



Cartography M.Sc.

Cross-cultural differences in topographic map design perception

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INTRODUCTION

cultural circumstances and cross-cultural diversity

cognitive abilities and style
(attention, perception, learning, reasoning)

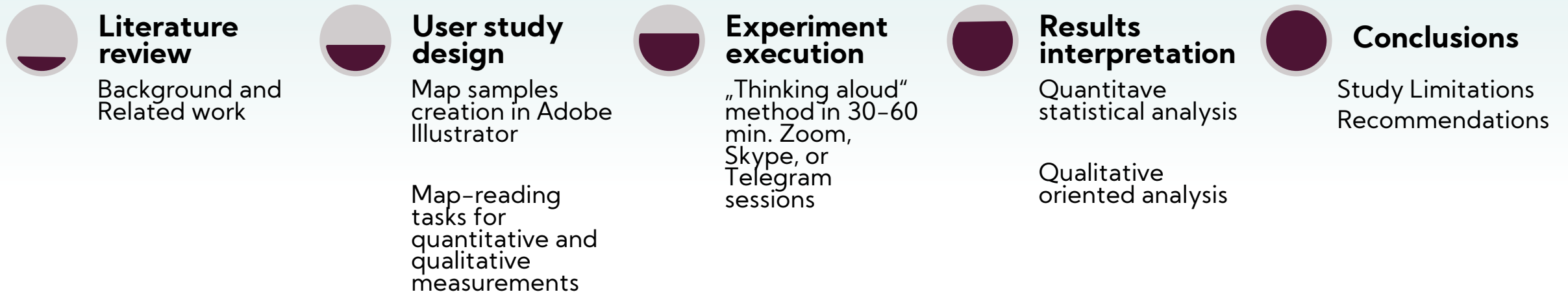
map reading tasks for examination map variables

RESEARCH QUESTIONS

Main purpose: to investigate to what extent a cultural background influences the process of interaction (perception, attention, learning, and interpretation of the cartographic information) with a specific topographic map design.

1. Do people perceive and process this information differently? Is there a presence of cross-cultural diversity? If yes, how and to what extent does cultural background influence cognitive abilities, and style?
2. What role does the topographic map design have in the process of map reading and information extraction?

WORKFLOW





1. MAP SAMPLES CREATION

Federal Office of Metrology and Surveying (BEV) of the Republic of Austria (Map I)



Committee of Geodesy and Cartography of the Republic of Kazakhstan (Map II)



Figure 1. Original map samples' source: topographic map of Austria [1] and Kazakhstan [2].

- **Selection Stage:**
linear features

lines of communication			
Austrian map			Kazakhstan map
standard gauge railway – railway station			railway road – railway station
motorway: completed			motorways
primary route			improved seal-coated road
secondary route			
first order road			seal-coated road
roadway			improved dirt road
footpath			dirt road
route number			-
distance in km – motorway - road motorway			distance in km – motorway - road motorway
boundary			
Austrian map			Kazakhstan map
state border			state borders
province boundary			oblast borders
administrative district boundary			region borders

Figure 2. Original map samples' source: topographic map of Austria [1] and Kazakhstan [2].

- **Selection Stage:**
surface objects










landcover			
Austrian map		Kazakhstan map	
white space			white space
forest			forest
large settlement			large settlement
-			small settlement
settlement			settlement

Figure 3. Original map samples' source: topographic map of Austria [1] and Kazakhstan [2].

- **Selection Stage:**
relief representation


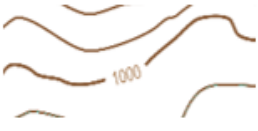


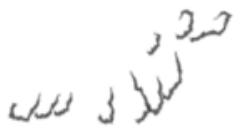

terrain representation			
Austrian map			Kazakhstan map
principal contour / elevation value			main contours and their labels
contour			additional contours (horizontals)
spot elevation	Winston 2437 x	Winston 2037 m. .	elevation marks
rocks			rocks

Figure 4. Original map samples' source: topographic map of Austria [1] and Kazakhstan [2].

- **Selection Stage:**
symbology
















individual objects			
Austrian map			Kazakhstan map
church			Buddhist and other temples
mine			mine
factory			plants and factories
transmitting station			TV and radio mast
beacon			lighthouse
hospital			hospital
air traffic			
aerodrome in correct positioned representation			aerodrome
airport			

Figure 5. Original map samples' source: topographic map of Austria [1] and Kazakhstan [2].

- **Selection Stage:**
typography

typography			
Austrian map		Kazakhstan map	
town > 100 000 inhabitants	SHARNWICK	SHARNWICK	large cities > 50,000 inhabitants
town > 25 000 inhabitants	Rivendell	Rivendell	small towns with less than 50,000 inhabitants
settlement > 2 000 inhabitants	Surabaya	Surabaya	villages
settlement < 2 000 inhabitants	Werowocomoco	Werowocomoco	rural settlements
district	KELEWAN	KELEWAN	city or village districts
water	Rivia Lake	RIVIA LAKE	water
mountain / mountain range	Karstark	KARSTARK	mountain / mountain range
valley	Cloverfeld	CLOVERFELD	valley

- **Selection Stage:**
water bodies





waters			
Austrian map		Kazakhstan map	
unnavigable river-stream - direction of flow			rivers and streams - arrows indicating the direction of flow of rivers
lakes			lakes

Figure 7. Original map samples' source: topographic map of Austria [1] and Kazakhstan [2].

