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Original Research

The Wayfinding Questionnaire-Turkish (WQ-TR): A study of cross-cultural adaptation and psychometric properties of validity and reliability

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Abstract

Objectıves: Navigation and wayfinding is a neurocognitive skill that we often use in daily life. The aim of this study is to adapt the Wayfinding Questionnaire-Turkish (WQ-TR), which assesses the navigation complaints of individuals, and to assess psychometric properties of WQ-TR in healthy individuals.
Materials and Methods: This study was conducted with 363 healthy participants (203 F, 160 M) aged 18 and 69 (mean: 39.0±13.1). WQ-TR and Money's Road Map Test (RMT) were applied to all participants. Validity analyses were conducted with construct and concurrent validity. Factory structures of the questionnaire were formed with principal axis factoring in construct validity. The correlation between the RMT error counts and WQ-TR scores was evaluated for concurrent validity. Internal consistency (Cronbach's alpha) and test-retest reliability were performed in reliability analyses.
Results: WQ-TR has 20 items and 3-factor structures: “Navigation and Orientation(NO)”, “Spatial Anxiety-Ambiguous(SA-A)” and “Spatial Anxiety-Organisation(SA-O)”. In line with the correlation between RMT error counts and WQ-TR scores, WQ-TR was found to have moderate validity. High internal consistency (a: 0.906) and high intraclass correlation coefficients (ICC: 0.976) were observed. WQ-TR showed satisfactory internal consistency, excellent test-retest reliability and moderate validity.
Conclusion: WQ-TR, the first Turkish questionnaire assessing navigation skills and showed perfect internal consistency, reliability and validity, was presented for clinical and scientific use.

Keywords: *Surveys and Questionnaires; Spatial navigation; Orientation; Psychometrics; Self report*

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Introduction

Navigation and orientation are neurocognitive abilities that are utilized in everyday life often without conscious awareness. The term "navigation" encompasses both the processes of wayfinding and physical movement, providing a more thorough understanding. However, it is important to note that wayfinding is a neurocognitive aspect of navigation and should not be conflated with the physical locomotion involved in the process (Darken & Peterson, 2002). It is much easier to complete many everyday tasks with the aid of navigational abilities, such as locating the automobile in a parking lot, going from one room of the house to another, or browsing shops in a mall.

Navigation relies on the integration of several sensory inputs, including visual, vestibular, proprioceptive, somatosensory, and auditory information (Ekstrom et al., 2018). Navigation and wayfinding are complex processes that include many cognitive, recollective, and administrative computations such as the integration of various spatial information and the selection of appropriate strategies (Lester et al., 2017). The process of navigation and wayfinding can be impacted by impairments in the integration and loss of sensory signals. Consequently, navigational difficulties may manifest in individuals with vestibular diseases, hearing impairment, visual impairments, and cerebral pathologies, including strokes. Nevertheless, the evaluation of this phenomenon poses significant challenges because to its intricate nature, characterized by a multitude of sensory inputs. Individuals sometimes have difficulties in articulating their grievances, thus complicating the assessment process. The evaluation of this skill may be conducted through several methods, including self-assessment by questioning about navigational abilities, the administration of specialized neurocognitive and neuropsychological tests using traditional pen and paper or virtual reality platforms, or the assignment of behavioral tasks to individuals (Prestopnik & Roskos–Ewoldsen, 2000). The utilization of a rapid and intuitive instrument throughout the evaluation process might prove advantageous. The Wayfinding Questionnaire (WQ) is a self-report questionnaire that has 22 items designed to evaluate navigational complaints and spatial anxiety associated with navigation.

The objective of this study is to culturally adapt the WQ, a tool used to identify navigation-related difficulties in people, into the Turkish language. Additionally, the study seeks to assess the validity and reliability of the adapted version of the WQ by conducting analyses on a sample of healthy adults. The ultimate goal is to establish the suitability of the Turkish version of the WQ for use in both clinical and scientific research.

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Materials and methods

Study Design

All permissions and ethical approval were obtained by the institute's ethics committee (Hacettepe University). The researchers collected demographic information, including age, gender, driving status, and educational status, from all participants. Subsequently, the Wayfinding Questionnaire-Turkish (WQ-TR) and the Money's Road Map Test (RMT) were administered to all participants.

Translation and cross-cultural adaptation

The translation and adaptation process of the WQ was implemented using a guide created by Beaton et al. (2000) for the self-report measurements. A flow chart showing the translation and adaptation process of the WQ in five steps is shown in figure 1. Two different bilingual translators independently translated the questionnaire from English to Turkish in step 1. This translated questionnaire was formatted as a synthesized questionnaire in step 2. Another two bilingual translators translated the synthesized questionnaire separately back to the source language to prevent significant inconsistencies and conceptual errors in step 3. In last steps, WQ's prefinal version was developed and tested on 30 Turkish native speakers, and these individuals were interviewed about the items. WQ's final version was formed with the committee's decision in line with the interviews and results.

