2.86 ^a	4.60 ^b	3.85 ^c	2.96 ^a	5.19 ^d	104.35 ^{**}	.29
37	Egalitarian	2.59 ^a	2.13 ^b	3.24 ^c	3.53 ^c	2.39 ^{ab}	41.83 ^{***}	.14
38	Safe	3.35 ^a	2.27 ^b	3.06 ^a	3.41 ^a	2.34 ^b	37.61 ^{***}	.13
39	Functional	3.76 ^a	2.33 ^b	3.26 ^c	3.42 ^{ac}	2.66 ^b	53.40 ^{***}	.17
40	Free flowing	3.36 ^a	2.41 ^b	3.02 ^a	3.21 ^a	2.90 ^a	22.71 ^{***}	.08
41	Requiring knowledge of traffic rules	4.66 ^a	4.23 ^{bc}	4.42 ^{ab}	4.26 ^{abc}	3.92 ^c	4.24 ^{**}	.02
42	Directing your behaviors	3.29 ^a	3.36 ^a	3.88 ^b	3.59 ^{ab}	3.89 ^b	6.08 ^{***}	.02
43	Unpredictable	2.83 ^a	4.72 ^b	4.01 ^c	3.30 ^a	5.06 ^b	93.91 ^{***}	.27
44	Dense	3.42 ^a	4.48 ^b	4.13 ^c	3.53 ^a	5.14 ^d	50.83 ^{***}	.17

Note: Bonferroni correction was used for pairwise comparisons. Different superscripts within rows are statistically different at $p < .05$ or better. *** $p < .001$; ** $p < .005$

Table 3.6. *The Means of the TCS Subscales (38 item) After Controlling for the Effects of Age and Gender, and ANCOVA Results in the Five Countries*

		Estonia	Greece	Kosovo	Russia	Turkey	F	η^2p
1	External affective demands	2.96 ^a	4.27 ^b	4.00 ^c	3.16 ^a	4.77 ^d	144.67 ^{***}	.36
2	Functionality	3.13 ^a	2.39 ^b	3.37 ^a	3.31 ^a	2.63 ^b	65.39 ^{***}	.20
3	Internal requirements	3.93 ^a	4.75 ^b	4.34 ^c	3.99 ^a	5.17 ^d	70.88 ^{***}	.22

Note: *** $p < .001$

Table 3.7. *The Means of the TCS Subscales (30 item) After Controlling for the Effects of Age and Gender, and ANCOVA Results in the Five Countries*

		Estonia	Greece	Kosovo	Russia	Turkey	F	η^2p
1	External affective demands	2.86 ^a	4.22 ^b	3.94 ^c	3.11 ^a	4.61 ^d	132.41 ^{***}	.34
2	Functionality	3.15 ^a	2.32 ^b	3.26 ^a	3.29 ^a	2.66 ^c	61.19 ^{***}	.19
3	Internal requirements	3.93 ^a	4.00 ^a	4.14 ^a	3.97 ^a	4.55 ^b	15.33 ^{***}	.06

Note: *** $p < .001$

Table 3.8. *The Means of the TCS Subscales (22 item) After Controlling for the Effects of Age and Gender, and ANCOVA Results in the Five Countries*

		Estonia	Greece	Kosovo	Russia	Turkey	F	η^2p
1	External affective demands	3.14 ^a	4.92 ^b	4.20 ^c	3.21 ^a	5.21 ^b	182.72***	.42
2	Functionality Internal	3.26 ^a	2.22 ^b	3.23 ^a	3.47 ^a	2.56 ^c	78.22***	.23
3	requirements	4.14 ^a	5.32 ^b	4.77 ^c	4.17 ^a	5.47 ^b	90.06***	.26

Note: ***p<.001

Table 3.9. *The Means of the TCS Subscales (16 item) After Controlling for the Effects of Age and Gender, and ANCOVA Results in the Five Countries*