- **Creation stage:**
map skeleton

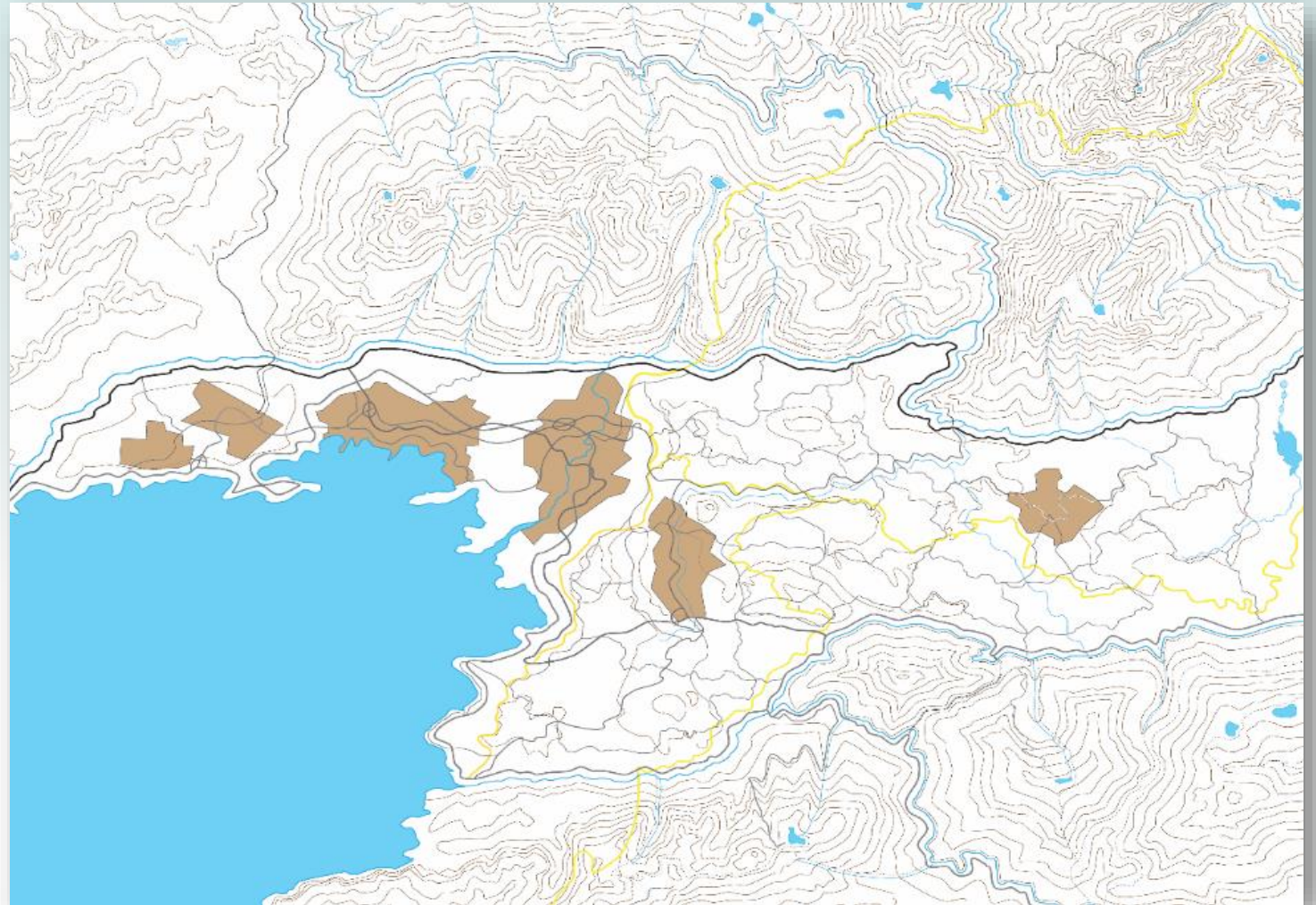


Figure 8. Sketch of the map sample produced for the experiment.

- **Creation stage:**
adding colour hues

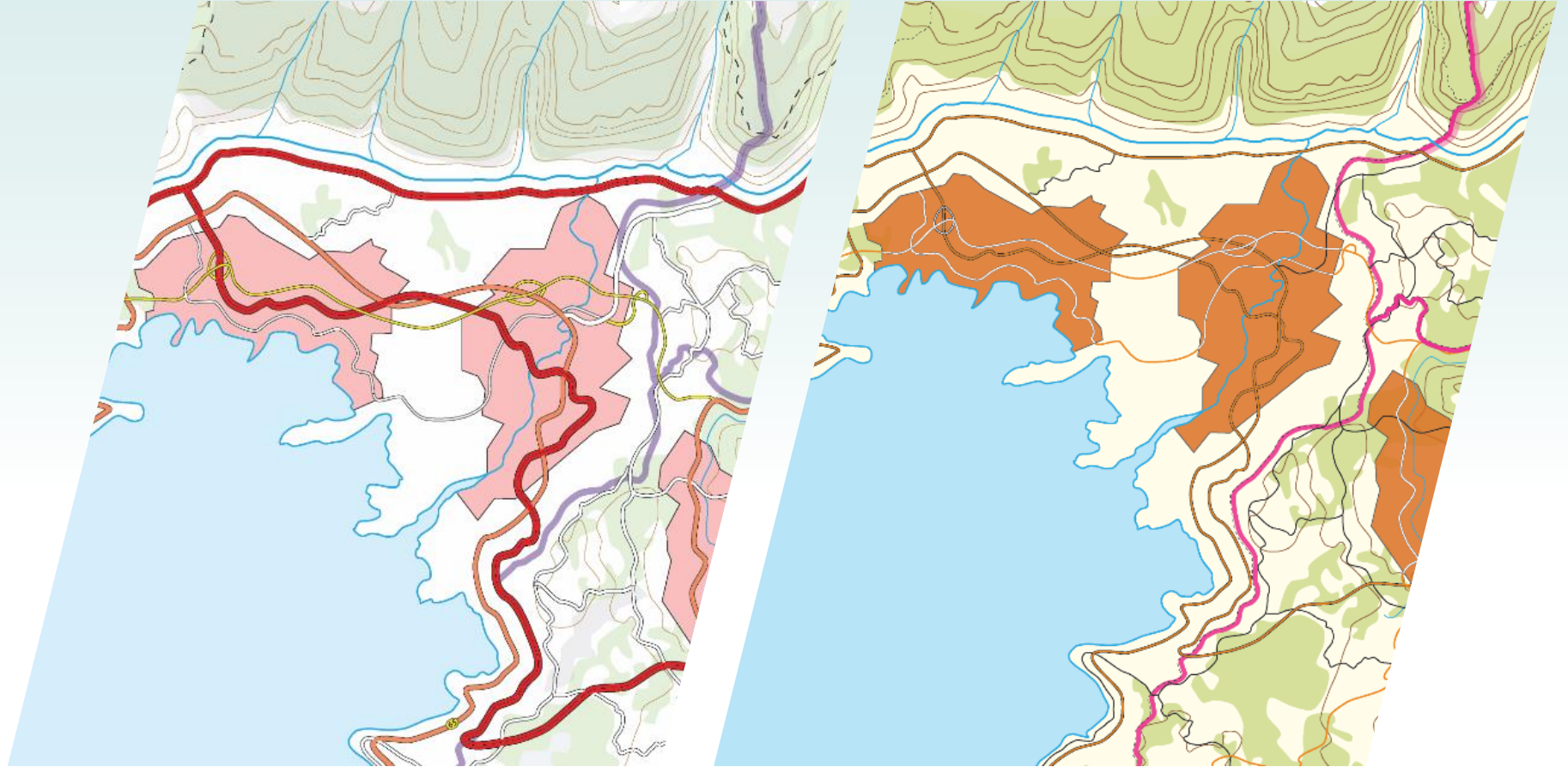


Figure 9. Sketch of the map sample produced for the experiment.

