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Kansei Engineering Experimental Research with University Websites

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Abstract: This technical report presents the data and some results of the experimental research in the field of Human-Computer Interaction (Kansei Engineering), undertaken jointly by Technische Universität Chemnitz (Germany) and Novosibirsk State Technical University (Russia) in Feb-March 2016. In the experiment, 82 Master and Bachelor students of both universities evaluated 21 website of selected German and Russian universities per 10 emotional and 5 quality scales.

1 Introduction

In our previous research work [1], we discussed the applicability of evolutionary algorithms for designing human-computer interfaces, reviewed the state-of-art in the field, and put forward combination of several existing AI and design methods to resolve the identified problems. The proposed evolutionary algorithm (EA) can be outlined as shown in Fig. 1.

In terms of an evolutionary approach currently prevalent interaction design methods seem to have notable ambiguities with selection of better candidates and with the reproduction operators. Evaluation with a fitness function is troublesome as defining computable expression of the design utility is problematic, especially since the function is very much likely to have its own evolution, due to changing requirements. At the same time, straightforward evaluation of manifold and potentially low-quality design solutions in real environments with real users, in accordance to A/B Testing, is also effectively impossible.

Thus, in the current state of interaction design, human participation would seem to be indispensable in most parts of EAs, and the situation deteriorates by the fact that the human designers working process is still largely unknown. So, for efficient selection of

candidate solutions we proposed to employ the well-known Kansei Engineering (KE) design method, which is described in more detail in the subsequent Section 2 of the report. There seems to be no fundamental obstacles why KE couldn't be extended from its conventional emotional aspect to the two other, physical and cognitive (of course, all the aspects are rather interrelated in real interaction, but we use them to illustrate transition to requirements). The goal of our experiment, described in this report, is to demonstrate that KE can be enhanced to consider non-emotional requirements, so that subsequently developed and trained KE-based neural network could be effectively used in the proposed EA for interaction design.

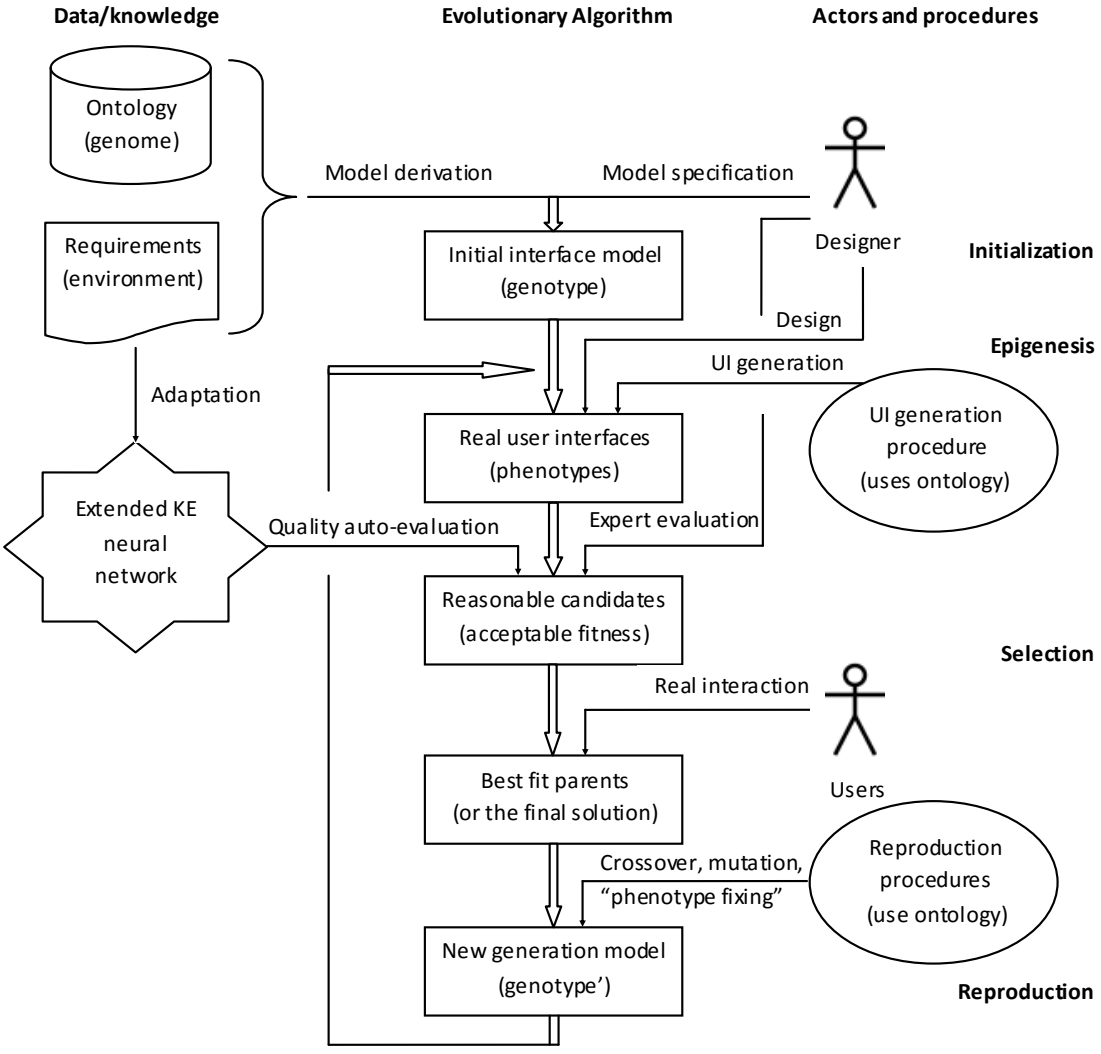


Fig. 1. Proposed evolutionary algorithm for interaction design [1]

2 Kansei Engineering for Web Design Fitness Evaluation

Currently, Kansei Engineering is a set of methods and techniques – some authors identify already as many as 6 types of KE [2] – relating customers' feelings and impressions with existing or prospective products or their certain features. KE application started in Japanese automotive industry in the 1980s, and its analytical method includes the following principal steps [3]:

1. Creating the list of concepts describing the emotional sphere of potential customers or users of the product. If no accepted catalogue exists for the domain, preliminary investigation may be performed to narrow down the initial hundreds of terms extracted from literature, experts, and users to dozens of most characteristic ones, which then constitute emotional scales (*Kansei Words*).
2. Developing the general set of a product's attributes and design-related decisions that can be made regarding them. Effectively, this is design space that we mentioned above – a tree-like or network-like structure, where each possible design resolution is represented as a pair: category (e.g. *color* or *size*) and value (e.g. *20 px*).
3. Selecting existing products or their prototypes that will be assessed, and then running the experimental research – generally a survey, when user representatives evaluate the artifacts per emotional scales, e.g. from 1 to 5, or from -3 to +3.
4. Using formal methods to analyze the obtained data and establish the relations between the emotional scales and the product's attributes. The most widely used types of KE and the corresponding approaches that are used for analyzing the data may be outlined as the following [2]:
    - Type I (KE simple category classification): uses statistical approach, most suitable for small data sets with simple relationships among variables.
    - Type II (KE Computer System): uses soft computing to find patterns in data, usually applied for large data sets with rather complex and dynamic relationships between variables.
    - Type III (KE Modeling): uses mathematical model approach, suitable for large data sets with highly complex system relationships.

The "inverse" task, or may we say synthetic method of KE, is obtaining the list of the prospective product's attributes and design resolutions from the desired Kansei (emotional feeling) of the target customer. This can be done if the knowledge about their relationships was already extracted and formally specified, thus synthetic KE is

essentially an AI method. Certainly Kansei knowledge bases already existed by the time when the Mazda Miata car was designed with the KE approach. Open publications related to practical KE expert/intelligent systems became rife in the mid-90s, see e.g. [4]. In this KE Type II, probably the most widely used AI method that kept its popularity to the present day and proliferated to the web design domain, was neural networks ([5], [6], [7]). The attractiveness of this method is due to its self-learning capability that is a natural requirement for KE (supervised learning would not be possible, since desirable correct teacher patterns are not known in advance) [5], [4], and due to reasonable computation effectiveness compared to other AI or statistical methods [8].

At the same time, neural networks (NN) have become recognized means to evaluate fitness in EAs, when neither precise values of fitness function can be determined due to obscurity or computational complexity, nor IEC is feasible [9]. Relevant hybrid methods imply accurate calculation of fitness function only for some of the candidate individuals, the ones that passed preliminary step of selection carried out with approximate values estimated by neural network [10]. Moreover, the natural adaptability of neural networks [11] allows them to accommodate fitness functions that may fluctuate over generations (mutable).

All of the above considerations suggest that KE approach in combination with neural networks could be effectively applied for selection in web interaction design. So, if candidate designs are first evaluated automatically, and only reasonably fit ones are subsequently used in A/B Testing in real a environment, the risk of causing aversion in website users would decrease significantly, while the evolution pace could speed up, as time required for IEC diminishes [12]. Furthermore, evaluation by adaptive neural networks could handle mutability in fitness functions that arises due to changing requirements, as well as due to adjustments in target users' experience and preferences [13].

The proposed KE NN evaluation method [1] belongs to model-based approaches, and conventionally the NN's input neurons are design factors, which we propose to supplement with requirements concordance metrics, and the output is user impressions or fitness evaluation for EA. Naturally, methods not involving real interactions can only provide approximate estimations of real usability, but this should be sufficient for application in EAs, for which fitness function approximations theory is reasonably well established. Also, since web interfaces are highly typical in terms of user tasks, technologies, standards, and platforms employed, compared to desktop or mobile software, the estimations should improve with NN training. So, in the next section we describe an ongoing experimental study undertaken to justify the proposed approach and illustrate how a factor of website cultural kinship affects user impressions.

3 Experiment

3.1 The Experiment Description

3.1.1 Subjects

First, there were 40 students (36 of whom were male) of Chemnitz TU, 14 of Bachelor and 26 of Master program, the greater part of them (38 subjects) majoring in Computer Science / Informatics. Their age ranged from 19 to 33 years, mean 24.5 (SD=3.19). Among them, 30 indicated German as the native language, while the other 10 specified Chinese, Arabic, Turkish, and Russian. The experiment was performed at the university computer rooms in several sessions during one day, with participants using diverse equipment: desktops with varying screen resolutions, mobile devices, etc., to better represent the real context of use for the target user group.

Second, there were 42 students (30 males) of a Novosibirsk State Technical University (Russia), 23 of Bachelor and 19 of Master program, majoring in Applied or Business Informatics. Their age ranged from 20 to 28 years, mean 21.7 (SD=0.89). Among this group, 38 indicated Russian as the native language, while the 4 other specified Yakut, Mongolian, German, and Kazakh. The experiment was performed at the university computer rooms in several sessions during several days, with the participants using desktop computers with screen resolutions ranging from 1280*1024 to 1920*1080. The subject registration page of the dedicated system that we developed for the experiment is presented in Fig. 2 (available at http://ks.khvorostov.ru). The data on both groups of participants is presented in Table 1.