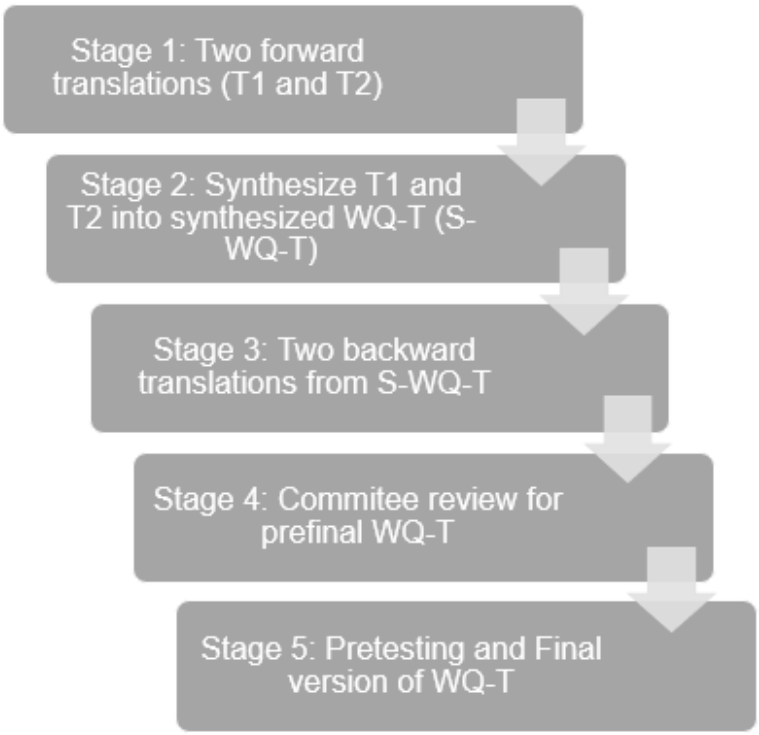

Figure 1: Flowchart of translation and cross-cultural adaptation of the WQ-TR.

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Participants

The inclusion criteria were to be 18 years and older, be in a good general state of health, have no pathology that could affect navigation skills (neurodegenerative disorders, cerebellar pathologies, hearing loss, no acute vertigo attacks in six months etc.), and be literate in Turkish. The study included 363 participants (203 F, 160 M) with mean age 39.0 (standard deviation=±13.1 and age range=18-69).

Wayfinding Questionnaire (WQ)

WQ, developed by van der Ham et al. (2013), is a screening questionnaire detecting the navigational problems. Claessen et al. (2016) reconstituted a new form consisting of 22 items after a validity study. The WQ has three subscales: Navigation and Orientation, Distance Estimation and Spatial Anxiety. Likert type scoring system ranging from 1 to 7 is used for the items in the questionnaire. The answers given to the items are scored as 1 "not applicable to me at all" and 7 "totally applicable to me". However, for items 12, 13 and 14, the scoring is "not uncomfortable at all" for 1 and "very uncomfortable" for 7. Scores of the items between 8-15 are reversed. Total and subscales scores are calculated with the arithmetic mean of the scores given to the items. A higher score indicates better spatial navigation and orientation skills.

Money's Road Map Test (RMT)

RMT, a pen and paper test assessing spatial orientation and perception of direction, is an accuracy test for mental spatial rotation (Rainville et al., 2002). It requires the participants to make mental rotations by using spatial coordinates to distinguish a route's left and right turns on a map. The map has a route with 32 turns. The test starts after trying a short trial route on the map to ensure whether the participants fully understood or not. Those who did the trial route correctly were tested. Low error (incorrect answers) counts show an excellent spatial orientation and mental rotation.

Psychometric assessments and statistical analysis

All the statistical analyses in this study were made with *IBM SPSS Statistics 23.0*. While the categorical data is shown with frequency statistics, numeric data is shown with descriptive statistics. Normally distributed data were indicated with mean and standard deviation values, while not normally distributed data were indicated with median and interquartile range values.

The distribution of the total questionnaire scores was checked in order to examine the floor and ceiling effects. It was accepted that the floor and ceiling effect occurred when the number of participants with the lowest or highest scores is more than 15% of the total number of participants. Item analysis was performed on all the questionnaire items, and the item was

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considered reliable when the item-total correlation coefficient was greater than 0.3 (Field, 2009).

Validity Analyses

Construct validity (exploratory factor analysis) and concurrent validity analyses were used to assess the validity of the questionnaire. The Kaiser-Meyer-Olkin (Measure of Sampling Adequacy) Analysis (KMO) value being bigger than 0.6 and Bartlett's Test of Sphericity were statistical significance ($p<0.05$), data was accepted to be adequate for the factor analysis (Howard, 2016). Factor analytical method was Principal Axis Factoring (PAF) and factor rotation method was direct oblimin (Howard, 2016). Communalities, eigenvalues and the scree plot were calculated. Those with Eigenvalue above 1 were accepted as a factor. 0.3 and above were accepted as a factor loading (Costello & Osborne, 2005). The correlation coefficient of concurrent validity was considered a weak correlation under 0.3, a moderate correlation between 0.3 and 0.5 and a high correlation with 0.7 and above (Abma et al., 2016).

Reliability Analyses

Test-retest reliability and internal consistency analyses were performed. In the test-retest method, WQ-TR was applied to the same 20 participants at 2-week intervals, and it was evaluated with the intraclass correlation (ICC). ICC values of 0.8 and above were accepted to be perfectly correlated (Weir, 2005). WQ-TR total and subscales were assessed with Cronbach's alpha for internal consistency. Cronbach's alpha value of 0.7 and above were accepted as satisfactory (Nunnally, 1994). The correlation between the total score and subscale scores and the inter-item correlations were examined. The weak inter-item correlation was accepted as reliable to reduce the repeatability of questionnaire items.

Relationship with demographical variables

Independent sample t-test, one-way ANOVA (Analysis of variance), Pearson correlation, Chi-square, and multiple regression analysis were performed for comparisons between WQ-TR scores and different demographic variables.