- **Creation stage:**
adding labelling (font style)



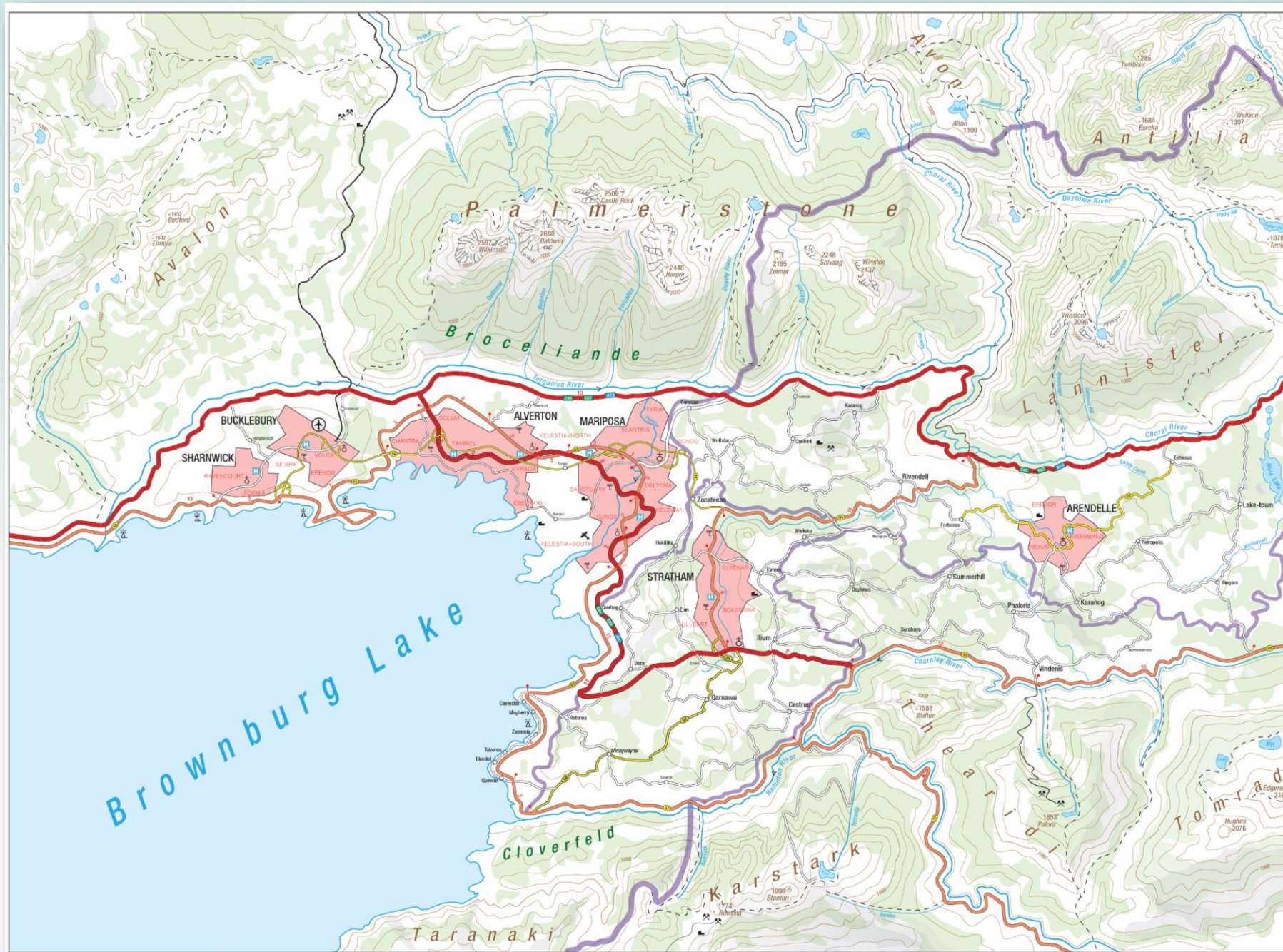
Figure 10. Sketch of the map sample produced for the experiment.

- **Creation stage:**
adding symbolization
(graphic symbols)