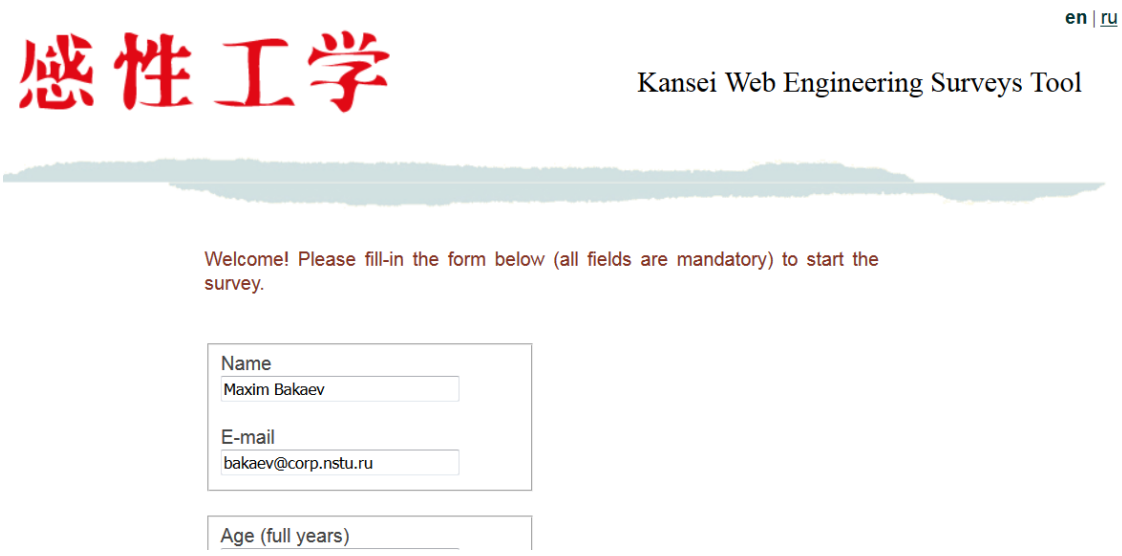


Fig. 2. Initial (registration) page of the experimental survey system

Table 1. The data on the two subject groups in the experiment

		German subjects	*Russian subjects*
Total number of subjects:		**40**	**42**
Gender	Male	90%	71.4%
	Female	10%	28.6%
Program	Bachelor	35%	54.8%
	Master	65%	45.2%
Age	Range	19~33	20~28
	Mean	24.5	21.7
	SD	3.19	0.89
Native language	Common	German: 75%	Russian: 90.5%
	Others	25%	9.5%

3.1.2 Websites and Procedure

The websites for the experiment were manually selected among operating university ones, with the requirements that 1) the website has an English version that is not radically different from the native language version; 2) the website has information about a Master program in Computer Science; and 3) the university is not too well-known, so that its reputation doesn't bias the subjects' evaluations of the website. In total there were 11 websites of German universities and 10 of Russian ones, so that designs (in terms of layout, colours, images, etc.) were sufficiently diverse in each selection. Each subject was asked to evaluate 10 websites (always starting with English version, but being able to switch to another language), randomly selected from the 21 and presented in random order. The university websites employed in the experiment are listed in Table 2.

According to the scenario given to the participants, their friend was considering enrolling for a Master in Computer Science program in one of the universities, being yet not concerned with the program's content or educational fee. The subjects were asked to browse each website for a few minutes, find the information about the Master program, and evaluate their feeling of the website as recommendation to the friend.

Table 2. The list of university websites employed in the experiment

ID	*URI*	*Group*	*University name*
1	www.uni-weimar.de	Ger	Bauhaus-Universität Weimar
2	www.uni-wuppertal.de	Ger	Bergische Universität Wuppertal
3	www.uni-tuebingen.de	Ger	Eberhard Karls Universität Tübingen
4	tu-dresden.de	Ger	Technische Universität Dresden
5	www.uni-ulm.de	Ger	Universität Ulm
6	www.uni-passau.de	Ger	Universität Passau
7	www.uni-siegen.de	Ger	Universität Siegen
8	www.uni-augsburg.de	Ger	Universität Augsburg
9	www.tuhh.de	Ger	Technischen Universität Hamburg
10	uni-koblenz-landau.de	Ger	Universität Koblenz - Landau
11	uni-osnabrueck.de	Ger	Universität Osnabrück
12	www.ranepa.ru	Rus	РАНХиГС
13	english.spbstu.ru	Rus	С-Пб. политехнический университет
14	www.rea.ru	Rus	Рос. экономический университет
15	urfu.ru	Rus	Уральский федеральный университет
16	mipt.ru	Rus	Московский физико-технич. институт
17	www.sgu.ru	Rus	Саратовский нац. исслед. ГУ
18	tpu.ru	Rus	Томский политехнич. университет
19	en.misis.ru	Rus	МИСиС
20	en.nstu.ru	Rus	Новосибирский гос. техн. университет
21	en.iee.unn.ru	Rus	Университет Лобачевского, ИЭиП

3.1.3 Evaluation Scales

The first groups, the Kansei evaluation scales, were defined after considering several related research works, such as [14], [15], [16], [17] and especially [18], where they applied the Kansei method to university websites and then performed design synthesis. It has been noted that participants in similar experiments, depending on their overall impression of the website, may give all-positive or all-negative ratings, without sufficient consideration of the scales, thus causing over-high correlations between them and impeding the analysis of emotional impressions. Thus we decided to employ as Kansei words only the adjectives that have no expressed negative meaning (e.g. unlike ugly or boring). The Kansei scales were finally organized as pairs of words with opposite or contrary meanings, which would be rated by participants by 5-point Likert scale, with 0 being the neutral value, -2 most prevalence of the first term, +2 most prevalence of the second term. The screenshot of a website evaluation page in the experimental survey system is presented in Fig. 3.

