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THE EFFECT OF SOCIO-CULTURAL FACTORS ON TIME PERCEPTION

Research paper

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Kokkuvõte

Käesolevas töös on uuritud, kas eestlaste ja venelaste sissetulek ja elukoht on seotud nende ajatajuga. Selleks analüüsiti 2227 Eesti elaniku andmeid (1628 eestlast ja 599 venelast vanuses 15 – 74 aastat, 972 meest ja 1255 naist). Osalejaid küsitleti läbi arvutil juhitava personaalintervjuu meetodil ja pärast seda, nad sooritasid aja produtseerimise ülesande. Uuringu tulemused tõendasid venelaste varem avastatud (Maar, 2013) kalduvust alaprodutseerida ajaintervalle rohkem kui seda teevad eestlased. Venelased alahindasid ajaintervalle 6% rohkem kui eestlased. Hüpoteesid, et sissetulek ja elukoht seostuvad ajataju erinevusega eestlaste ja venelaste vahel ei leidnud kinnitust.

Märksõnad: aja taju, eestlased, venelased, sissetulek, elukoht, aja produtseerimise ülesanne.

The Effect of Socio-Cultural Factors on Time Perception

Abstract

Current study examined relationships between income and place of residence of Estonians and Russians with their time perception. It was analyzed the data of 2227 residents of Estonia (1628 Estonians and 599 Russians ages 15 through 74 years, 972 men and 1255 women). Participants were interviewed with CAPI method (Computer Assisted Personal Interviewing) and completed Time Production Task (TPT). As a result, reported before tendency of Russians to underproduce time intervals more than Estonians (Maar, 2013) was confirmed. Russians underestimated time durations 6% more than Estonians. However, hypotheses that difference in time perception of Estonians and Russians associated with income and place of residence didn't find it`s confirmation.

Keywords: time perception, Estonians, Russians, income, residence, Time Production Task .

The Effect of Socio-Cultural Factors on Time Perception

Internal Clock

The most researchers consider perception of time as timing-specific mechanism (or internal clock), to perceive duration of temporal intervals (Allan, 2001). Originally the theory of scalar timing was proposed by Gibbon (1977) and developed later with other colleagues (Gibbon, Church, & Meck, 1984). It suggested that timed behavior is regulated by a complex mechanism - internal clock, which consists of an arousal sensitive mechanism - pacemaker and accumulator with a switch connecting them, also memory and decision mechanisms. This scalar timing mechanism is in the center of the SEM -scalar expectancy theory (see overview in Tamm, 2014, p.12). The scalar expectancy theory proposes three phase model: clock phase, memory phase and decision phase.

The clock phase consists of a pacemaker-counter/accumulator mechanism. Arousal makes the pacemaker to emit pulses ("ticks"), which are further temporarily stored in an accumulator. A switch (attention), which connects pacemaker and counter, regulates the pulses' stream between them. The switch closes at the beginning of the timing duration and stays closed as long as the pulses streaming to the counter. The switch opens again and cuts off the connection between pacemaker and accumulator, when timing of the interval is over. At the end of the timing process, the counter supposed to contain the amount of pulses that correspond to the duration of just perceived subjective time/clock readings. The scientists usually examine the clock stage functioning manipulating with arousal and attention mechanisms (Tamm, 2014).

The memory phase consists of the working memory and reference memory. When to-be-timed duration is over the number of received pulses transfers from accumulator to the working memory where it stores for the further processing. It is supposed that reference memory accumulates criterion durations - the memory of the standard or target time intervals perceived before, which relevant for the current to-be-timed duration. Criterion durations are represented as the number of pulses from previously reinforced clock readings (Buhusi & Meck, 2005; Tamm, 2014).

In the decision phase just perceived subjective time from the working memory compares to sample taken from remembered before criterion durations stored in the reference memory. Behavioral output is based on the result of this comparison (Buhusi & Meck, 2005; Tamm, 2014).