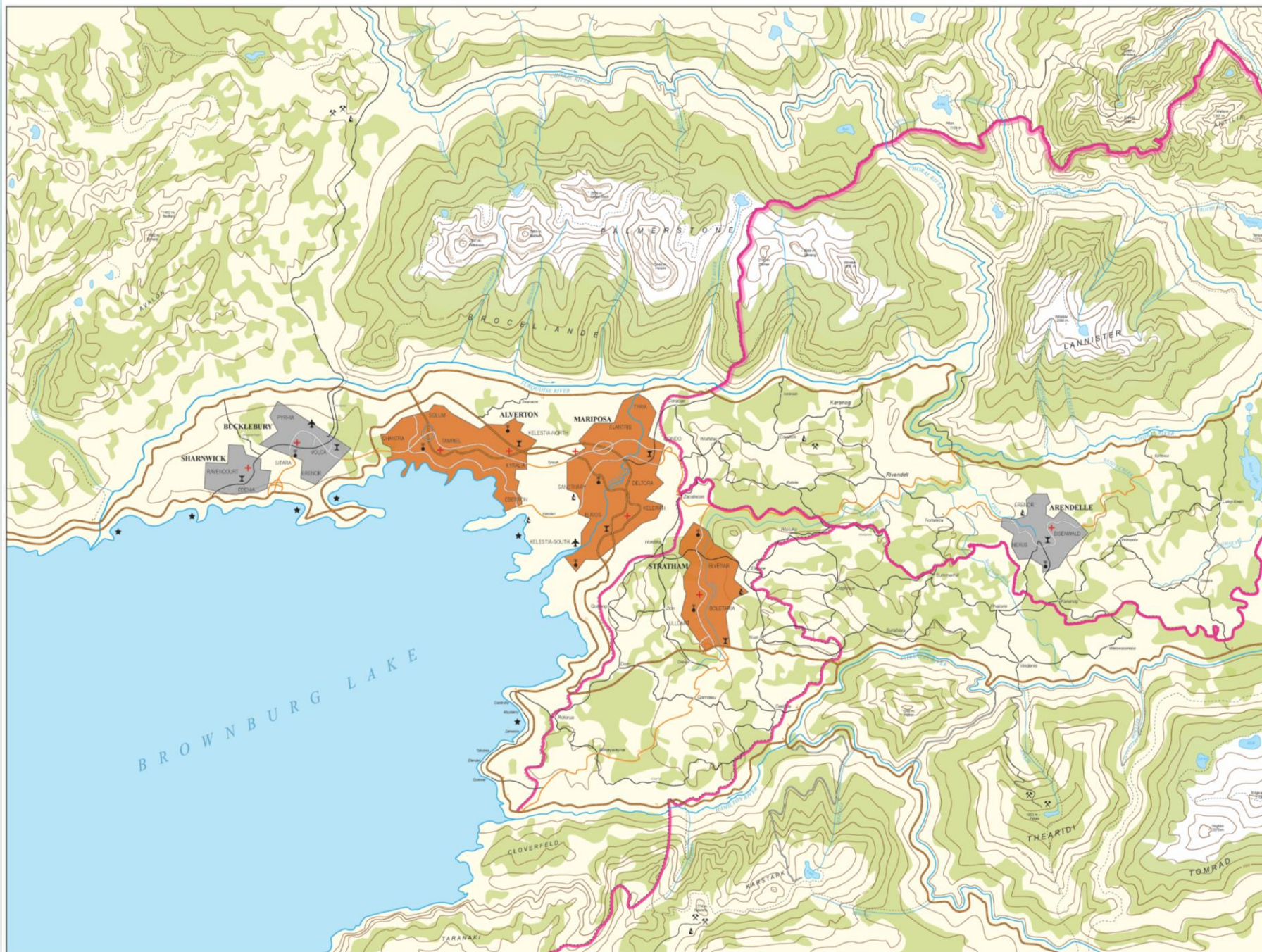


Figure 11. Sketch of the map sample produced for the experiment.

■ Final stage:



■ Final stage:





1. MAP SAMPLES CREATION



2. USER GROUP FORMATION

Cultural and environmental determinants	Culture enculturation	Western (Group 1)	Asian (Group 2)
		↓	↓
Psychological constructs	Self-dependence measured by IISS	Individualism	Collectivism
	Cognitive style measured by CFT	Analytic	Holistic
		↓	↓
Hofstede's cultural dimensions model at the national level			

Table 1. Research model used for user group division.
Note. IISS – Independent and Interdependent Self-Scale; CFT – Compound Figure Test.

Independent social orientation		Interdependent social orientation
Individualism	Values, beliefs	Collectivism
Autonomy		Harmony
Personal social identity	Self	Relational social identity
Happiness as a disengaging emotion	Emotions	Happiness as an engaging emotion
Individual achievement	Motivation	Achievement for in-group
Self-enhancement		Self-criticism

Table 2. Analytic Versus Holistic Cognitive Patterns [4].

Analytic Cognition		Holistic Cognition
Field independent	Attention	Field dependent
Narrow		Broad
Taxonomic, focus on a single dimension or shared property	Categorization	Thematic, focus on functional relationship or overall similarity
Dispositional	Attribution	Situational
Analytic	Reasoning	Dialectical

Table 3. Independent Versus Interdependent Social Orientation Patterns[4].

Hofstede's cultural model [5]

Power distance (PDI)

acceptance or rejection of hierarchy and authority

Uncertainty Avoidance (UAI)

evasion or following of rules (technology, law, religion)

Individualism/Collectivism (IDV)

level of humans' integration into groups and society

Masculinity/Femininity (MAS)

focus on assertiveness, success or on social activities, family

Long/Short Term Orientation (LTO)

openness or reluctance to up-to-date approaches, norms

Indulgence/Restraint (IND)

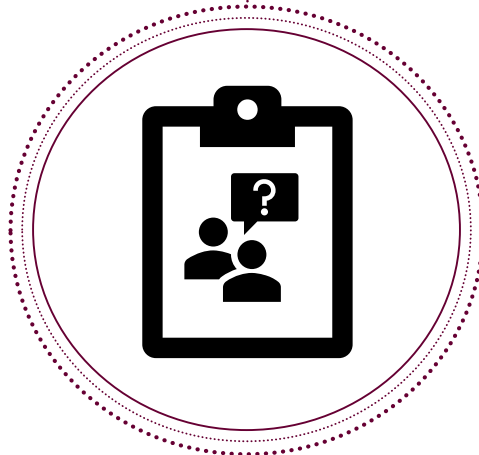
allowance or suppression of gratification of basic desires



1. MAP SAMPLES CREATION



2. USER GROUP FORMATION



3. SURVEY STRUCTURE

1. Personal data

1. *Age/sex;*
2. *Obtained level of education;*
3. *Academic background;*
4. *Current employment status;*
5. *Cultural background (the place where they spent most of their life);*
6. *The level of familiarity with maps.*

1. Quantitative method (Part I): Objective measurements

■ Map-reading tasks in finding a labelled place on two map samples:

- Q1.1 Which river separates the Wilkinson and Baldwin mountain peaks?*
- Q1.2 What small town/village is located close to the airport in Bucklebury?*
- Q1.3 What is the highest point of the Palmerstone mountain system?*
- Q1.4 Which districts of Alverton city are closest to hospitals?*
- Q1.5 What large settlement/town is located on a most direct road connecting Mariposa and Stratham?*
- Q1.6 What lake does the Terrania River flow from?*
- Q1.7 What rivers flow in the Broceliande valley?*
- Q1.8 Which mountain system is surrounded by Choral and Daytown Rivers?*
- Q1.9 What are the closest city districts to the churches in Bucklebury and Sharnwick?*
- Q1.10 What rivers flow through the cities?*

3. Qualitative method (Part II): Subjective measurements

- **AttrakDiff method [6], [7] – a bipolar semantic differential 5-scale ranking characterizing the negative and positive variables.**

Q2.1.1 How attractive is the design of this map?

Ugly - Attractive

Q2.1.2 What feelings does the design of the map evoke?

Discouragement - Motivation

Q2.1.3 What feelings does the design of the map evoke?

Confusion - Clarity

related to identification and evocation, stimulation, and pragmatic quality.

Q2.2.1 What particularly caught the eye on this map?

Q2.2.2 What did you like most on this map? (what was aesthetically appealing and pleasing)

Q2.2.3 What did not you like on this map? (what was irritating, creating conflicts and confusions)

Q2.2.4 Which of the maps is familiar particularly for you and why?