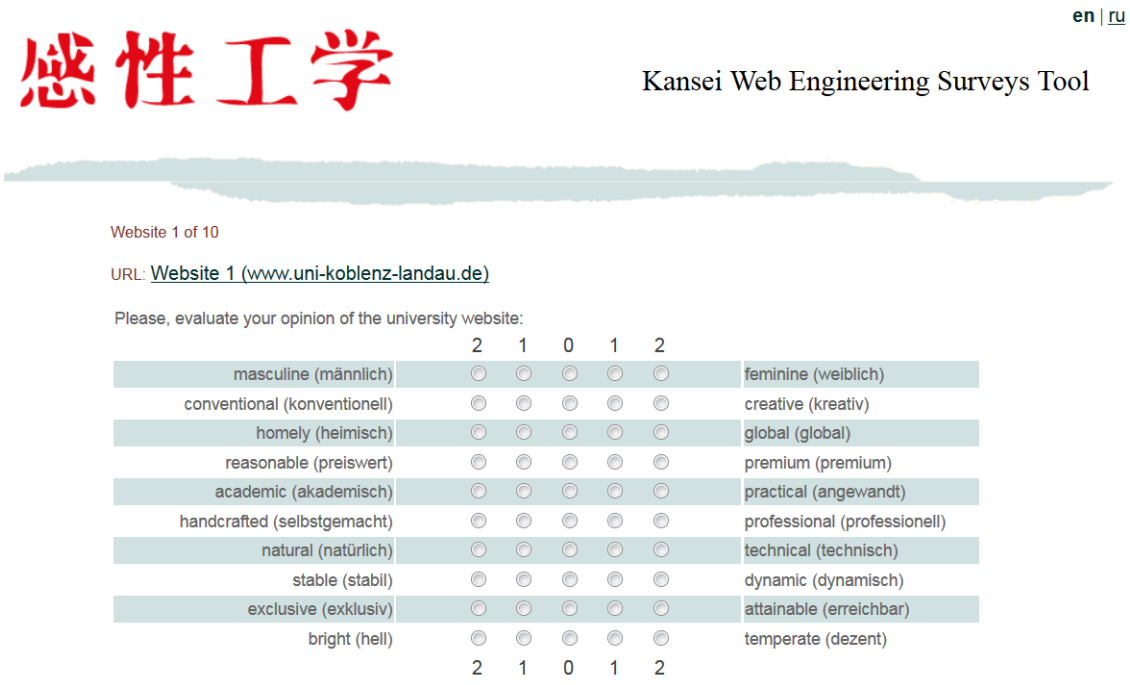


Fig. 3. The emotional scales on the website evaluation page of the experimental system

The second group of scales represented more conventional dimensions of perceived website quality (“quality scales”) and consisted of 5 single-word scales ranging from 1 (worst) to 7 (best): beautiful, trustworthy, fun, evident, and usable. Also, an additional evaluation was collected reflecting the websites’ success in the suggested task: “Based on the website, would you recommend to your friend to go there for the Master's program?” which we’ll call Overall further on, ranging from 1 (“definitely no”) to 5 (“definitely yes”).

3.2 The Collected Data

In total, 13991 website evaluation data were recorded in the experimental system's DB. It is thus impossible to adequately represent in the report all the data, so we decided to provide mean evaluations grouped per subject groups, websites, and scales (Tables 3-10). More complete data may be obtained from the authors by request.

Please note that "German" and "Russian" does not necessarily denote nationality of the subjects, but the subject group in the experiment, as described in chapter 3.1.1.

Table 3. Kansei evaluations of the German university websites by the German subjects

Website / ***Scale***	***#1***	***#2***	***#3***	***#4***	***#5***	***#6***	***#7***	***#8***	***#9***	***#10***	***#11***
masculine – feminine	0.56	-0.06	-0.30	-1.37	-0.25	0.28	-0.53	-0.68	-0.06	-0.38	0.13
conventional – creative	0.31	-0.25	-1.09	-1.21	0.15	0.11	-1.05	-1.26	0.81	0.43	0.33
homely – global	0.06	-0.25	-0.30	0.21	0.40	0.33	0.11	0.05	0.19	0.24	0.40
reasonable – premium	0.31	-0.25	-0.65	-0.47	0.35	0.06	-0.21	-0.74	0.63	-0.19	0.53
academic – practical	-0.25	-0.25	-0.61	-1.11	-0.05	-0.33	0.21	-0.89	0.38	-0.05	0.20
handcrafted – professional	0.50	-0.13	-0.22	-0.11	0.60	0.56	-0.74	-0.68	0.19	0.52	0.33
natural – technical	-0.06	0.13	0.17	1.11	0.15	0.44	0.05	0.53	0.44	0.00	0.00
stable – dynamic	0.44	-0.63	-1.13	-1.21	0.20	0.33	-0.32	-0.84	0.63	0.62	0.00
exclusive – attainable	0.56	0.50	0.43	0.21	0.55	0.22	0.21	0.53	0.13	0.52	0.47
bright – temperate	-0.56	-0.69	-0.04	0.79	-0.35	-0.44	-0.21	-0.26	-0.38	-0.38	-1.07

Table 4. Kansei evaluations of the German university websites by the Russian subjects

Website / ***Scale***	***#1***	***#2***	***#3***	***#4***	***#5***	***#6***	***#7***	***#8***	***#9***	***#10***	***#11***
masculine – feminine	0.55	-0.25	-0.17	-1.47	-0.85	0.07	-1.00	-0.86	-0.74	-0.52	0.00
conventional – creative	-0.14	-0.67	-1.09	-1.47	-0.15	0.50	-0.96	-1.48	0.79	-0.29	0.28
homely – global	0.14	0.42	0.04	0.06	0.85	0.64	0.13	-0.29	0.79	0.57	0.44
reasonable – premium	-0.27	-0.58	-0.87	-1.47	0.00	0.29	-1.08	-1.38	0.79	0.29	0.39
academic – practical	0.23	-0.42	-0.39	-0.18	0.35	0.07	-0.38	-0.10	0.53	0.10	0.39
handcrafted – professional	0.55	0.08	-0.17	-0.24	1.00	0.93	-0.54	-0.86	1.11	0.86	0.89
natural – technical	0.23	-0.08	0.48	1.41	0.95	0.43	1.04	0.29	0.37	1.10	0.33
stable – dynamic	-0.45	-0.25	-1.09	-1.12	-0.40	0.57	-1.21	-1.24	0.47	-0.10	-0.06
exclusive – attainable	0.86	0.67	0.61	0.88	0.75	0.07	1.04	1.10	-0.42	0.38	-0.06
bright – temperate	-0.45	-0.50	0.65	1.65	0.25	-0.57	1.33	1.57	-0.89	0.57	-0.39

Table 5. Kansei evaluations of the Russian university websites by the German subjects