Like any other psychological process, the perception of time is sensitive to disturbances and occasionally subjected to errors (Campbell, 1990). Thereby in this model, internal and external stimuli are supposed to modify the activity of internal clock by modifying the activity of the peacemaker (Gros, et al., 2015). For example, when person experiences strong positive emotions, time feels as it goes faster (Gable &Poole, 2012). Impulsive subjects feel time as it lasts too long, so produce time intervals as shorter (Maar, 2013). Higher general intelligence corresponds to better accuracy on the time production task (Bartholomew, Meck & Cirulli, 2015). Also subjective time perception may be influenced by psychiatric and neurological disorders (Perbal, et al., 2005; Poryazova, et al., 2013), hormonal and circadian rhythms (Morita, Nishijima, & Tokura, 2005), reaction time (Der & Deary, 2006), and many other factors.

A pacemaker–accumulator model is traditionally used to explain the manner in which time intervals in the seconds-to-minutes range are perceived and estimated. To investigate duration judgments three types of tasks are used: production, reproduction and estimation (Buhusi & Meck, 2005). 1) In the time production task, a numeric value of target interval are presented at the beginning of each trial, after presentation disappeared from the screen, participants produce the indicated time interval by pressing a button for start and end. 2) In the time reproduction task, participants first perceive the sample of target duration, and then are required to reproduce the duration by pressing a button for start and end (Honma, et al., 2016). 3) In the estimation task participants are asked to judge durations using time units - seconds, minutes. For example, Wittmann with colleagues (2007) used following design: participants listened to two tones (one a standard tone, the other the comparison tone) one after the other and have to decide which is longer.

These time judgment tasks are based on retrospective and prospective timing. In retrospective tasks, participants are asked to estimate time only after they have completed a task. Thus retrospective timing is based mostly on memory processes and memory capacity. In prospective time tasks participants are told in advance that they should estimate time, so they have possibility to focus on time durations. Therefore results of prospective time task largely dependent on amount of attention dedicated to the time interval. (Bisson, Tobin & Grondin, 2012). If attention is concentrated on the task, produced by pacemaker “ticks” flow to the accumulator. If, however, attention is engaged elsewhere, the “tick” output is slowed and/or “ticks” may not be accumulated. In this case, sum of accumulated “ticks” will be less than the actual elapsed time. As a result, participants tend to underestimate the actual time

interval. The more attention engaged with distractive factors, the more underestimation of time (Chaston & Kingstone, 2004). Time production tasks can be effective in estimating individual differences in pacemaker speed and/or the storage of the "ticks" into memory. The rate of functioning of the internal clock may be associated with one's preferred spontaneous motor tempo and may also be modulated by working memory (Bartholomew, Meck & Cirulli, 2015).

The current study is concentrated on prospective time production task.

Socio-Cultural Factors

It seems that scientific interest in the influence of socio-cultural factors on time perception somewhat subsided after 2000 year. I found only a few studies related to this topic.

Socio-cultural factors have undeniable influence on time perception. The central concept in cross-culture researches is pace/tempo of life. It is defined as "flow or movement of time that people experience" (Levin, 1997, p.3). Also Levin (1997) established five factors that determine the tempo of different cultures and regions: economic well-being, the level of industrialization, population size of place of residence, climate (colder vs. hotter), and culture (individualism vs. collectivism) (p.9). Current work focused on some of these factors.

Large-scale study of Levine and Norenzayan (1999) conducted in a large cities with populations of more than 1 million, clearly showed that tempos of life are highly related to economies. The fastest pace of life, measured by three indicators - walking speed, work speed among postal clerks, and accuracy of bank clocks, was found in wealthier Switzerland, Ireland, Germany and Japan (Western Europe and Asia). The slowest in life tempo were relatively non-industrialized countries from Africa (Kenya), Asia (China), the Middle East (Jordan, Syria), and Latin America (El Salvador, Brazil, Indonesia, and Mexico). Such dependence can be resulted from the quantifying time value in monetary terms. Time value increased due to increasing income rate and cost of living in the large cities. So economizing on time became essential, and inevitably leaded to careful time calculations and clock-orientation, rooted in the assumption that "time is money" (Adam, 2003). A study conducted in Poland showed that people with higher income have more rigid clock-based organization in daily life then individuals with lowest income (Jarosz, 2019). That means that wealthier people value time more and they are more accurate in it estimation. Effective use of time is