USERS' BACKGROUND INFORMATION

- **Cultural background:**

25 from the European (Germany (n = 6), Bosnia and Herzegovina (n = 2), Russia (n = 2), Great Britain (n = 2)) and **25 from Central Asian countries** (Kazakhstan (n = 22) and Kyrgyzstan (n = 3));

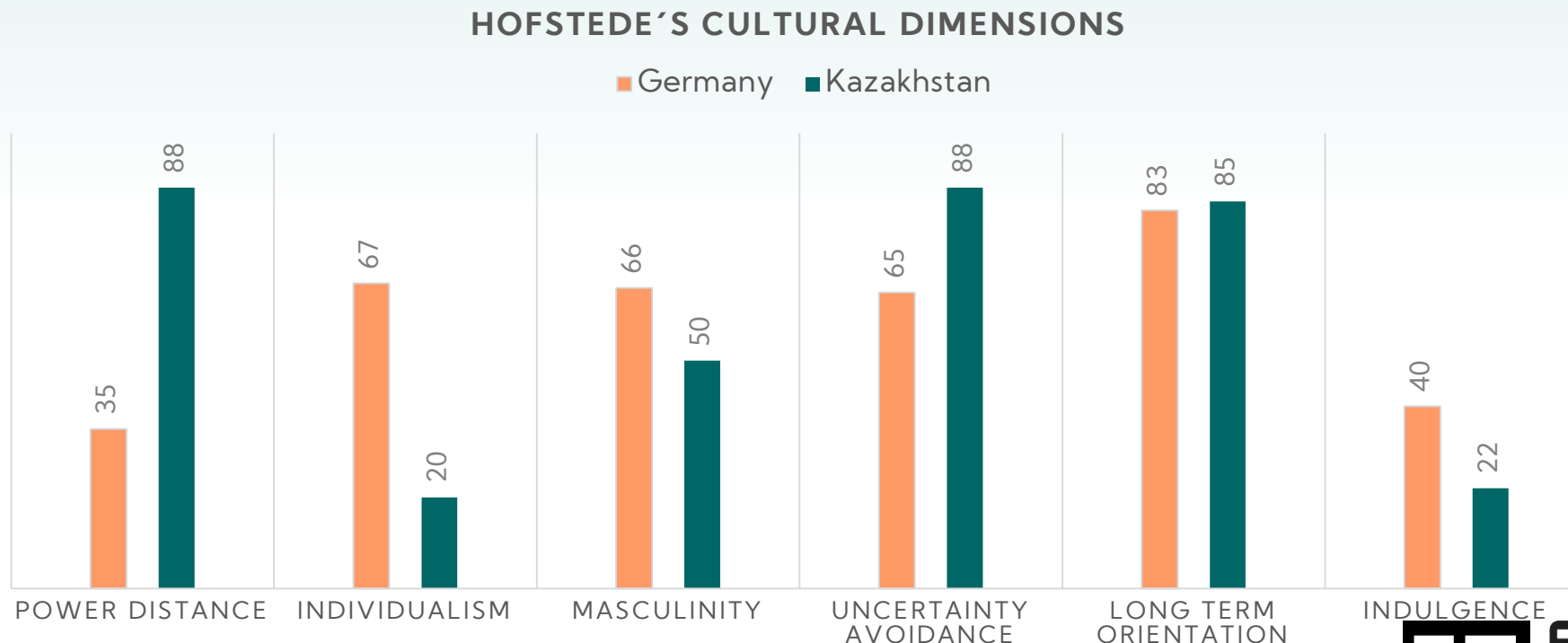














Figure 12. Hofstede's cultural model for Germany and Kazakhstan.







USERS' BACKGROUND INFORMATION

- Age and sex structure:

Group 1		Group 2
	12–17 y.o.	
	18–24 y.o.	 
 	25–34 y.o.	 
 	35–44 y.o.	 













USERS' BACKGROUND INFORMATION

- Educational background:

Group 1		Group 2
	High school	
	Undergraduate	
	Graduate	
	Doctoral	



















































USERS' BACKGROUND INFORMATION

- Academic background:

Group 1		Group 2
	Geographical/ Environmental Sciences	
	Geodesy/Cartography/ GIS	
	Applied mathematics/physics	
	Engineering/ Oil and Gas/Mining	
	Law/Economics/ Management	
	IT	
	Graphic design	

USERS' BACKGROUND INFORMATION

- Map experience level:

Group 1		Group 2
	Novice	          
	Competent	     
                       	Expert	       

QUANTITATIVE METHOD RESULTS (PART I)

■ Time measurements:

AVERAGE TIME OF COMPLETING THE TASK

■ Group 1 ■ Group 2

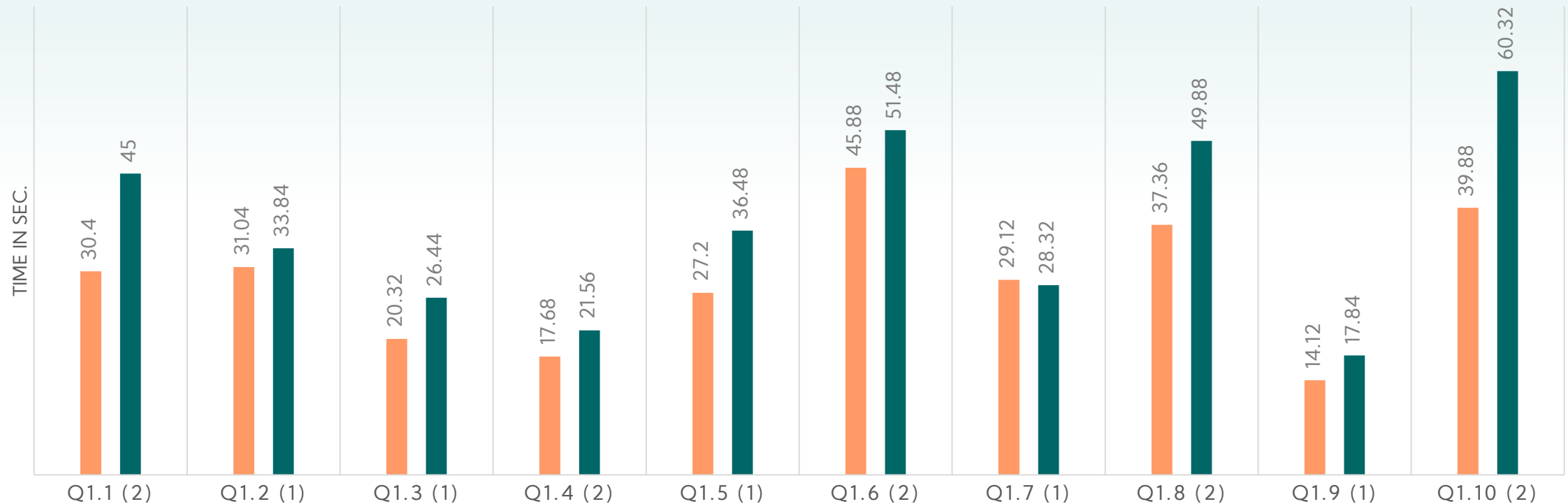


Figure 12. Hofstede's cultural model for Germany and Kazakhstan.