Website / ***Scale***	***#12***	***#13***	***#14***	***#15***	***#16***	***#17***	***#18***	***#19***	***#20***	***#21***
masculine – feminine	0.00	-0.05	0.18	0.44	-0.95	-0.65	0.20	0.24	0.05	0.05

conventional – creative	1.05	0.90	0.82	0.61	-0.62	-0.85	0.40	0.90	-0.79	-0.26
homely – global	0.58	0.95	0.77	0.28	0.19	-0.70	0.40	1.33	-0.21	0.21
reasonable – premium	0.58	0.48	0.64	-0.39	0.05	-0.50	0.20	0.86	-0.53	-0.32
academic – practical	-0.32	0.29	0.36	-0.06	0.10	-0.45	0.35	0.14	-0.58	0.32
handcrafted – professional	0.68	0.95	0.55	0.11	-0.14	-0.90	0.35	1.19	-0.37	-0.42
natural – technical	0.05	-0.05	-0.05	-0.33	0.57	0.20	0.80	0.19	0.26	-0.63
stable – dynamic	0.84	1.19	0.45	0.06	-0.57	-0.70	0.35	0.90	-1.05	-0.26
exclusive – attainable	-0.16	-0.19	0.23	0.56	0.43	-0.30	0.35	0.19	0.42	0.53
bright – temperate	-0.21	-0.57	-0.09	-0.17	0.00	0.25	0.15	-0.33	0.26	-0.05

Table 6. Kansei evaluations of the Russian university websites by the Russian subjects

Website / ***Scale***	***#12***	***#13***	***#14***	***#15***	***#16***	***#17***	***#18***	***#19***	***#20***	***#21***
masculine – feminine	-0.30	0.17	-0.26	0.11	-0.90	-0.30	0.25	-0.25	-0.30	-0.52
conventional – creative	0.09	1.38	0.74	0.05	-0.81	-0.95	1.00	1.00	-0.91	-0.33
homely – global	0.91	0.92	1.00	0.42	-0.10	-0.70	0.94	1.00	0.26	0.00
reasonable – premium	0.43	1.04	0.91	0.16	-0.67	-1.50	0.69	0.45	-0.48	-0.95

academic – practical	0.61	0.71	0.22	0.21	-0.14	-0.20	0.69	-0.15	0.26	-0.24
handcrafted – professional	0.96	1.29	1.30	1.00	-0.24	-1.05	1.19	1.05	0.30	-0.38
natural – technical	0.96	0.04	1.13	0.63	0.86	0.00	1.31	0.90	1.13	0.00
stable – dynamic	0.74	1.42	1.26	0.58	-0.48	-0.95	1.00	1.00	-0.70	-0.62
exclusive – attainable	0.74	0.25	-0.04	0.47	0.48	0.75	0.63	0.15	1.26	0.67
bright – temperate	-0.35	-1.13	-0.09	-0.68	0.43	0.25	-0.81	-0.65	1.13	-0.38

Table 7. Quality evaluations of the German university websites by the German subjects

Website / ***Scale***	***#1***	***#2***	***#3***	***#4***	***#5***	***#6***	***#7***	***#8***	***#9***	***#10***	***#11***
beautiful	4.31	3.75	2.91	2.74	4.35	4.50	3.16	2.89	4.19	3.81	4.27
trustworthy	4.88	3.94	4.17	4.21	4.75	4.44	3.68	3.79	4.00	4.29	3.93
fun	4.13	3.31	2.48	2.89	3.75	3.61	3.42	2.95	4.25	3.10	3.87
evident	4.00	3.81	3.87	3.68	4.05	4.33	3.79	4.00	3.81	3.90	3.53
usable	4.06	3.50	3.83	3.26	4.60	4.67	4.00	3.89	3.75	4.00	3.47
overall	3.06	3.06	3.13	2.79	3.75	3.83	3.05	2.47	3.56	3.43	3.33

Table 8. Quality evaluations of the German university websites by the Russian subjects

Website / ***Scale***	***#1***	***#2***	***#3***	***#4***	***#5***	***#6***	***#7***	***#8***	***#9***	***#10***	***#11***
beautiful	4.77	3.42	3.39	2.24	4.00	4.71	2.79	2.10	5.32	4.33	4.83

trustworthy	4.59	3.83	4.00	3.41	5.10	5.00	3.54	2.86	5.00	4.71	5.06
fun	4.45	3.83	3.26	2.53	4.55	4.50	2.79	2.00	5.37	4.33	4.67
evident	4.59	3.67	4.26	4.24	4.65	4.79	3.54	3.24	4.63	4.19	5.11
usable	4.41	3.42	4.30	3.53	4.70	5.14	3.33	3.29	4.95	4.19	5.17
overall	3.41	2.92	3.35	2.24	3.40	3.93	2.83	2.14	3.79	3.43	3.72

Table 9. Quality evaluations of the Russian university websites by the German subjects

Website Scale	***#12***	***#13***	***#14***	***#15***	***#16***	***#17***	***#18***	***#19***	***#20***	***#21***
beautiful	4.53	4.81	4.45	3.94	3.57	3.05	3.60	5.19	3.11	3.37
trustworthy	4.21	4.81	4.32	3.61	4.14	3.60	3.80	4.76	3.37	3.32
fun	4.11	4.38	3.95	3.72	3.19	2.90	3.65	4.76	2.84	3.11
evident	3.32	4.33	4.05	3.67	3.86	3.10	3.70	4.29	3.58	2.84
usable	3.37	4.29	3.68	3.72	3.71	2.80	3.65	4.48	3.47	3.11
overall	3.32	4.10	3.27	3.11	3.14	1.85	3.30	3.76	2.42	2.42

Table 10. Quality evaluations of the Russian university websites by the Russian subjects

Website Scale	***#12***	***#13***	***#14***	***#15***	***#16***	***#17***	***#18***	***#19***	***#20***	***#21***
beautiful	4.87	5.88	5.30	4.74	3.05	2.30	5.38	5.25	4.04	3.33
trustworthy	5.35	5.79	5.52	5.05	3.90	2.55	5.63	5.35	4.83	4.14
fun	5.39	5.83	5.35	4.95	3.33	2.30	5.69	5.35	4.39	3.43
evident	5.48	5.83	5.70	5.26	4.14	2.95	5.44	5.45	5.22	4.33
usable	5.04	5.71	5.57	5.32	4.00	2.20	5.75	5.40	5.30	4.19
overall	3.87	4.54	4.09	3.95	2.86	1.90	4.56	4.00	4.00	3.14

3.3 Descriptive Statistics and Preliminary Results

The mean evaluations with standard deviations per scales are presented in Table 11 (Kansei scales have average value of 0, quality scales – of 4, overall evaluation – of 3). We used ANOVA to assess statistical significance of differences between evaluations by the two user groups – the significant ones at α=.07 are marked in bold, while the p-values are provided in the respective column of the table.