inextricably linked with punctuality, because to be “on time“ in the right place became extremely important in the places with vital economies (Brislin & Kim, 2003). White and colleagues (2011) examined national differences in punctuality among the students from Estonia, Morocco, and the United States. Participants were asked to indicate how early (or late) someone could arrive for an appointment, before he was inappropriately early (or late). It was found that Moroccans (with 35.6 min On-Time Window) was less punctual than Americans (20.8 min). Estonians had average level of punctuality (26.3 min). Thus, people from wealthier societies had less flexible definition “on time”, and consequently had more correct perception of physical time. White and colleagues (2011) proposed that higher level of punctuality may be an adaptive response to living in a wealthier and faster paced societies. All the same, between pace of life and economic activity exists both way direction of causality. People with higher income value time more and therefore they have faster tempo of life, and people that value time are more economically active and consequently have higher rate of life (Levine ,1997, p.10).

Different countries have adopted different thresholds for a human settlement to be considered a ‘city’, but there is near universal agreement that a settlement of 100,000 people or more constitutes a city (Sánchez, et al., 2018). The rate of income is inextricably linked with population size of the place of residence. The bigger city size, the wealthier and more socioeconomically active is average citizen (Bettencourt & West, 2010). The numbers of papers indicated that with an increase in city size, pace of life becomes faster (Bettencourt, Lobo, Helbing, Kühnert & West, 2007; Levine & Norenzayan, 1999; Walmsley & Lewis, 1989). For example, city size was related to walking speed in Australia and England, where pedestrians moved more quickly in the big cities than in small towns (Walmsley & Lewis, 1989). Levine and Bartlett (1984) found that walking speed was faster in the large cities compared with medium-sized in six different countries. Greater work intensity of entrepreneurial teams was registered in the big fast-paced urban US metro areas, however, in smaller slow-paced regions it decreased, so entrepreneurial teams worked less intensive (Vedula & Kim, 2018). Thus higher value of time and faster tempo of life more typical for the large cities’ habitants then for those of small towns (Levine,1997). Therefore place of residence’s pace of life affects the tempo in which its inhabitants go about their daily lives and the extent to which they are hurried in general (Vedula & Kim, 2018).

The cultural differences also play role in peoples’ understanding of time. Hofstede (1991) defined culture as a mental programming, which “distinguishes the members of one

group or category of people from another" (p.5). Individualism and collectivism are cultural values that influence time perception (Levine & Norenzayan, 1999). People from individualistic cultures oriented toward themselves and their nuclear family. People from collectivistic cultures oriented to themselves as a part of larger collective. It was found that individualistic cultures, compared to collectivistic ones put more emphasis on achievement than on affiliation (Leonard, Billing, Bhagat, & Lammel, 2019). The focus on achievement usually leads to a time-is-money oriented behavior, which results in tending more effective using one's time. Cultures with more important social relationships characterized by slower tempos of life (Levine & Norenzayan, 1999). According to Cultural dimensions theory (Hofstede, 2011) Estonian culture is more individualistic (with score of 60 from 100) then Russian (score of 39 from 100) (Hofstede Insights, 2018). Consequently in compliance with Levine and Norenzayan (1999), Estonians as representatives of more individualistic culture should have faster pace of life, and therefore should perceive time as it's running faster than Russians do. Maar (2013) study's results contradict to this statement, she found that Russians tended to underproduce time intervals 13% more than Estonians. The aim of the current study is to find out whether income and place of residence of Estonians and Russians could cause these differences in time perception.

Unexplained National Difference

In her master's thesis "Impulsivity and time perception as predictors of pathological gambling" Aili Maar (Maar, 2013) used the data collected in the course of the study "Contacts of the Estonian residents with gambling in 2010" (Emor, 2010). The examined sample consisted of 3530 residents of Estonia and was representative for the country's population, (age range 15-74 years, 1506 men and 2024 woman, 2455 Estonians and 1075 non-Estonian residents, including Russians and people of other nationalities). The study was focused on examining association between time perception, impulsivity and pathological gambling. She also tested effect of several covariates like age, sex and education on key variables. It was found that time perception as measured by a production task, was significantly associated with the level of impulsivity and that time intervals were differently underproduced depending on nationality. There was established moderate relationship between time perception and nationality: non-Estonians tended to underproduce time intervals on average 0.3 standard deviations more than Estonians with the same impulsivity

score and all the covariates controlled (Maar, 2013). Covariates like sex, age and education showed no effect on time perception.