QUANTITATIVE METHOD RESULTS (PART I)

- **Efficiency of the map design : Map I by conducting a Student T-test [8]**
- **Main hypothesis:** participants from Group I will show faster performance on Map I rather on Map II, and Group II – vice- versa:

H_0 – there is no significant difference in the performance of Group 1 and Group 2 on Map I;

H_a – there is a significant difference in the performance of Group 1 and Group 2 on Map I;

- **Step 1. Generation of the specific equation:**

$$t_{\varepsilon} = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{124s_1^2 + 124s_2^2}{248}} \cdot \sqrt{\frac{1}{125} + \frac{1}{125}}} = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{s_1^2 + s_2^2}{5}}} = \frac{5|\bar{x}_1 - \bar{x}_2|}{\sqrt{s_1^2 + s_2^2}}$$

where:

\bar{x}_1 – mean values of the sample set of Group I, \bar{x}_2 – mean values of the sample set of Group 2;

n_1 – number of records in a sample set of Group I, n_2 – in a number of records in a sample set of Group 2;

s_1 – standard deviation of Group I, s_2 – standard deviation of Group 2.

- **Step 2. Defining the Degree of Freedom:**

$$D_f = n_1 + n_2 - 2 = 125 + 125 - 2 = 248$$

where:

D_f – the Degree of Freedom;

n_1 – number of records in a sample set of Group 1, n_2 – number of records in a sample set of Group 2.

- **Step 3. Calculating a t-score:**

$$t_1 = \frac{5(24.36 - 29)}{\sqrt{15.4^2 + 21.6^2}} = \frac{23.2}{703.72} = 0.03$$

- **Step 4. Specifying the level of probability:**

$$p = 0.488046.$$

- **Step 5. Checking the hypotheses:**

$$t_1 (0.03) < t (0.488), \text{ so that we accept } H_0.$$

QUANTITATIVE METHOD RESULTS (PART I)

- **Efficiency of the map design : Map II by conducting a Student T-test**
- **Main hypothesis:** participants from Group II will act faster on Map II rather on Map I, and Group I – will not:

H_0 – the is no significant difference in the performance of Group I and Group 2 on Map II;

H_a – the is a significant difference in the performance of Group I and Group 2 on Map II;

- **Step 1. Generation of the specific equation:**

$$t_{\varepsilon} = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}} \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{124s_1^2 + 124s_2^2}{248}} \cdot \sqrt{\frac{1}{125} + \frac{1}{125}}} = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{s_1^2 + s_2^2}{5}}} = \frac{5|\bar{x}_1 - \bar{x}_2|}{\sqrt{s_1^2 + s_2^2}}$$

where:

\bar{x}_1 – mean values of the sample set of Group I, \bar{x}_2 – mean values of the sample set of Group 2;

n_1 – number of records in a sample set of Group I, n_2 – in a number of records in a sample set of Group 2;

s_1 – standard deviation of Group I, s_2 – standard deviation of Group 2.

- **Step 2. Defining the Degree of Freedom:**

$$D_f = n_1 + n_2 - 2 = 125 + 125 - 2 = 248$$

where:

D_f – the Degree of Freedom;

n_1 – number of records in a sample set of Group 1, n_2 – number of records in a sample set of Group 2.

- **Step 3. Calculating a t-score:**

$$t_1 = \frac{5(34.2 - 46)}{\sqrt{20^2 + 28.8^2}} = \frac{59}{35} = 1.68$$

- **Step 4. Specifying the level of probability:**

$$p = 0.488046.$$

- **Step 5. Checking the hypotheses:**

$$t_1 (1.68) < t (0.488), \text{ so that we accept } H_0.$$

CONCLUSION

- **Main hypothesis was not supported;**
- **Map II: Group I** ($t = 4280$ sec) vs **Group 2** ($t = 5705$ sec);
- **Map I: Group I** ($t = 3045$ sec) vs **Group 2** ($t = 3573$).

QUALITATIVE METHOD RESULTS (PART II)

- Deductive approach for Q2.1.1, Q2.1.2, and Q2.1.3:

- Main hypothesis:

H_1 : Participants will highly assess the map based on their experience and familiarity.

- The mere exposure effect [9] – the tendency to make preferences and to like things based on subjective familiarity;
- Perceptual fluency [10] – prior exposure positively influences the processing speed and fluency;
- The modified two-factor model [10] posits that an individual prefers something familiar, and thus, it reflects the process of learning.

QUALITATIVE METHOD RESULTS (PART II)

- **Deductive approach for Group 1:**

- **Step 1. Hypotheses:**

H_0 – there is no significant difference between the records for “Ugly – Attractive” dimensions in the sample set to the sample size;

H_a – there is a significant difference between the records for “Ugly – Attractive” dimensions in the sample set to the sample size;

H_0 – there is no significant difference between the records for “Discouragement – Motivation” dimensions in the sample set to the sample size;



H_a – there is a significant difference between the records for “Discouragement – Motivation” dimensions in the sample set to the sample size;

H_0 – there is no significant difference between the records for “Confusion – Clarity” dimensions in the sample set to the sample size;

H_a – there is a significant difference between the records for “Confusion – Clarity” dimensions in the sample set to the sample size;

QUALITATIVE METHOD RESULTS (PART II)

- Deductive approach for Group 1:
- Step 2. Collecting categories in coding agenda:

Map I				Map II			
							
Attributes	\bar{x}	σ	σ	\bar{x}	Attributes	\bar{x}	σ
Ugly - Attractive	3.96	0.84	0.94	2.84	Ugly - Attractive	2.84	0.94
Discouragement - Motivation	4.04	0.88	0.89	2.72	Discouragement - Motivation	2.72	0.89
Confusion - Clarity	4.4	0.7	0.85	2.32	Confusion Clarity	2.32	0.85

QUALITATIVE METHOD RESULTS (PART II)

- Deductive approach for Group 1:
- Step 3. Checking the hypotheses: T-test method:

Ugly – Attractive:

$$t_1 = \frac{5(3.96-2.84)}{\sqrt{0.84^2+0.94^2}} = \frac{5.6}{1.26} = 4.44$$

Discouragement – Motivation:

$$t_2 = \frac{5(4.04-2.72)}{\sqrt{0.88^2+0.89^2}} = \frac{6.6}{1.25} = 5.27$$

Confusion – Clarity:

$$t_3 = \frac{5(4.4-2.32)}{\sqrt{0.85^2+0.7^2}} = \frac{10.4}{1.10} = 9.44$$

$t_1 (4.44) > t (1.677)$, so that we reject H_0 and accept H_a .