		Estonia	Greece	Kosovo	Russia	Turkey	F	η^2p
1	External affective demands	3.04 ^a	4.78 ^b	4.15 ^c	3.10 ^a	5.06 ^b	182.77***	.42
2	Functionality Internal	3.25 ^a	2.28 ^b	3.27 ^a	3.30 ^a	2.77 ^c	59.73***	.19
3	requirements	4.33 ^a	5.52 ^b	4.86 ^c	4.29 ^a	5.53 ^b	83.13***	.24

Note: ***p<.001

4. Summary of the Results and Discussion

In the current study, the original version of the TCS was revised and the number of items was reduced. In order to develop the Mini-TCS, first, CFA was conducted for 38-item version and 30-item version separately for the five countries (i.e. Estonia, Greece, Kosovo, Russia, and Turkey). The present study aimed to use items with the highest loadings under the three factors. Items with loading higher than .40 (Stevens, 1996) that were common in all of the five countries were taken to develop a mini-TCS. After the elimination, based on the 38-item version, Mini-TCS with 22 items; and based on the 30-item version, Mini-TCS with 16 items were developed. Several fit indexes were used (i.e. χ^2 /degree of freedom ratio, RMSEA, CFI, and SRMR) to test the fitness of the models. When the results were considered for 38-item and 30-item versions, χ^2 /degree of freedom ratio and RMSEA had acceptable results; however, in both long versions, CFI had low values and SRMR had high values. The results of fit indexes for shorter versions with 22-items and 16-items yielded better results with acceptable and relatively acceptable values than longer versions. In addition, when the Cronbach's Alpha results for the four versions were evaluated, the values were lower for Mini-TCS versions than the original version of the TCS. Since the number of the items affect the Cronbach's Alpha values (Cortina, 1993), these results were not surprising. It should be noted that, Cronbach's Alpha values for the Mini-TCS were still acceptable.

The higher fit of the two versions of Mini-TCS (i.e. 22-item version and 16-item version) supported the three-factor structure of the original TCS developed by Özkan and Lajunen (2011). The better fit of the Mini-TCS indicated that the items in

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the short versions capture the most important items of external affective demands, functionality, and internal requirements and can be called as the core items of the TCS. Since both 22-item and 16 item versions of the Mini-TCS showed good fit, researchers might use any of the two versions based on their research design and purposes. When the factor loadings and item based comparisons are taken into account together, “Stressful”, “Putting pressure on you”, “Chaotic”, and “Making irritated” items can be categorized as the core items of external affective demands dimension since they loaded on this factor in all versions of the TCS. Additionally, countries had significantly different scores for the stated four items. It can be inferred that, these four items might be important determinant items to interpret differences among different countries.

Another aim of the present study was to compare the perceived traffic climate between five countries. The differences between countries (i.e. Estonia, Greece, Kosovo, Russia, and Turkey) on items of the original TCS were investigated by using ANCOVA and all items showed significant differences among countries. Among 44 items, 17 of them showed larger effect size (higher than .20) (see Table 3.5). In general, Estonia and Russia did not show statistically significant differences from each other. Similarly, in general, Greece and Turkey did not show statistically significant differences from each other. In majority of the items, Kosovo showed statistically significant differences from other four countries. Among the 17 items with larger effect sizes, 16 of them had similar patterns. Estonia and/or Russia had the lowest scores, Greece and/or Turkey had the highest scores, and Kosovo had the middle scores. Based on these interpretations, it might be inferred that, the TCS is an effective tool to understand the similarities and differences in traffic contexts among different countries/cultures.

The differences between countries (i.e. Estonia, Greece, Kosovo, Russia, and Turkey) on the factors of longer versions of the TCS (i.e. 38 item and 30 item), and the Mini-TCS versions (i.e. 22 item and 16 item) were also investigated by using ANCOVA. Among the five countries, Kosovo had the middle scores in all analyses and differed from other four countries. It can be suggested that road users of Estonia and Russia had similar patterns. To illustrate, both samples showed highest scores on functionality dimension and lowest scores on external affective demands and internal requirements. Although they had a similar trend, the road traffic fatality rates of the two countries were different, which was 18.9 for Russia and 7 for Estonia per 100 000 people (WHO, 2015). On the other hand, Greece and Turkey had similar patterns, such as having the highest scores for external affective demands and internal requirements but they differed mainly on functionality dimension. Differently from Estonia and Russia, the road traffic fatality rates of Greece (9.1) and Turkey (8.9) were close to each other (WHO, 2015).