My study bases on the same sample that Maar used in her work and analyses time production from another point of view. The result showing such a big difference between Estonians and non-Estonians is surprising and deserves further examination. In addition to nationality, I decided to focus on relationships between time perception and two social-cultured factors not analyzed in Maar's thesis, namely place of residence and income per person. There are important differences between my sample and whole sample used by Maar (2013). The above mentioned data was adjusted for current study purposes by filtering cases (see Method). In Maar's (2013) work variable "Nationality" included three categories: non-Estonians (average time production accuracy M=0.87, SD=0.4), Russians (M=0.77, SD=0.39) and people of Other Nationalities (M=0.82, SD=0.54). So Russians underproduced time intervals 13% more than Estonians (calculation based on the TPT results of Russians). (see Fig.1).

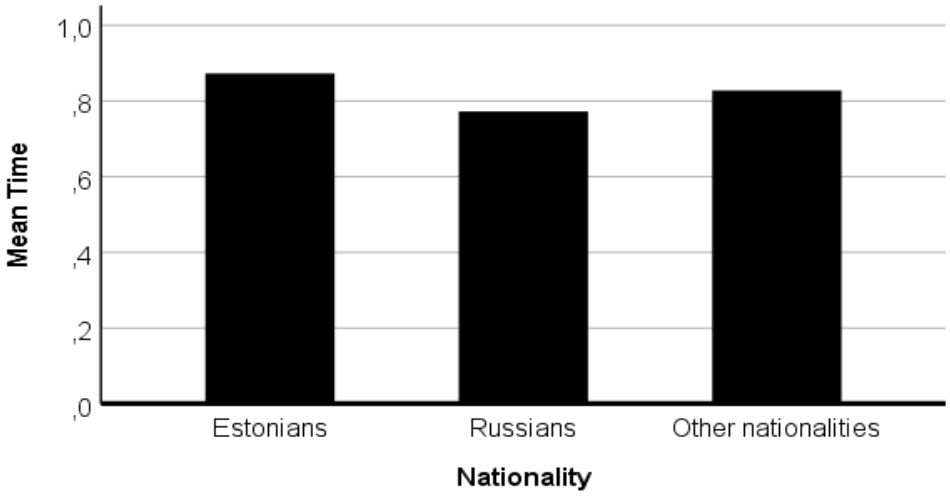

Figure 1. Comparison of national groups by time perception.

Insofar as there was no any information about nationality of people from category "Other Nationalities" and test of between-subjects effects of variables showed no statistically significant difference in time perception between categories "Other Nationalities"- "Estonians" and "Other Nationalities"- "Russian", to improve reliability of the study, category "Other Nationalities" was excluded from the sample.

The aim of the current study is to examine whether difference in time perception between Estonians and Russians identified by Maar (2013) could be caused by income and place of residence. So it is expected that following hypotheses will find its confirmation:

1) Estonians and Russians with higher level of income are more accurate in time estimation, that is they underproduce time intervals less than Estonians and Russians with lower income.

2) Estonians and Russians who live in the villages and small towns tend to underestimate time less then Estonians and Russians who live in the cities.

Method

Sample

According to Emor (2010), the sample of the study is representative to population, it made up of permanent residents of the all counties of Estonia aged 15–74. All the participants have different educational and socio-economical background.

It was used a simple random sampling method, i.e. each member of population had an equal probability to be chosen. The participants were selected with two-stage stratified sampling method. On the first stage the population was geographically divided into 6 clusters (strata) according to place of residents. Then two-stage sampling procedure was performed in each cluster. Primary sample units were settlements (cities, towns, small towns, villages). The sample points - houses (with accurate up to the address of starting point) were randomly selected in proportion with settlement size (the number of habitants). In every primary selection unit - settlement, were selected the secondary selection units - people. The participants was found with so-called young men - young women rule. It means that from the being at home men in the age of 15 to 74 years old it was interviewed the youngest. If there was no men age 15-74 lived at that address or they were not at home at the moment, the younger women of age 15-74 was interviewed.