$t_2 (5.27) > t (1.677)$, so that we reject H_0 and accept H_a .

$t_3 (9.44) > t (1.677)$, so that we reject H_0 and accept H_a .

CONCLUSION

- **The outcomes corroborate with the main hypothesis for 100% (n = 25) that the level of familiarity plays a crucial role in such types of ratings as evaluation of attractiveness and usability [10].**

QUALITATIVE METHOD RESULTS (PART II)

- **Deductive approach for Group 2:**

- **Step 1. Hypotheses:**

H_0 – there is no significant difference between the records for “Ugly – Attractive” dimensions in the sample set to the sample size;

H_a – there is a significant difference between the records for “Ugly – Attractive” dimensions in the sample set to the sample size;

H_0 – there is no significant difference between the records for “Discouragement – Motivation” dimensions in the sample set to the sample size;



H_a – there is a significant difference between the records for “Discouragement – Motivation” dimensions in the sample set to the sample size;

H_0 – there is no significant difference between the records for “Confusion – Clarity” dimensions in the sample set to the sample size;

H_a – there is a significant difference between the records for “Confusion – Clarity” dimensions in the sample set to the sample size;

QUALITATIVE METHOD RESULTS (PART II)

- Deductive approach for Group 2:
- Step 2: Collecting categories in coding agenda:

Map I				Map II			
							
Attributes	\bar{x}	σ	σ	\bar{x}	Attributes	\bar{x}	σ
Ugly - Attractive	3.6	1.08	1.15	3.4	Ugly - Attractive	3.4	1.15
Discouragement - Motivation	3.4	1.08	1.29	3.4	Discouragement - Motivation	3.4	1.29
Confusion - Clarity	1.8	0.76	0.81	3.9	Confusion Clarity	3.9	0.81

QUALITATIVE METHOD RESULTS (PART II)

- Deductive approach for Group 2:
- Step 3: Checking the hypotheses: T-test method

Ugly – Attractive:

$$t_1 = \frac{5(3.6-3.4)}{\sqrt{1.08^2+1.15^2}} = \frac{1}{1.58} = 0.63$$

Discouragement – Motivation:

$$t_2 = \frac{5(3.4-3.4)}{\sqrt{1.08^2+1.29^2}} = \frac{0}{1.68} = 0.0$$

Confusion – Clarity:

$$t_3 = \frac{5(1.8-3.9)}{\sqrt{0.76^2+0.81^2}} = \frac{10.5}{1.11} = 9.45$$

$t_1 (0.63) < t (1.677)$, so that we accept H_0 .

$t_2 (0.0) < t (1.677)$, so that we accept H_0 .

$t_3 (9.45) > t (1.677)$, so that we reject H_0 and accept H_a .

CONCLUSION

- The overall picture supported the current hypothesis for **67%**;
- **Confusion – Clarity: Map I** ($M = 1.8$, $SD = 0.76$) **and Map II** ($M = 3.9$, $SD = 0.81$);
- **Ugly – Attractive: Map I** ($M = 3.6$, $SD = 1.08$) **and Map II** ($M = 3.4$, $SD = 1.15$);
- **Discouragement – Motivation: Map I** ($M = 3.4$, $SD = 1.08$) **and Map II** ($M = 3.4$, $SD = 1.28$).

QUALITATIVE METHOD RESULTS (PART II)

- Inductive approach for Q2.2.1, Q2.2.2, Q2.2.3, Q2.2.4, and Q2.2.5.
- **Step 2.** Determination of criterion of selection:

Which map design Group I / Group II liked most and why?

- **Step 2.** Step-by-step formulation of categories out of the results:

“colour scheme”, “font-style”, “font-size”, “relief representation”, “road network”,

“depiction of settlement areas”, “graphical symbols”.

QUALITATIVE METHOD RESULTS (PART II)

- Inductive approach for Q2.2.1, Q2.2.2, Q2.2.3, Q2.2.4, and Q2.2.5.
- **Step 1.** Determination of criterion of selection:

Which map design Group I / Group II liked most and why?

- **Step 2.** Step-by-step formulation of categories out of the results:

“colour scheme”, “font-style”, “font-size”, “relief representation”, “road network”,

“depiction of settlement areas”, “graphical symbols”.

GROUP 1 (MAP I)

Map variables	Comments
Colour scheme	<p>is well-balanced, uniform, and harmonized; has neutral, muted, pastel-tone, soft colour tone; looks nice, visually attractive and aesthetically pleasing for the eyes; has “speaking” colours, label colours are linked to the map elements (green for valleys, brown for mountains) eases the orientation, navigation and reading; it seems like it follows some standards or guidelines and, thus, it looks correct; looks recognizable, familiar; is similar to German, French, Spanish, Czech, Polish topographic maps’ colour scheme;</p>
Font style	<p>is harmonized and consistent because of one font style; is readable and legible; is self-explanatory, especially for natural objects; eases the map reading process; it seems like it follows some standards or guidelines and, thus, it looks correct;</p>
Font size	<p>is distinct, eye-catching, visible; has good legibility but it is hard to “feel” on a digital format of the map; self-explanatory and logical so that it is possible to notice hierarchy levels in labelling; it seems like it follows some standards or guidelines and, thus, it looks correct;</p>

GROUP 1 (MAP I)

Map variables	Comments
Relief representation	mountainous areas have a kind of 3D effect; mountain peaks with rock depiction are well visualized; rock depiction makes more sense than on Map II;
Road network	is detailed; is well-categorized, and straightforward since it is illustrated by the thickness of the line, colour hues, and road intersections; is distinguishable, prominent, and dominating; is well-balanced and efficient for navigation purposes; the thick red line is too strong and distracting; road categories and types are clear; it seems like it follows some standards or guidelines and, thus, it looks correct;
Depiction of settlement areas	the outline of large settlements makes more sense than Map II; pink colour for large residential areas is familiar and no confusion occurs here; label placement is logical and follows the direction of an object on a map; city district names in reddish colour are irritating; it seems like it follows some standards or guidelines and, thus, it looks correct;
Graphical symbols	are unambiguous and straightforward; hospital sign sometimes was messed with a bus stop sign in Germany at first sight.