Results

WQ-TR final version was formed after fixing minimal Turkish expressions with the committee's approval at the pretesting step of the WQ-TR translation and adaptation process to solve the language differences and provide better clarity. There were no significant problems at the other steps of WQ-TR translation and cross-cultural adaptation processes.

Descriptive statistics of WQ-TR items (mean, standard deviation and item-total correlation for each item) were shown in Table 1. When the item-total correlations of the items

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were examined, it was found that the correlation coefficients of all the items were higher than 0.3 except item 7. Item 7 was removed from further analyses as its correlation coefficient was found to be 0.222, and its distribution differed from the other items.

There were two participants (0.6%) who scored the highest and no one who scored the lowest. WQ-TR scale did not have any floor and ceiling effect, and there was no data loss.

Validity Analyses

KMO measure of sample adequacy value was 0.910 and Barlett's test of sphericity was significant ($\chi 2(210)= 3863.556$, $p < 0.001$). Communalities and eigenvalues were calculated, and the scree plot was formed (Figure 2). WQ-TR had 3-factor structures explained 35.12%, 11.6% and 4.6% of the variance, respectively. The 3-factor structures were found suitable for the questionnaire by explaining 51.44% of the cumulative variance. Table 2 showed the communalities values of the items and factor loading. Item 20 was removed from the questionnaire because its communalities value was 0.222, and it did not load on any factors. Items 1, 2, 3, 4, 5, 6, 16, 17, 18, 19, 21 and 22 formed Factor 1 (12 items), items 8, 9, 10, 11 and 15 formed Factor 2 (5 items) and items 12, 13 and 14 formed Factor 3. Factor structures were named "Navigation and Orientation (NO)", "Spatial Anxiety-Ambiguous (SA-A)", and "Spatial Anxiety-Organisation (SA-O)", respectively.

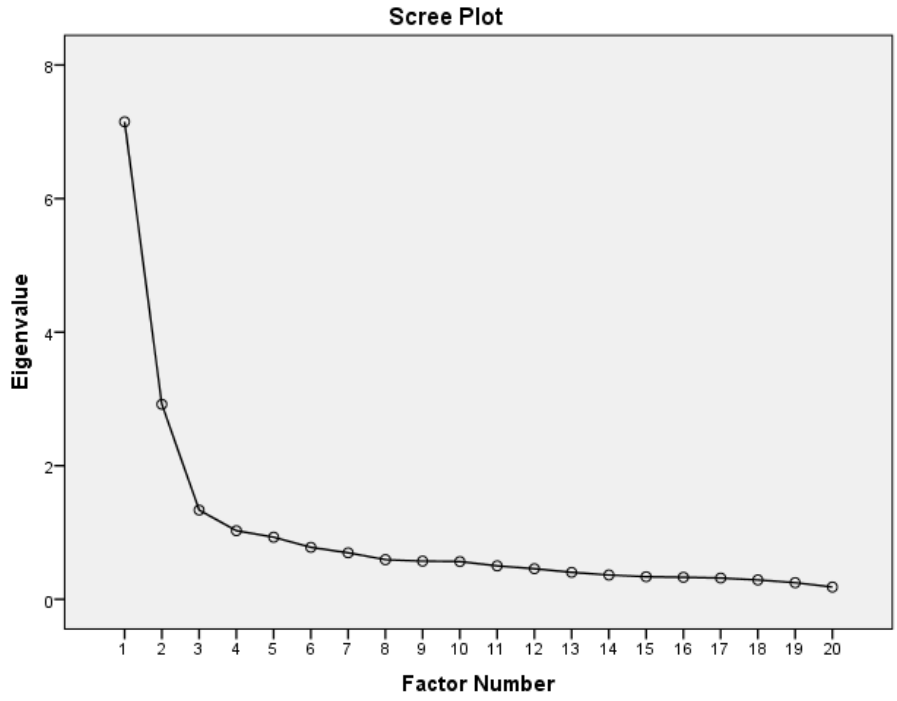

Figure 2: Scree plot of the factor analysis, based on Eigenvalues>1.
Note: The flexion of the elbow at the third factor is maximal denoting 3 factors retaining

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Table 1: Descriptive statistics (means, standard deviations (SD) and item-total correlations) for 22 items of WQ-TR.

Items		**Mean ± SD**	**Item-Total Correlation**
1.	When I am in a building for the first time, I can easily point to the main entrance of this building.	5.59 ± 1.60	0.615
2.	If I see a landmark (building, monument, intersection) multiple times, I know exactly from which side I have seen that landmark before.	5.52 ± 1.65	0.609
3.	In an unknown city I can easily see where I need to go when I read a map on an information board.	5.28 ± 1.62	0.613
4.	Without a map, I can estimate the distance of a route I have walked well, when I walk it for the first time.	4.79 ± 1.70	0.609
5.	I can estimate well how long it will take me to walk a route in an unknown city when I see the route on a map (with a legend and scale).	4,53 ± 1.72	0.588
6.	I can always orient myself quickly and correctly when I am in an unknown environment.	4.65 ± 1.73	0.685
7.	I always want to know exactly where I am (meaning, I am always trying to orient myself in an unknown environment).	5.91 ± 1.49	0.222
8.*	I am afraid of losing my way somewhere.	4.23 ± 2.11	0.579
9.*	I am afraid of getting lost in an unknown city.	4.19 ± 2.10	0.590
10.*	In an unknown city, I prefer to walk in a group rather than by myself.	3.65 ± 2.07	0.330
11.*	When I get lost, I get nervous.	4.22 ± 2.02	0.592
12.*	How uncomfortable are you in the following situation: Deciding where to go when you are just exiting a train, bus, or subway station.	4.60 ± 2.13	0.398
13.*	How uncomfortable are you in the following situation: Finding your way in an unknown building (e.g., a hospital).	4.69 ± 2.02	0.441
14.*	How uncomfortable are you in the following situation:Finding your way to a meeting in an unknown city or part of a city.	3.39 ± 1.91	0.481
15.*	I find it frightening to go to a destination I have not been before.	5.11 ± 1.93	0.460
16.	I can usually recall a new route after I have walked it once.	5.11 ± 1.90	0.545
17.	I am good at estimating distances (e.g., from myself to a building I can see).	4.82 ± 1.84	0.540
18.	I am good at understanding and following route descriptions.	5.10 ± 1.74	0.597
19.	I am good at giving route descriptions (meaning, explaining a known route to someone).	5.09 ± 1.89	0.571
20.	When I exit a store, I do not need to orient myself again to determine where I have to go.	4.58 ± 1.93	0.421
21.	I enjoy taking new routes (e.g., shortcuts) to known destinations.	5.02 ± 2.11	0.531
22.	I can easily find the shortest route to a known destination.	5.15 ± 1.88	0.592