The original sample (Maar, 2013) (3530 participants) was filtered by selection of cases and had several stages:

1) Participants who didn't perform time production task were excluded (remaining sample size 2963).

2) Time production task data was filtered to abandon too quick and too slow productions. Criterion of mean +/-2SD instead of +/-3SD as was used by Maar (2013) was implemented (2895 participants remained).

3) “Other Nationalities” were excluded from variable “Nationality” and only “Estonians” and “Russians” were kept (2754 participants).

4) Only participants revealing their income were included, thus participants who declared to have no income or refused to report the last month’s income per member of their household were excluded (2227 participants).

As a result, the sample size reduced from 3530 to 2227 participants (see Table1), 1628 Estonians and 599 Russians ages 15 to 74 years old, 972 men and 1255 women. To examine the relation between Maar’s (2013) sample and current study sample, the chi-square test was performed. It showed that there is no statistically significant difference between proportions of Estonians and Russians in two samples ($\chi 2 = 0.02$, *p*-value =0.88, $p < 0.05$).

Table 1 Comparison of national composition of the original sample from Maar (2013) and sample in current study. .

Sample	Estonians	Russians	Total
A. Maar	2054 (73%)	763 (27%)	2817
Current study	1628 (73%)	599 (27%)	2227

For further calculations variables “Income per Person” and “Place of Residence” were recalculated based on the distribution of variables values in the sample (Table 2). The point was to make groups as equal sized as possible. Categorization of variable “Income per person” (for original categorization see Appendix 1) based on declared by participants last month income per person in their householders. According to the collected data (2010 year) it was following:

1. Low income - from 1 to 40000 EEK
2. Middle income from 4001 to 6 000 EEK
3. Rather high income 6 001 to more then 20 000 EEK per person.

Following the principal of distribution of values in the sample and equal sizing of the groups, the number of categories of variable “Place of Residence” was reduced from five (in original sample) to two categories:

1. City (includes original sample categories the “Capital” and “ Cities”)
2. Small town/village (includes original categories “County center”, “Other towns”, “Boroughs”, “Villages”).

Table 2 Socio - cultural background of the sample.

			Nationality			
		Total	Estonians	Russians	$\chi 2$	*p*
N		2227	1628	599		
Sex	Male	972	743	229		**< .001**
	Female	1255	885	370		
Age	15-19	152	124	28		
	20-29	383	290	93		
	30-39	388	281	107		
	40-49	350	251	99		**< .001**
	50-59	442	296	146		
	60-74	512	386	126		
Place of recidence	City	1078	605	473		
	Small town/village	1149	1023	126	306.39	**<.001**
Income per person	Low income	896	659	237		
	Middle income	708	510	198	0.606	**0.74**
	Rather high income	623	459	164		

NOTE: p<0.05

As we can see from the Table 2, there is no significant difference in the income between Estonians and Russians. But place of recidence differs significantly between Estonians and Russian. 63% of Estonians lived in the small towns and villages, but Russians was mostly urban residents - 79% of them lived in the cities. So does this difference affect time perception? The answer to this question is subject to study.

Procedure

CAPI method

The survey was conducted by 78 trained interviewers face to face, using CAPI method (Computer Assisted Personal Interviewing) in Estonian and Russian languages. The questionnaire was programmed and the program was translated to Russian. The questions were displayed on the laptop screen and the answers were entered directly to the computer by the interviewer. Average time of the interview was 8.4 minutes. To control the quality of the poll it was contacted with 15% of respondents and asked about different aspects of interviewers´ work (Emor, 2010).

Time Production Task

Time perception was estimated by prospective computerized Time Production Task (TPT). In the time production task, a numeric value of target time interval was presented at the beginning of each trial, after the number presentation disappeared from the screen, participants estimates the indicated time interval by pressing a button for start and end. So the participants were asked to indicate when they thought a certain time interval (2, 3 and 4 seconds) had run out, by holding down the computer space key (the text on the screen was: "Hold down the space bar for 2/3/4 seconds"). Also the subjects received the following instructions: "I will estimate how you experience flow of time. Would you perceive time as going by faster or slower comparing to it actual duration?" Before experimental trials, it was conducted four rehearsal trials with immediate feedback of duration elapsed while holding the key. It was produced six experimental trials in total, each of three time intervals (2, 3 and 4 sec) was repeated two times in random order. The interviewers guided and helped to participants in making trials. After they reported the results and closed the program of time measurement by themselves. For each time interval, the time produced by participant was compared with the physical time interval, and performance was measured as the deviation of time produced by participants from the actual length of the intervals. The results of time production task were counted only if participant performed four rehearsal trials and six experimental trials (Maar, 2013).