GROUP 1 (MAP II)

Map variables	Comments
Colour scheme	<p>is very bright, and saturated;</p> <p>has a high contrast of colour hues;</p> <p>looks nostalgic, similar to Hungarian, Albanian, Georgian old maps;</p> <p>yellowish colour as a background (i.e. white space) looks old-fashioned;</p> <p>yellowish colour as a background (i.e. white space) looks unusual;</p>
Font style	<p>a mix of serif and sans serif fonts is not good;</p> <p>seems like randomly chosen, inconsistent;</p> <p>looks retro, old-fashioned and not typical for a topographic map;</p> <p>labels for natural objects and relief does not serve the purpose of a map;</p>
Font size	<p>too small, especially for natural objects;</p> <p>not readable and visible in comparison to Map I;</p> <p>does not stand out easily;</p> <p>difficult to understand the hierarchy from the font size;</p>
Relief representation	<p>isolines are prominent and visible;</p> <p>yellowish, light green, brown colours represent the relief well;</p>
Road network	<p>lines are too thin so that everything looks like a big mess, redundant;</p> <p>the whole network looks empty from the perspective of knowledge;</p> <p>has no real information for navigation;</p> <p>is not visually appealing;</p> <p>is a bit illogical in the case when the road changes its style when it enters the city area;</p>
Depiction of settlement areas	<p>representation of cities in two distinct colours (grey and orange) does not make makes;</p> <p>grey colour for cities gives an impression of the “industrial area”</p>
Graphical symbols	<p>are puzzling, especially for beacon, religious places, factory, TV, radio station;</p> <p>only symbolization of hospital, aerodrome, and mining site was easy to interpret;</p>

GROUP 2 (MAP I)

Map variables	Comments
Colour scheme	<p>is too pale, so that the objects on a map are not clearly visible and even lost;</p> <p>the colour hues are not facilitating an easy map reading;</p> <p>does not invite a map user because of low contrast and light colour hues;</p> <p>looks very harmonized and homogeneous;</p> <p>looks as a “gold standard”, follows some rules for better visual perception;</p>
Font style	<p>very clear and legible;</p> <p>nothing special;</p> <p>it seems like it follows some standards or guidelines and, thus, it looks correct;</p>
Font size	<p>facilitates good findability and readability;</p> <p>are straightforward especially when it comes to natural objects;</p> <p>the hierarchy of labels is distinctive;</p>
Relief representation	<p>is not visible and eye-catching;</p> <p>isolines (horizontal) are not aesthetically appealing, lost for eyes;</p>
Road network	<p>is eye-catching and outstanding;</p> <p>is too detailed, dense, distracting,</p> <p>is “too much” like a ball of yarn;</p> <p>requires more attention and unravelling the situation;</p> <p>gives pressure and confusion;</p> <p>has too many categories for road hierarchy, which is needless information</p>
Depiction of settlement areas	<p>the pink colour makes cities very prominent but does not make sense to show cities in this colour;</p>
Graphical symbols	<p>some of them are clear and understandable but the majority is unknown or does not make sense;</p> <p>hospital sign was unclear (hotel or hospital?);</p> <p>beacon sign reminded an oil-, gas field like on Kazakhstan thematic maps in atlases.</p>

GROUP 2 (MAP II)

Map variables	Comments
Colour scheme	<p>is very familiar and native; reminds maps from books used in childhood; is aesthetically attractive, illustrative, and fancy; invites to explore the content of the map; is similar to retro-style; it seems like it follows some standards or guidelines and, thus, it looks correct;</p>
Font style	<p>is simple and understandable; fits the overall composition; is highly legible and readable;</p>
Font size	<p>could be bigger but is not critical; too small for reading or navigating on a map;</p>
Relief representation	<p>is bright, clear, illustrative, outstanding, self-explaining; natural objects' colour is saturated and, thus, depicts it at its best (lakes, forests); too crude and bright colour tones;</p>
Road network	<p>the complexity is just right; is muted for eyes; is simple and clear;</p>
Depiction of settlement areas	<p>is familiar and intuitive, used to see them before; is clear-cut and depicts the places better than on Map I; is clear and self-explaining: brown colour reminds brick structures, grey colour represents residential buildings;</p>
Graphical symbols	<p>are familiar and „correct“ (how a good map should look like); symbolization of beacon and religious places is unclear.</p>

QUALITATIVE METHOD RESULTS (PART II)

- Inductive approach for Q2.2.1, Q2.2.2, Q2.2.3, Q2.2.4, and Q2.2.5.
- Step 3. Hypotheses:

H_1 : Participants tend to like the map based on their experience and familiarity.

The theory was exemplified by the case study of Group I and Group II (except five people, who recognized the familiarity with Map II but neglected this fact).

H_2 : The participants perform better on chosen and liked maps.

The results of the Quantitative method: Objective measurements (Part 1) failed to confirm this hypothesis since both groups performed faster on Map I with only differences in speed.

STUDY LIMITATIONS

1. The format of the experimental study;
2. The level of map experience;
3. The exposure of technologies.

OVERVIEW AND CONCLUSIONS

1. Map-reading tasks did not show a significant difference in map design perception and learning due to study limitations;
2. The assessment ranking and feedback from **Group I** (100%) highlighted a significant level of the importance of cultural background whilst communicating the map; **Group II** (67%) only partially supported this theory;
3. The presence of psychological phenomena, namely, **the mere exposure, perceptual fluency, and modified two-factor model.**

OVERVIEW AND CONCLUSIONS

- 1. Do people perceive and process cartographic information differently? Is there a presence of cross-cultural diversity? If yes, how and to what extent does cultural background influence cognitive abilities, and style?**

In terms of semantic meaning of the cartographic information – yes; in terms of the speed of solving the task – need more investigations taking into account the current study limitations;

- 2. What role does the topographic map design have in the process of map reading and information extraction?**

It is the most prominent and standardized design that is recognized at the national level.

RECOMMENDATIONS FOR FUTURE STUDIES

1. **To consider study limitations:** the format of the experimental study, hardware components, the level of map experience, the exposure of technologies;
2. **Promising research areas:** colour scheme, graphical symbols, the level of complexity, and visual hierarchy.

THANK YOU FOR YOUR ATTENTION!

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