*Reversed score

The concurrent validity of the questionnaire was examined between the RMT error counts and WQ-TR total, NO, SA-A, and SA-O scores. The correlation coefficients (r) of WQ-

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TR total, NO, SA-A and SA-O scores were respectively -0.374, -0.312, -0.288 and -0.222 ($p<0.001$).

Table 2: Factor loading and communalities of WQ-TR.

Item	Extracted Communalities	Factor		
		1	2	3
1.Item	0.449	**0.604**	0.111	0.034
2.Item	0.559	**0.768**	-0.010	-0.052
3.Item	0.499	**0.674**	0.104	-0.041
4.Item	0.543	**0.741**	0.016	-0.031
5.Item	0.436	**0.604**	0.115	0.008
6.Item	0.578	**0.679**	0.183	-0.021
16.Item	0.505	**0.752**	-0.092	-0.036
17.Item	0.502	**0.747**	-0.107	-0.012
18.Item	0.559	**0.766**	-0.106	0.051
19.Item	0.507	**0.732**	-0.039	-0.019
21.Item	0.308	**0.307**	0.170	0.231
22.Item	0.385	**0.501**	0.110	0.132
8.Item	0.655	0.079	**0.785**	-0.019
9.Item	0.768	0.043	**0.883**	-0.048
10.Item	0.294	-0.047	**0.568**	-0.019
11.Item	0.707	0.008	**0.788**	0.089
15.Item	0.359	0.027	**0.465**	0.192
12.Item	0.544	-0.078	0.033	**0.745**
13.Item	0.676	-0.032	-0.046	**0.855**
14.Item	0.433	0.064	0.137	**0.549**
20.Item	0.215	0.282	-0.013	0.290

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization.
Note: Only factor loadings higher than 0.3 are bold.

Reliability Analyses

WQ-TR test-retest reliability was excellent in line with the ICC results of the WQ-TR total and all subscales (Table 3). Moreover, while WQ-TR total, NO and SA-A subscales were found to have high reliability, SA-O was found quite reliable during the internal consistency assessments (Table 3). The ICC (test-retest reliability) and Cronbach's alpha (internal consistency) showed excellent reliability of WQ-TR.

The correlation coefficient (r) between NO and SA-A was 0.429, NO and SA-O was 0.327, SA-A and SA-O was 0.48 ($p<0.001$). The correlation coefficients (r) between WQ-TR total and NO, SA-A and SA-O scores were 0.893, 0.749, and 0.613, respectively ($p<0.001$). When the correlations of all items were examined, the correlation coefficient between items 8 and 9 was found to be 0.8, while all the other items had a correlation coefficient below 0.8.

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Table 3: Test-retest realibility and internal consistency of WQ-TR.

	Cronbach's Alpha	Test (mean+SD)	Retest (mean+SD)	ICC (95%CI)
WQ-TR Total	0.906	4.75 ± 1.12	4.82 ± 1.13	0.976 (0.941-0.991)
WQ-TR NO	0.908	5.24 ± 0.96	5.33 ± 1.01	0.949 (0.872-0.980)
WQ-TR SA-A	0.847	3.90 ± 1.86	3.94 ± 1.83	0.960 (0.900-0.984)
WQ-TR SA-O	0.780	4.20 ± 1.67	4.23 ± 1.61	0.947 (0.865-0.979)

ICC: Intraclass Correlation, CI: Confidence interval, SD: Standart deviation, NO: Navigation and Orientation, SA-A: Spatial Anxiety-Ambigous, SA-O: Spatial Anxiety-Organisation.

Relationship with demographic variables

Means, standard deviations and p values of WQ-TR total and subscale scores in gender, age, driving status and educational status were shown in table 4. In the comparison of the WQ-TR total and subscale scores of the individuals who can and cannot drive, while WQ-TR total, NO and SA-A subscales had statistical significance ($p<0.05$), the SA-O subscale score showed no significance ($p>0.05$). Besides, it was observed that individuals who could drive had higher scores both in total and all subscales. Also, it was found that men had statistically higher scores when compared to women both in WQ-TR total and all subscale scores ($p<0.05$). There was no significant difference to observe between age groups and WQ-TR scores. However, a weak negative statistical relationship was found only between the SA-A subscale score and age ($r=-0.129$, $p=0.014$). There was no statistical relationship between other subscales and the total score. In education level, group 1 represented pre-university education (elementary, middle and high school) individuals, while group 2 represented individuals with university and graduate school degrees. There was no statistical significance in the comparison of WQ-TR total and subscale scores between the group 1 and group 2 ($p>0.05$).