For current study, average time produced by each participant was calculated with the formula:

$$((mean2)/2 + (mean3)/3 + (mean4)/4)\ /3$$

Results

To examine the mean difference between Maar sample and current study sample it was calculated standardized mean effect. Cohen's effect size of current study sample (d=0.18) decreased comparing with Maar's sample (d = 0.25). So practical significance of the effect size reduced from "low to moderate" (d = 0.25) to "low" (d=0.18). It means that current study sampling criteria weren't quite random – relatively many Estonians who underestimate time more than Russians, or Russians who underestimate time less then Estonians were left out from the sample. Decreasing effect size gap probably means also that Estonians who underproduced time less than other Estonians and Russians who underproduce intervals more than other Russians, didn't report their income.

A results claimed by Maar (2013) that Russians tend to underestimate time intervals more than Estonians, was confirmed in the smaller subsample as well. Russians underestimated time intervals (M=0.78, SD=0.32) statistically significantly more than Estonians (M= 0.83, SD=0.28), t (2225) = 3.681, $p < .001$). But gap between time production task's results of Estonians and Russians decreased 2 times - from 0.1 (13%) in Maar's sample to 0.05 (6%) in current sample.

Income per person

A two-way ANOVA with Nationality (Estonians, Russians) and Income per person (low, middle, rather high) as between-subjects factors, showed significant main effect of Nationality F(1, 2221) = 15.24 , $p < 0.001$ on Time perception: Estonians (M =0.83, SD=0.28), Russians (M =0.78, SD=0.32). Main effect of Income per person was non-significant F(2, 2221) = 0.588, p = 0.56. Interaction effect between Nationality and Income was no statistically significant as well, F (2, 2221) = 1.734 , p = 0.177 (Figure 2).

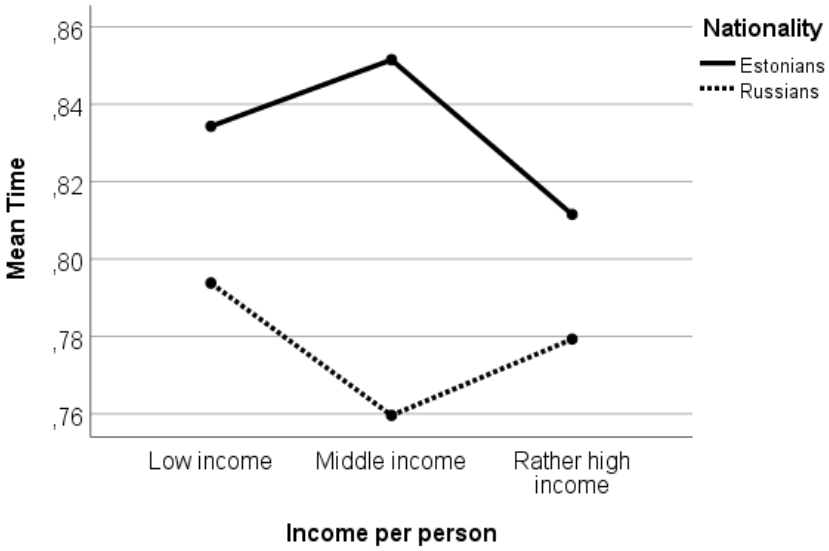

Figure 2. Time production results of Estonians and Russians from different income groups.

Place of Residence

Tests of Between-Subjects Effects of Nationality (Estonians, Russians) and Place of residence (cities, small towns/villages), also showed statistically significant main effect of Nationality F (1, 2223) = 8. 932 , $p < 0.05$ on Time perception: Estonians (M =0.83, SD=0.28), Russians (M =0.78, SD=0.32). Place of residence showed no significant main effect F (1, 2223) = 0.92 , p = 0.338. Interaction effect between nationality and place of residence was also nonsignificant F(1, 2223) = 0.89 , p = 0.765 (Figure 3).