When the results were considered within the findings in the literature, it can be suggested that, the underlying reason behind the differences in road traffic fatality rates might not be only due to differences in perceived traffic climate. Özkan

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and Lajunen (2015) suggested that in macro level, traffic climate might influence road user behaviors and level of enforcements, which might influence road traffic accidents/fatalities. Although Estonia and Russia showed similarities in perceived traffic climate, they show differences in level of enforcements (WHO, 2015). Based on the report of WHO (2015), Estonia has a higher level of enforcement for traffic rules than Russia. The similar pattern was also observed for the item (27) “including deterring rules”. Hence, even the two cultures perceive their traffic climate similarly, Estonia has a lower traffic fatality rate, which might show that enforcements has a buffering role and is effective to decrease number of road traffic fatalities in Estonia. Another similar pattern was perceived for Greece and Turkey; however they mostly differed on the functionality dimension. The perceived law enforcements for traffic rules were different for Greece and Turkey (WHO, 2015), which was lower for Turkey than Greece. It can be inferred that, in Turkey perceived functionality of traffic climate and in Greece perceived law enforcements for traffic rules might have a buffering effect in decreasing number of road traffic accidents and fatalities. In order to test these relationships statistically, in future research, the indirect effect of traffic climate on road traffic accidents through perceived level of enforcements and road user behaviors might be studied.

Testing the applicability of a scale is a crucial step in development of a short version (Smith, McCarthy, & Anderson, 2000). Hence, testing the Mini-TCS in different samples from five countries highlights the stability of factor structures among different cultures. In the literature, the TCS was used with lower numbers of items (Zhang, Ge, Qu, Zhang, & Sun, 2018); however, the current is the first one verifying the factor structure of TCS cross-culturally by using CFA. In the current study, to develop the Mini-TCS, first, the core items of longer versions for the all five countries were identified. Second, CFAs were carried out for all versions and for the five countries, separately. Third, the patterns between the countries were investigated for both long and short versions. The similar patterns between long versions and short versions in ANCOVA results indicate stability across different countries. Since traffic climate is a term for all road user groups, and it was tested with different road user groups, the Mini-TCS can be used in all research working with sub-groups of road users. The two versions of the Mini-TCS (22 item and 16 item) can be used to evaluate traffic climate of countries and researchers can choose any of the short versions based on their research designs and purposes. At a practical level, since participants might be willing to complete shorter questionnaires, using the Mini-TCS might be an easier tool to complete than the longer version to evaluate traffic climate. Hence, it might be used in applied settings for professional drivers, students in driver schools, and research that includes a long questionnaire package to save time.