It was found that gender and driving status variances affected the WQ-TR scores. However, a statistical difference was attained between the driving status of men and women ($p<0.001$). 43.3% of women and 86.9% of men were driving. Multiple regression analysis was applied to ascertain whether the WQ-TR total and subscale scores were affected only by gender, driving, or both. While the gender variance had statistical significance ($p<0.05$), driving status variance was not significant on WQ-TR total, SA-A and SA-O subscale scores ($p>0.05$). It was also found that both gender ($p<0.001$) and driving status ($p=0.033$) variances had a statistical effect on the NO subscale score.

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Table 4: Comparison of demographic information with WQ-TR scores.

		N	%	Total		NO		SA-A		SA-O	
				mean	SD	mean	SD	mean	SD	mean	SD
Gender	**Female**	203	55.9	4.32	1.12	4.59	1.27	3.84	1.54	4.05	1.58
	Male	160	44.1	5.26	0.90	5.64	0.96	4.83	1.52	4.44	1.78
	p value			<0.001**		<0.001**		<0.001**		0.029*	
Age groups	**18-29**	112	30.9	4.78	1.10	5.00	1.18	4.50	1.60	4.40	1.55
	30-39	77	21.2	4.55	1.25	4.79	1.39	4.35	1.62	3.93	1.61
	40-49	94	25.9	4.84	1.14	5.19	1.25	4.27	1.57	4.41	1.73
	50 and upper	80	22	4.73	1.05	5.23	1.22	3.92	1.64	4.05	1.85
	p value			0.374		0.101		0.108		0.135	
Education level	**Group 1**	113	31.1	4.78	1.11	5.20	1.25	4.22	1.58	4.03	1.91
	Group 2	250	68.9	4.71	1.14	4.98	1.25	4.30	1.62	4.31	1.56
	p value			0.572		0.122		0.676		0.187	
Driving	**Yes**	227	62.5	4.94	1.10	5.32	1.12	4.45	1.68	4.25	1.73
	No	136	37.5	4.38	1.09	4.60	1.34	3.98	1.44	4.17	1.60
	p value			<0.001**		<0.001**		0.005*		0.65	

**p value is significant at the 0,001 level, *p value is significant at the 0,05 level, NO: Navigation and Orientation, SA-A: Spatial Anxiety-Ambigous, SA-O: Spatial Anxiety-Organisation.
SD:Standart deviation,
One-way ANOVA for age groups
Independent sample t test for gender, education level and driving

Discussion

Navigation and orientation are multisensory processes that integrate environmental and spatial information temporally and spatially, including perceptive and memory-based operations (Wolbers & Hegarty, 2010). Questionnaires are the accessible, fast, highly accurate, and frequently used scaling tools used to assess the quality of life. WQ is one of the self-report questionnaires that define the navigational complaints of individuals.

WQ-TR validity and reliability analyses were performed on a big heterogeneous group. Based on the exploratory factor analysis, two items (Item 7 and 20) were removed in WQ-TR. Item 7 was removed for having a very weak correlation, while item 20 was removed because its variances did not load any factor. As a result of the factor analysis, a 20 items WQ-TR with

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a 3-factor structure was formed (Appendix 1). The original 22 items WQ also had a 3-factor structure (Claessen et al., 2016).

Three factors of the WQ-TR were named as NO (12 items), SA-A (5 items) and SA-O (3 items) based on the spatial skills measured with the items in the questionnaire. While "navigation and orientation" and "distance estimation" factors of WQ corresponded to the NO factor of WQ-TR, the "spatial anxiety" factor of WQ appeared as two different factor structures: SA-A and SA-O in WQ-TR. It was thought that the reason behind this difference could have been the changes related to the social, cultural, and psychological components of the populations.

Contents of the 12 items of WQ-TR's NO subscale include mainly navigation and orientation skills but also wayfinding skills such as mental transformation, distance estimation and sense of direction. NO subscale explained the %35,12 of the variance by gathering under the one-factor structure. The fear of navigation and the psychosocial attitudes such as stress and motivation disorder caused by it can be explained as the fear of orientation and mobility. Moreover, the fear of navigation triggers ambiguity anxiety emerging in situations. The literature defines some specific fears: fear of getting lost, fear of unknown/unexpected events, fear of making mistakes, fear of trusting oneself and losing control, etc. (Baskett, 2005). In line with this information, certain situations requiring an organized use of decision-making, route planning and orientation skills were characterized in SA-O subscale's items 12, 13 and 14. The individuals were asked to indicate their disturbances in certain situations. It was found that these items assessed the anxiety of individuals about organizing their navigation skills, and it caused organization anxiety which is a part of spatial anxiety. It was observed that the items of the SA-A subscale (e.g. item 9, "I am afraid of getting lost in an unknown city." and item 15, "I find it frightening to go to a destination I have not been before.") showed the ambiguity which emerges in unknown places and unknown situations. It was also found that these items assessed the ambiguous anxiety that is included in spatial anxiety.

Since there is no valid and reliable Turkish test assessing navigation and orientation skills, RMT, one of the traditional neuropsychological tests evaluating mental rotation, navigation and orientation skills, was used as a golden test. In literature, it was found that the mental rotation of the individuals was moderately related to the navigation skills (Driscoll et al., 2005). In the study it was found that RMT error counts and WQ-TR total and NO scores had moderate, and SA-A and SA-O had weak validity.