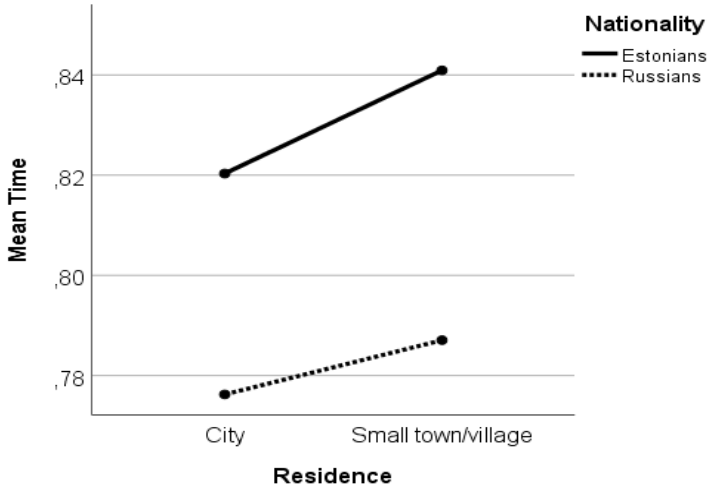

Figure 3. Time production results of Estonians and Russians according to place of residence.

Discussion

The current work showed no relationship between place of residence and time perception. Majority of above mentioned studies (Levine & Norenzayan, 1999; Vedula & Kim,2018; Walmsley & Lewis, 1989), was focused on a large cities with populations of more than 1 million. Due to small number of inhabitants - 1,038,848 people on 01.01.2009 (Emor, 2010), Estonia has no million cities. Population of the capital and the biggest city - Tallinn on 01.01.2009 was 404 005 inhabitants (Tallinn.ee, 2018). So in this context Tallinn can be considered a middle city, and therefore it has slower pace of life than those large cities in above mentioned papers (Levine and Bartlett, 1984). Probably the smaller population gap between cities and small towns/villages in Estonia could provide the result that contradicts the outcomes in above mentioned studies. Another possible reason why current work showed no relationship between place of residence and time perception is internal migration from smaller towns to the cities (Eesti Statistika, 2012). Since period of residence in the cities left uncontrolled in the current study, there is no data whether participants just moved to a current place of their residence or live there for a long time. Shift in the tempo of life could blur peoples' feeling of time and affect their time production results. Another factor that could influence study's results is unequal grouping. Russians underproduce time intervals more than Estonians regardless of whether they live in the cities or in the country. Considering the fact that 79% of Russians lived in the cities, and 63% of Estonians lived in the small towns and village, probably Russians underestimated time intervals more than Estonians rather by the fact that they live in the cities, than because they are Russians. The same, Estonians could underproduce time intervals less then Russians, because they mostly live in the small towns and villages, than because they are Estonians.

Also current work failed to identify income effect on time perception. Contrary to the statements, that income is related to the place of residence, and peoples' well-being is higher in the cities (Bettencourt & West, 2010; Levine & Norenzayan, 1999), study showed that income of Estonians and Russians did not differ, despite the fact that most Russians lived in the cities, and majority of Estonians lived in the small towns and villages (see Table 2). It could be resulted by relatively small number of high-income people in original sample (Maar, 2013). Perhaps right more high-income people were not reached during original survey, or they rejected to report their income. So after recategorization of variable "Income per Person" with purpose to make groups in current sample as equal sized as possible, lower threshold of category "Rather High Income" decreased, and just included people with lower-income could blur time production task' results. If there were more people with high income in the

sample, that is middle income in category “Rather High Income” would be higher, the results could show another interaction of income and time perception. Another possible factor that could affect the results of the study and left uncontrolled, is some number of people that could live in the small towns or villages, but have work in the cities (and consequently could report higher income). The constant alternation of two paces of life could shift participants’ time perception, and therefore affect time production task performance.