Table 11. Mean (SD) evaluations per scales for the two subject groups

Scales	***German subjects***	***Russian subjects***	***Diff***
masculine – feminine	-0.15 (0.37)	-0.36 (0.38)	
conventional – creative	-0.03 (0.68)	-0.16 (0.70)	
homely – global	0.25 (0.30)	0.40 (0.39)	
reasonable – premium	0.02 (0.42)	-0.18 (0.71)	
academic – practical	**-0.12** (0.35)	**0.10** (0.30)	p=.069
handcrafted – professional	0.13 (0.47)	0.43 (0.66)	
natural – technical	**0.19** (0.27)	**0.64** (0.42)	p=.001
stable – dynamic	-0.03 (0.61)	-0.08 (0.73)	
exclusive – attainable	**0.30** (0.21)	**0.53** (0.34)	p=.039
bright – temperate	-0.21 (0.28)	0.04 (0.71)	
beautiful	3.83 (0.59)	4.10 (0.98)	
trustworthy	**4.10** (0.37)	**4.53** (0.76)	p=.058
fun	**3.54** (0.50)	**4.20** (0.97)	p=.025
evident	**3.79** (0.27)	**4.60** (0.66)	p<.001
usable	**3.78** (0.36)	**4.52** (0.79)	p=.003
overall	3.15 (0.39)	3.43 (0.58)	

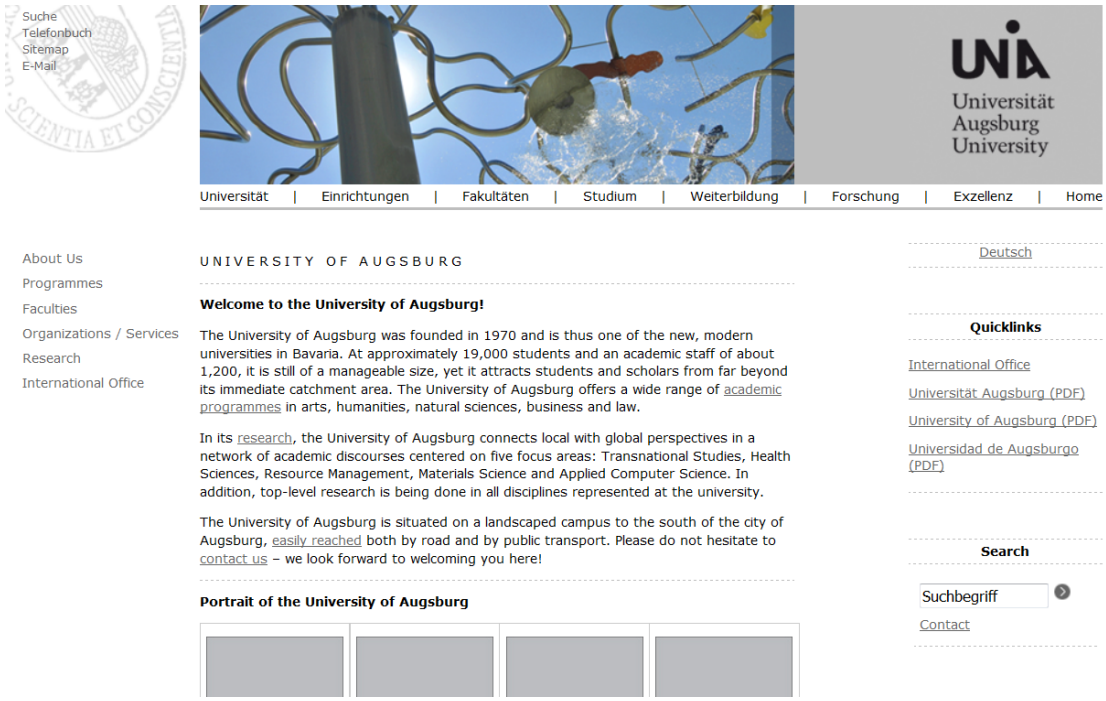
In Table 12 we illustrate how an objective factor of website's cultural kinship affects the resulting Overall evaluation for the two groups of subjects.

Table 12. Mean *overall* evaluations per subject and website groups

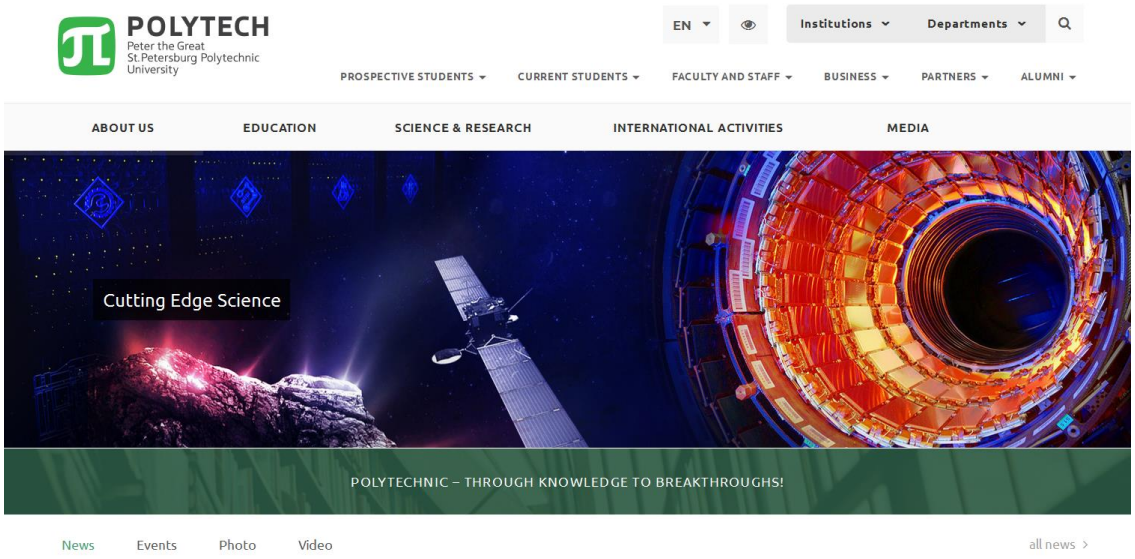
Subjects / ***Websites***	***German***	***Russian***
German	3.22	3.20
Russian	3.07	3.69