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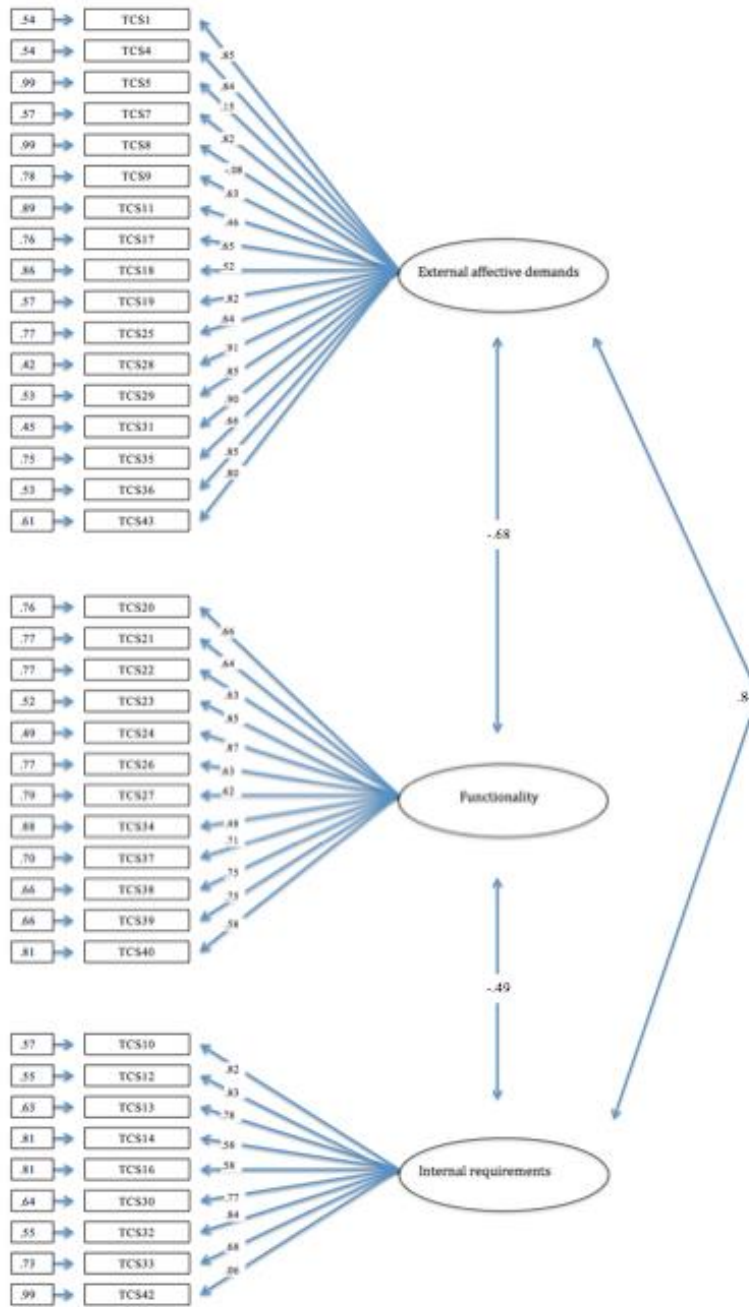


Figure 3.1. The TCS – 38 Item Structure in the Turkish Sample

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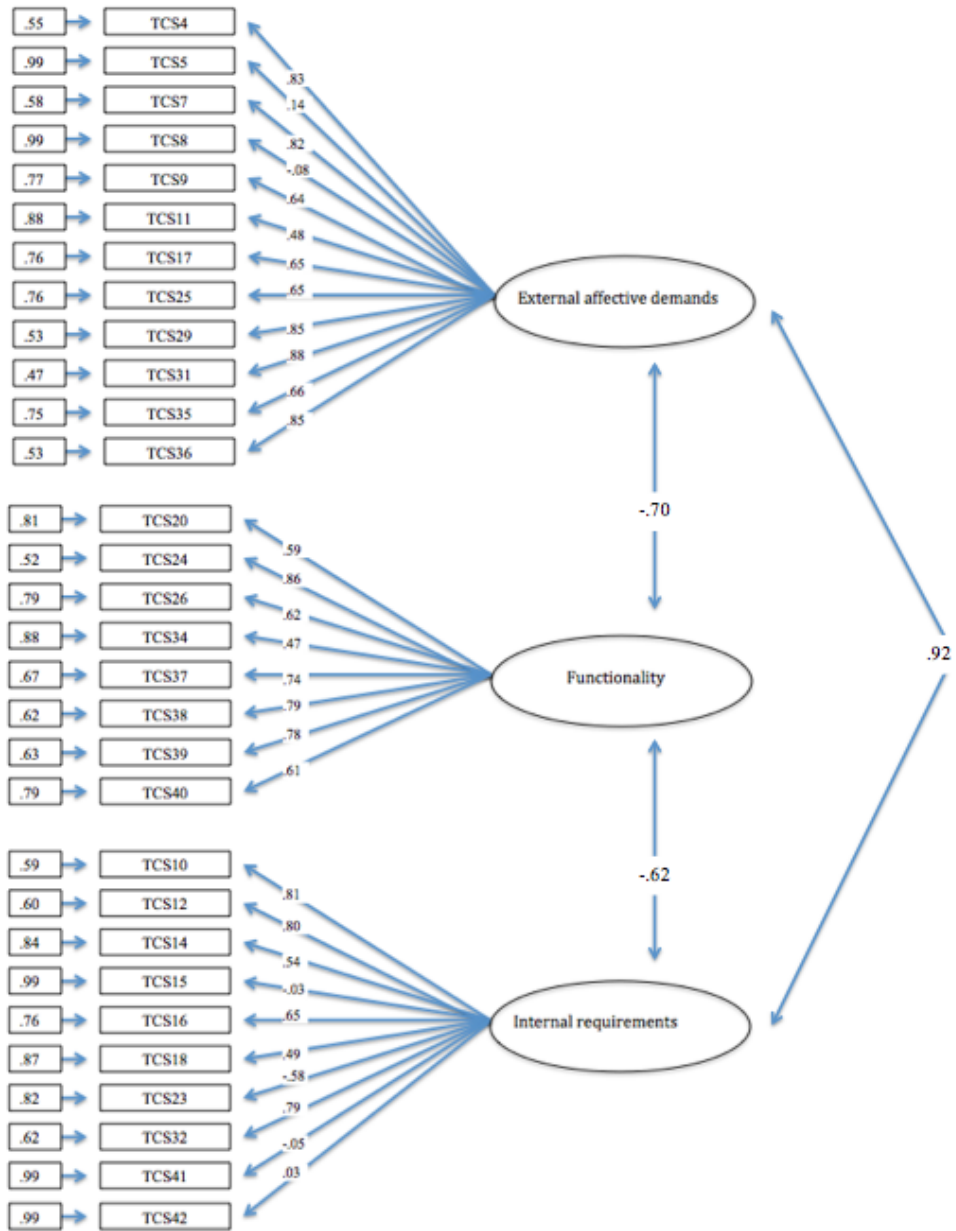