The internal consistency of WQ had satisfactory reliability (Claessen et al., 2016). Moreover, internal consistency Cronbach's coefficient was 0.89 in the Spanish version of WQ's

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spatial anxiety items (8 items) (Mendez-Lopez et al., 2020). Cronbach's alpha internal consistency coefficient of WQ-TR's total and subscales (NO, SA-A and SA-O) was found satisfactory reliability 0.906, 0.908, 0.847 and 0.780 respectively in this study. Excellent correlation was acquired in test-retest reliability. The inter-item correlation coefficient was found to be under 0.8 almost all, and it was stated that each item represented a different situation. Only the inter-item correlation coefficient between items 8 and 9 was found to be 0.8. The expert committee predicted that these items do not represent the same situations and that cultural and linguistic differences may have led to such consequences. A weak to moderate correlation was observed between subscales in WQ-TR and a high correlation between subscales and the total WQ-TR in the intra-scale correlation. All these findings showed that the WQ-TR had perfect reliability.

Men had higher scores than women on both the WQ and WQ-TR. A meta-analysis study indicated that male advantage was slight to medium level in human spatial navigation skills (Nazareth et al., 2019). Especially the mental rotation and navigation tasks create the most consistent and notable difference in gender (Pintzka et al., 2016). The biological mechanism that lies beneath this difference is still not clarified. Some studies stated that the cumulative impact of environmental opportunities and expectancies towards men in society and another study reports that testosterone levels can effectively affect navigation and orientation (Pintzka et al., 2016). Not only navigation and orientation skills but also wayfinding-related spatial anxiety are affected by gender. Some studies suggest that women feel less safe than men and therefore experience spatial anxiety related to wayfinding (Lawton & Kallai, 2002).

The relationships between driving performance and the cognitive domains such as speed of processing, visuospatial skills and executive function were observed in the literature (Mathias & Lucas, 2009). Besides, it was shown that the professions allowing the use of navigation skills frequently (e.g. taxi drivers) positively affect the navigation skills of the spatial experience (van der Ham et al., 2020). A statistical difference was observed between gender and driving status. Most of the drivers were men in this study. When analyzed with regression model, the gender variance was effective over WQ-TR total, SA-A and SA-O scores ($p<0.001$), and the driving status variance did not affect these scores ($p>0.05$). However, it was found that both gender ($p<0.001$) and driving status variance ($p=0.033$) affected on the NO subscale score. It was found that while driving was effective on navigation and orientation, it was not effective on spatial anxiety in this study.

Experimental studies indicate that the differences caused by gender and ageing also affected the decrease in spatial navigation skills (Head & Isom, 2010; van der Ham & Claessen,

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2020; Wolbers & Hegarty, 2010). Moreover, it is proven that visuospatial working memory performance decreases with age in spatial navigation (Perrochon et al., 2018). In this study, no relationship was found between age and scores. Only the age and SA-A subscale scores were found to be weakly correlated. However only 10 out of 363 participants were over 65 years old in this study sample. The studies observing the age differences in the literature compare the groups of young people and groups older than 65 years old. WQ-TR data can be detailed in individuals 65+ and the age effect can be examined in future studies.

Even though it is reported in the literature that individuals with high education levels can use their wayfinding strategies more flexibly (Ulrich et al., 2019), this study found that WQ-TR scores were not affected by the level of education. However, it should be noted that the studies made in the literature are experimental, and this study only compares the questionnaire results and the information from the literature. Furthermore, the original WQ scores also were not affected by age and education level (Claessen et al., 2016).

One of the most substantial aspects of WQ-TR is the first questionnaire study adapted to assess the navigation, orientation, and spatial anxiety complaints. It is essential to apply it to a broad population for validity and reliability as the navigation skill is affected by environmental factors such as geography and cultural differences. Moreover, WQ-TR's 20-item structure allows it to be used as a short and fast scanning tool to assess the navigation complaints of individuals.

It is essential to mention some of the limitations of this study. The validity and reliability of WQ-TR were performed only on a healthy group. However, it is reported in the literature that navigation skills got affected by the disease groups such as mild cognitive impairment, epilepsy, Alzheimer's disease, mild stroke and vestibular disorders (Cánovas et al., 2011; Hort et al., 2007; van der Ham et al., 2013; Vlček & Laczó, 2014; Xie et al., 2017). For this reason, it is crucial to make the validity and reliability studies by applying the WQ-TR on different populations to increase its clinical use.

The personal security parameter may affect spatial anxiety especially on populations living in different cities and countries. This parameter was ignored as our study was conducted on the participants living in the same country and area. However, in future studies, where people live and how safe they feel are considerable parameters that should not be ignored.

In conclusion, WQ, the questionnaire assessing the navigation complaints of individuals, was adapted to Turkish and was assessed psychometrically with the aim of research and application on the Turkish population in this study. WQ-TR showed perfect internal consistency, reliability, and validity. Navigation is a part of daily living activities and

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significantly affects the quality of life. Using practical information tools and observing cultural differences when assessing cognitive skills like navigation help use correct idiosyncratic intervention methods and improve scientific data. As a consequence of this study, the literature gained WQ-TR, the first Turkish questionnaire assessing navigation skills.

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Conflict of Interests

The authors declare that they have no confict of interests.