Interestingly, both subject groups were almost uniform in their evaluation of best and worst websites on the *overall* scale, for both German and Russian universities. So, among the German websites, #6 got the best overall rating from both groups: 3.83 (Ger) and 3.93 (Rus), while #8 got the lowest evaluations: 2.47 (Ger) and 2.14 (Rus). Among the Russian websites, #13 had the highest rating of 4.10 from the German group and 4.54 from the Russian subjects – close to the maximum rating of 4.56 assigned to website #18, which although got only a very moderate evaluation 3.30 from the German subjects. The groups were consistent in assigning the lowest ratings of 1.85 (Ger) and 1.90 (Rus) to website #17. In Fig. 4 we show homepages screenshots of the websites that received the highest and the lowest ratings.

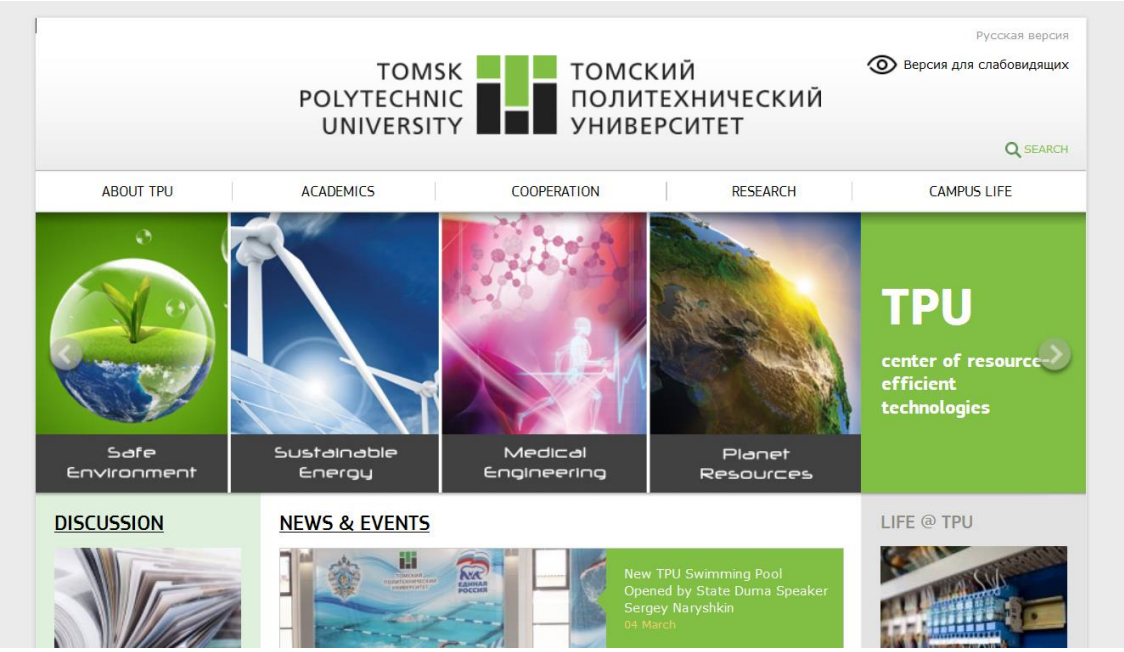
(a) Website #6, highest *overall* evaluation among the German websites



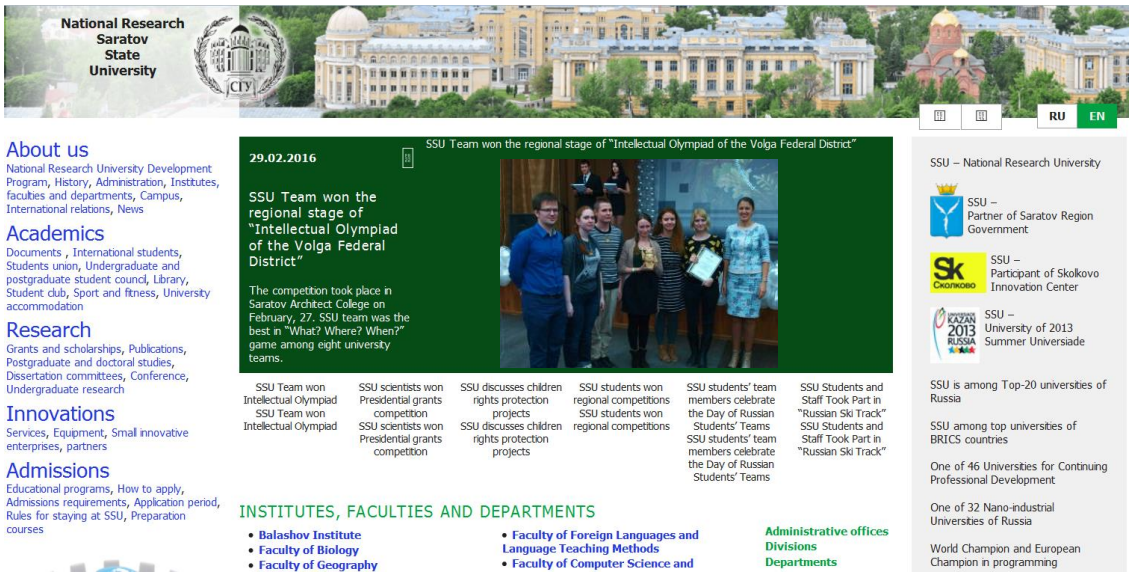
(b) Website #8, lowest *overall* evaluation among the German websites