Figure 3.2. The TCS – 30 Item Structure in the Turkish Sample

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Figure 3.3. The Mini-TCS – 22 Item Structure in the Turkish Sample

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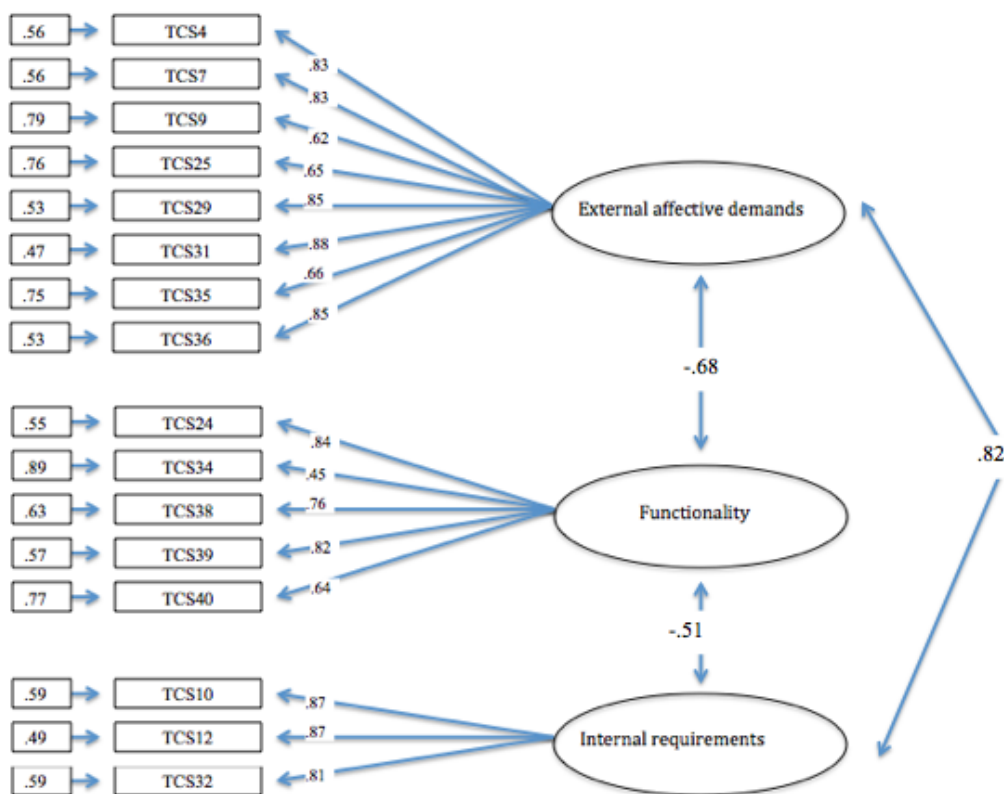