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References

Abma, I. L., Rovers, M., & van der Wees, P. J. (2016). Appraising convergent validity of patient-reported outcome measures in systematic reviews: constructing hypotheses and interpreting outcomes. *BMC research notes, 9*(1), 226.

Baskett, L. (2005). Fear of orientation and mobility. International Congress Series,

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine, 25*(24), 3186-3191.

Cánovas, R., León, I., Serrano, P., Roldán, M. D., & Cimadevilla, J. M. (2011). Spatial navigation impairment in patients with refractory temporal lobe epilepsy: evidence from a new virtual reality-based task. *Epilepsy & Behavior, 22*(2), 364-369.

Claessen, M. H., Visser-Meily, J. M., de Rooij, N. K., Postma, A., & van der Ham, I. J. (2016). The wayfinding questionnaire as a self-report screening instrument for navigation-related complaints after stroke: internal validity in healthy respondents and chronic mild stroke patients. *Archives of Clinical Neuropsychology, 31*(8), 839-854.

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research, and evaluation, 10*(1), 7.

Darken, R. P., & Peterson, B. (2002). Spatial orientation, wayfinding, and representation. In *Handbook of virtual environments* (pp. 533-558). CRC Press.

Driscoll, I., Hamilton, D. A., Yeo, R. A., Brooks, W. M., & Sutherland, R. J. (2005). Virtual navigation in humans: the impact of age, sex, and hormones on place learning. *Hormones and behavior, 47*(3), 326-335.

Ekstrom, A. D., Spiers, H. J., Bohbot, V. D., & Rosenbaum, R. S. (2018). *Human spatial navigation*. Princeton University Press.

Field, A. (2009). Discopering Statistics Using SPSS, Thrid Edition.

Head, D., & Isom, M. (2010). Age effects on wayfinding and route learning skills. *Behavioural brain research, 209*(1), 49-58.

Hort, J., Laczó, J., Vyhnálek, M., Bojar, M., Bureš, J., & Vlček, K. (2007). Spatial navigation deficit in amnestic mild cognitive impairment. *Proceedings of the National Academy of Sciences, 104*(10), 4042-4047.

Howard, M. C. (2016). A review of exploratory factor analysis decisions and overview of current practices: What we are doing and how can we improve? *International Journal of Human-Computer Interaction, 32*(1), 51-62.

Lawton, C. A., & Kallai, J. (2002). Gender differences in wayfinding strategies and anxiety about wayfinding: A cross-cultural comparison. *Sex roles, 47*, 389-401.

Lester, A. W., Moffat, S. D., Wiener, J. M., Barnes, C. A., & Wolbers, T. (2017). The aging navigational system. *Neuron, 95*(5), 1019-1035.

Mathias, J., & Lucas, L. (2009). Cognitive predictors of unsafe driving in older drivers: a meta-analysis. *International psychogeriatrics, 21*(4), 637.

Mendez-Lopez, M., Fidalgo, C., Osma, J., & Juan, M.-C. (2020). Wayfinding Strategy and Gender–Testing the Mediating Effects of Wayfinding Experience, Personality and Emotions. *Psychology research and behavior management, 13*, 119.

Nazareth, A., Huang, X., Voyer, D., & Newcombe, N. (2019). A meta-analysis of sex differences in human navigation skills. *Psychonomic bulletin & review, 26*(5), 1503-1528.

Nunnally, J. C. (1994). *Psychometric theory 3E*. Tata McGraw-hill education.

Perrochon, A., Mandigout, S., Petruzzellis, S., Garcia, N. S., Zaoui, M., Berthoz, A., & Daviet, J. (2018). The influence of age in women in visuo-spatial memory in reaching and navigation tasks with and without landmarks. *Neuroscience letters, 684*, 13-17.

Pintzka, C. W., Evensmoen, H. R., Lehn, H., & Håberg, A. K. (2016). Changes in spatial cognition and brain activity after a single dose of testosterone in healthy women. *Behavioural brain research, 298*, 78-90.

Prestopnik, J. L., & Roskos–Ewoldsen, B. (2000). The relations among wayfinding strategy use, sense of direction, sex, familiarity, and wayfinding ability. *Journal of environmental psychology, 20*(2), 177-191.

Rainville, C., Marchand, N., & Passini, R. (2002). Performances of patients with a dementia of the Alzheimer type in the Standardized Road-Map test of Direction Sense. *Neuropsychologia, 40*(5), 567-573.

Ulrich, S., Grill, E., & Flanagin, V. L. (2019). Who gets lost and why: A representative cross-sectional survey on sociodemographic and vestibular determinants of wayfinding strategies. *PloS one, 14*(1), e0204781.

van der Ham, I. J., & Claessen, M. H. (2020). How age relates to spatial navigation performance: functional and methodological considerations. *Ageing research reviews, 58*, 101020.

van der Ham, I. J., Claessen, M. H., Evers, A. W., & van der Kuil, M. N. (2020). Large-scale assessment of human navigation ability across the lifespan. *Scientific reports, 10*(1), 1-12.

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van der Ham, I. J., Kant, N., Postma, A., & Visser-Meily, J. (2013). Is navigation ability a problem in mild stroke patients? Insights from self-reported navigation measures. *Journal of rehabilitation medicine, 45*(5), 429-433.

Vlček, K., & Laczó, J. (2014). Neural correlates of spatial navigation changes in mild cognitive impairment and Alzheimer's disease. *Frontiers in behavioral neuroscience, 8*, 89.