(c) Website #13, highest (Ger) and second-highest (Rus) *overall* evaluation among the Russian websites



(d) Website #18, highest *overall* evaluation among the Russian websites by Russian subjects



(e) Website #17, lowes *overall* evaluation among the Russian websites

Fig. 4. Screenshots of the university websites with highest and lowest *overall* evaluations

All in all, the correlation between the evaluations provided by German and Russian subjects was highly significant (R^2=.994, p<.001). However, the results of the regression analysis for the *overall* evaluation have shown that the significant factors (the single ones at p≤.01) were different for the two groups of participants: handcrafted

– professional (HP) for the German subjects (R^2=.718) and reasonable – premium (RP) for the Russian ones (R^2=.806):

$$Overall_{GER} = 3.04 + 0.81 * HP \quad (1)$$

$$Overall_{RUS} = 3.58 + 0.82 * RP \quad (2)$$

4 Conclusions and Future Prospects

In our research work we seek to develop approaches for extension of Kansei Engineering beyond the conventional emotional aspect, so that the method could be used to consider other types of requirements and can be effectively applied in web interaction engineering. The motivation for this stems from our existing work, in which we proposed to use extended KE NN to assess the fitness for solutions obtained in the course of evolutionary web interaction design [1]. To confirm that KE can be effectively enhanced to consider non-emotional requirements, we designed an experimental study and performed its first stage with 82 subjects evaluating 21 operating university websites per 10 specially developed Kansei scales. Then we are going to construct the extended KE NN, train it with data collected from the subjects, and use it to generate two "optimal" website designs, #1 considering purely emotional aspects, and #2 taking into account the extra parameters. In the second part of the experiment, in another survey with target customers we'll test the hypothesis that web design #2 rates significantly better than #1 and the control group of websites.

In the current technical report we provided description of the experiment, published aggregated data, and performed basic analysis. The preliminary results suggest that subjects from different cultural groups are reasonably diverse in their emotional perception of university websites and its effect on the overall evaluation: *handcrafted – professional* dimension had the greatest effect for the German subjects, but for the Russian ones the most significant was the *reasonable – premium* dimension. Although there was significant difference in mean quality evaluations, the correlation per websites was very high (R^2=.994), and the university websites that had the highest and the lowest overall ratings were very much consistent between the two groups (Fig. 4).

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References

1. M. Bakaev, M. Gaedke. "Application of Evolutionary Algorithms in Interaction Design: from Requirements and Ontology to Optimized Web Interface." In IEEE ElConRusNW, LETI, St Petersburg, 2016, pp. 125-130.
2. V. Čok, M.D. Fikfak, J. Duhovnik. "Integrating the Kansei Engineering into the Design Golden Loop Development Process." In ICoRD'13, 2013, pp. 1253-1263.
3. S.T.W. Schütte, J. Eklund, J.R.C. Axelsson, M. Nagamachi. "Concepts, methods and tools in Kansei Engineering." Theoretical Issues in Ergonomics Science 5, no. 3, 2004, pp. 214-231.
4. S. Ishihara, K. Ishihara, M. Nagamachi, Y. Matsubara. "An automatic builder for a Kansei Engineering expert system using self-organizing neural networks." Int. J. of Industrial Ergonomics 15, no. 1, 1995, pp. 13-24.
5. Y.C. Lin, C.H. Yeh, C.C. Wei. "How will the use of graphics affect visual aesthetics? A user-centered approach for web page design." Int. J. of Human-Computer Studies 71, no. 3 (2013): 217-227.
6. Q.X. Qu. "Kansei knowledge extraction based on evolutionary genetic algorithm: an application to e-commerce web appearance design." Theoretical Issues in Ergonomics Science 16, no. 3, 2015, pp. 299-313.
7. F. Guo, W.L. Liu, Y. Cao, F.T. Liu, M.L. Li. "Optimization design of a webpage based on Kansei Engineering." Human Factors and Ergonomics in Manufacturing & Service Industries, 26, no. 1, 2016, pp.110-126.
8. S. Ishihara, K. Ishihara, M. Nagamachi, Y. Matsubara. "An analysis of Kansei structure on shoes using self-organizing neural networks." Int. J. of Industrial Ergonomics 19, no. 2, 1997, pp. 93-104.
9. J. Dias, H. Rocha, B. Ferreira, M.C. Lopes. "A genetic algorithm with neural network fitness function evaluation for IMRT beam angle optimization." Central European J. of Operations Research 22, no. 3, 2014, pp. 431-455.
10. Y. Jin, B. Sendhoff. "Reducing fitness evaluations using clustering techniques and neural network ensembles." In Genetic and Evolutionary Computation–GECCO, 2004, pp. 688-699.
11. X. Yao. "Evolving artificial neural networks." Proceedings of the IEEE 87, no. 9, 1999, pp. 1423-1447.
12. H. Takagi. "Interactive evolutionary computation: Fusion of the capabilities of EC optimization and human evaluation." Proceedings of the IEEE 89, no. 9, 2001, pp. 1275-1296.

13. A. Milani. "Online genetic algorithms." International Conference ICT&P, Sofia, 2004.
14. F. Guo et al. "Optimization design of a webpage based on Kansei Engineering." Human Factors and Ergonomics in Manufacturing & Service Industries 26 (1), 2016, pp. 110-126.
15. Q.X. Qu. "Kansei knowledge extraction based on evolutionary genetic algorithm: an application to e-commerce web appearance design." Theoretical Issues in Ergonomics Sc. 16 (3), 2015, pp. 299-313.
16. A.M. Lokman, N.M. Noor, M. Nagamachi. "Kansei Database System for Emotional Interface Design of E-Commerce Website." In 4th Int. Cyberspace Conf. on Ergonomics, 2008.
17. N.M. Noor, M.L. Anitwati, M. Nagamachi. "Applying Kansei Engineering to Determine Emotional Signature of Online Clothing Websites." In 10th ICEIS (5) vol. HCI, 2008.
18. Z. Song, T.J. Howard, S. Achiche, A.G. Özkil. "Kansei Engineering and Web Site Design." In ASME 2012 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, 2012, pp. 591-601.

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