Figure 3.4. The Mini-TCS – 16 Item Structure in the Turkish Sample

References

Chu, W., Wu, C., Atombo, C., Zhang, H., & Özkan, T. (2019). Traffic climate, driver behaviour, and accidents involvement in China. *Accident Analysis & Prevention*, 122, 119-126.

Cortina, J.M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology* 78, 98–104.

Gehlert, T., Hagemester, C., & Özkan, T. (2014). Traffic safety climate attitudes of road users in Germany. *Transportation Research Part F: Traffic Psychology and Behaviour*, 26, 326-336.

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55.

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- Lajunen, T., Parker, D., & Summala, H. (2004). The Manchester Driver Behaviour Questionnaire: A cross-cultural study. *Accident Analysis & Prevention, 36*(2), 231-238.
- Martinussen, L. M., Lajunen, T., Møller, M., & Özkan, T. (2013). Short and user-friendly: The development and validation of the Mini-DBQ. *Accident Analysis & Prevention, 50*, 1259-1265.
- Osberg, J. S., Stiles, S. C., & Asare, O. K. (1998). Bicycle safety behavior in Paris and Boston. *Accident Analysis & Prevention, 30*(5), 679-687.
- Özkan, T., & Lajunen, T. (2011). Person and environment: Traffic culture. In *Handbook of Traffic Psychology* (pp. 179-192).
- Özkan, T. & Lajunen, T. (2015). A general traffic (Safety) culture system (G-TraSaCu-S). *TraSaCu Project, European Commission, RISE Programme*.
<https://doi.org/10.13140/RG.2.2.16515.20006>.
- Özkan, T., Lajunen, T., Chliaoutakis, J., Parker, D., & Summala, H. (2006). Cross-cultural differences in driving behaviours: A comparison of six countries. *Transportation Research Part F: Traffic Psychology and Behaviour, 9*, 227-242.
- Russell, D. W. (2002). In search of underlying dimensions: The use (and abuse) of factor analysis. *Personality and Social Psychology Bulletin, 28*(12), 1629-1646.
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*(2), 23-74.
- Smith, G.T., McCarthy, D.M., & Anderson, K.G. (2000). On the sins of short-form development. *Psychological Assessment, 12*, 102-111.
- Solmazer, G., Azık, D., Findik, G., Üzümcüoğlu, Y., Ersan, Ö., Kaçan, B., ... & Pashkevich, M. (2020). Cross-cultural differences in pedestrian behaviors in relation to values: A comparison of five countries. *Accident Analysis & Prevention, 138*, 105459.
- Stevens, J. (1996). *Applied multivariate statistics for the social sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.
- Üzümcüoğlu, Y., Özkan, T., Wu, C., & Zhang, H. (2019). How drivers perceive traffic? How they behave in traffic of Turkey and China?. *Transportation Research Part F: Traffic Psychology and Behaviour, 64*, 463-471.
- Warner, H. W., Özkan, T., Lajunen, T., & Tzamalouka, G. (2011). Cross-cultural comparison of drivers' tendency to commit different aberrant driving behaviours. *Transportation Research Part F: Traffic Psychology and Behaviour, 14*(5), 390-399.
- World Health Organization (2015). *Global Status Report on Road Safety*. World Health Organization. Retrieved from:
http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/

A Short Scale of Traffic Climate Across Five Countries

- World Health Organization. (2016). *World Health Statistics 2016*. World Health Organization. Retrieved from:
http://gamapserver.who.int/mapLibrary/Files/Maps/Global_RoadTraffic_Mortality_2013.png
- Zhang, Q., Ge, Y., Qu, W., Zhang, K., & Sun, X. (2018). The traffic climate in China: the mediating effect of traffic safety climate between personality and dangerous driving behavior. *Accident Analysis & Prevention*, *113*, 213-223.