Weir, J. P. (2005). Quantifying test-retest reliability using the intraclass correlation coefficient and the SEM. *The Journal of Strength & Conditioning Research, 19*(1), 231-240.

Wolbers, T., & Hegarty, M. (2010). What determines our navigational abilities? *Trends in cognitive sciences, 14*(3), 138-146.

Xie, Y., Bigelow, R. T., Frankenthaler, S. F., Studenski, S. A., Moffat, S. D., & Agrawal, Y. (2017). Vestibular loss in older adults is associated with impaired spatial navigation: data from the triangle completion task. *Frontiers in neurology, 8*, 173.

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Appendix 1: Wayfinding Questionnaire-Turkish version

Yön Bulma Anketi-YBA

Aşağıdaki verilmiş olan 20 madde, yönünüzü bulma becerileriniz ile ilişkilidir. Maddeleri size en uygun olan rakamı işaretleyerek cevaplayınız.

1'den 7'ye kadar olan rakamların açıklaması:

1	2	3	4	5	6	7
Kesinlikle bana uymamakta	Neredeyse hiçbir zaman bana uymamakta	Nadiren bana uymakta	Arada sırada bana uymakta	Çoğunlukla bana uymakta	Hemen hemen her zaman bana uymakta	Her zaman bana uymakta

1. İlk defa geldiğim bir binanın ana girişini kolaylıkla belirleyebilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

2. Kentsel bir simgeyi (bina, anıt, ana kavşak) birkaç kez görürsem, daha önce hangi yönden gördüğümü tam olarak bilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

3. Bilmediğim bir şehirde bilgi panosundaki haritadan nereye gideceğimi kolaylıkla belirleyebilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

4. Harita olmaksızın ilk defa yürüdüğüm bir yolu yürürken, gittiğim uzaklığı tahmin edebilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

5. Bilmediğim bir şehirde (ölçekli) bir haritadan baktığımda gitmem gereken yolu ne kadar sürede yürüyebileceğimi tahmin edebilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

6. Bilmediğim bir çevrede nerede bulunduğumu kolaylıkla ve hızlıca belirleyebilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

7. Bir yerlerde yolumu kaybetmekten korkarım.*

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

8. Bilmediğim bir şehirde yolumu kaybetmekten korkarım.*

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

9. Bilmediğim bir şehirde tek başıma olmaktansa bir grupla yürümeyi tercih ederim.*

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

10. Yolumu kaybettiğimde endişe duyarım.*

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

Aşağıda verilmiş durumlarda ne kadar rahatsızlık duyarsınız? (12., 13. ve 14. maddeler):

11. Tren, otobüs ya da metro istasyonundan çıkar çıkmaz nereye gideceğinizi belirlemek.*

Hiç bir rahatsızlık duymam	1	2	3	4	5	6	7	Son derece rahatsız olurum

12. Aşağıda verilmiş durumda ne kadar rahatsızlık duyarsınız: Bilmediğiniz bir binada (hastane vb. gibi) yolunuzu bulmak.*

Hiç bir rahatsızlık duymam	1	2	3	4	5	6	7	Son derece rahatsız olurum

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13. Aşağıda verilmiş durumda ne kadar rahatsızlık duyarsınız: Bilmediğiniz bir şehirde ya da şehrin bilmediğiniz bir bölgesinde toplantıya yetişmek için yolunuzu bulmak.*

Hiç bir rahatsızlık duymam	1	2	3	4	5	6	7	Son derece rahatsız olurum

14. Daha önce gitmediğim bir yere gitmeyi korkutucu bulurum.*

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

15. Daha önce sadece bir kere yürüdüğüm bir yolu genellikle hatırlarım.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

16. Uzaklıkları (örneğin bulunduğum yerden görmekte olduğum bir bina arasındaki uzaklığı) tahmin etmekte iyiyimdir.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

17. Yapılan yol tariflerini anlayıp takip etmekte oldukça iyiyimdir.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

18. Yol tarif etmekte oldukça iyiyimdir (yani bilinen bir yolu başka birine açıklamak).

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

19. Bildiğim yerlere (kestirmeler vb. gibi) giden yeni yollar denemekten zevk alırım.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

20. Bildiğim bir yere giden en kısa yolu kolaylıkla bulabilirim.

Kesinlikle bana uymamakta	1	2	3	4	5	6	7	Her zaman bana uymakta

Toplam Skor ……

Navigasyon ve Oryantasyon ……

Uzamsal Anksiyete-Belirsizlik ……

Uzamsal Anksiyete-Organizasyon ……

Puanlama:

*7 – 14 arasındaki maddelerin puanlaması yapılırken puanları ters çevrilerek hesaplanır. (Örneğin 7.maddeye kişi 3 puan verdiyse, puanlamada 5 puan olarak değerlendirilir.)

Toplam Skor: Anketteki tüm maddelere verilen puanlar toplanarak 20'ye(madde sayısı) bölünür.
Navigasyon ve Oryantasyon: 1,2,3,4,5,6,15,16,17,18,19 ve 20. maddeleri içerir. Puanlama yapılırken maddelere verilen puanlar toplanarak 12'ye(madde sayısı) bölünür.
Uzamsal Anksiyete-Belirsizlik: 7,8,9,10 ve 14. maddeleri içerir. Puanlama yapılırken maddelere verilen puanlar toplanarak 5'e(madde sayısı) bölünür.
Uzamsal Anksiyete-Organizasyon: 11,12 ve13. maddeleri içerir. Puanlama yapılırken maddelere verilen puanlar toplanarak 3'e(madde sayısı) bölünür.