If to take as a basis that higher impulsivity is associated with lower educational level (Maar, 2013), it should mean that more impulsive people have nonintellectual work, lower income and tend to underproduce time intervals. From the other hand, higher intelligence and higher income associated with more accurate production of time intervals (Bartholomew, Meck, & Cirulli, 2015). All the same, in Estonia only 29% men have high education comparing with 48% women (Eesti Statistika, 2017). But right men have 7% higher income than women (Fontes, 2017), and therefore supposed to be more precise in time estimation despite the lower level of education. As we can see, interaction of income and time perception is pretty complicated. Since the relationship between these two factors mostly was studied in the context of place of residence (income is higher in the cities), it is hard to identify whether income has an influence on time perception as independent factor. We don’t actually know how uncontrolled factors can interact with each other, and affect perception of time.

Another reason why current work’s findings failed to support both hypotheses could be difference between measure methods used in the current study and in before mentioned researches. Walking or working speed is rather unconscious respond on society’s pace of life. That is, people just go about their daily routine and don’t actively choose the speed of their movements. Time production task (TPT) used in current study, is experimental method of time estimation, it is more conscious because participants know in advance that now they have to estimate time. TPT requires not only motor response to terminate the timing of an interval with a button press, but also attention (switch) and reference memory for timing duration (Tamm, 2014, p.16). Since external disturbances or psychological state of participants can affect TPT performance (Gros, et al., 2015), the results can be more susceptible to distortion, then tempo of walking speed. For example, some noises or other factors could distract participants’ attention during the TPT performance, and enhance the underestimation of time intervals (Chaston & Kingstone , 2004). Depending on phase of menstrual cycle women could feel time as it lasts longer, and therefore produce time intervals

as shorter (Morita, Nishijima & Tokura, 2005). These and other factors that could affect the perception of time left controlled.

Regardless method of measurement, we don't know what exactly we measure in internal clock mechanism - accumulated number of pacemaker pulses or criterion durations in reference memory. We have total outcome of these two mechanisms' interaction. I can speculate, that probably in the methods of measures used in above mentioned papers, and in time production task are more engaged different internal time mechanisms – attention or memory, that could condition the reason why results of the current study differ from results described in above mentioned papers.

The present study has some limitations. One of those is outdated data used in the current work. Life in Estonia changed for the last 10 years, so the analysis does not indicate the current socio-economic situation in the country. Analysis of newer data in the future researches would probably show different and more relevant results. Another limitation regards the comparison of Russians who live in Estonia and Estonians. For making socio-cultured difference more clear it would be perfect to compare Russians who live in Russia with Estonians. In this case the more individualistic culture of Estonians and more collectivistic culture of Russians would have more influence on their everyday life, and therefore on their time perception. In further researches such a comparison can possibly shade the light on relationship between income, place of residence and time perception in the cultural context.

In spite of accuracy of time measurement, time production task can be another weak point of this study. Taking in consideration used in the scientific literature measures, it would be more appropriate to use walking or working speed for increasing ecological validity in further researches. Probably it would be a good idea to measure walking speed of pedestrians in the cities and smaller towns of Estonia. The results would be more comparable with other tempo-of-life studies' outcomes.

For deeper analysis of relationship between socio-cultural factors and time perception, the further studies also can be focused on interaction of socio-cultural factors with personal traits (from The Big Five). For example, it would be good to examine whether habitants of the cities or habitants of the smaller towns have higher level of neuroticism, and how combination of these factors influence on their time perception.

Despite the negative results and limitations discussed earlier, current study showed that relationship of socio-cultural factors and time perception in Estonia differs from results

obtained in other countries. Since this topic is relatively little studied, the current work provides a focus and direction for the further researches.

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Appendix 1

The categorization of A.Maar sample

1) Average monthly income per person in EEK (tax excluded).

1. No income
2. Less than 2000
3. 2001-2500
4. 2501-3000
5. 3001-3500
6. 3501-4000
7. 4001-5000
8. 5001-6000
9. 6001-7000
10. 7001-8000
11. 8001-9000
12. 9001-10000
13. 10001-12000
14. 12001-15000
15. 15001-17000
16. 17001-20000
17. More than 20000

2) Place of recidence:

1. The capital
2. Cities (Tartu, Pärnu, Narva, Kohtla-Järve)
3. County center (maakonnakeskus)
4. Other towns, boroughs (muu linn, alev)
5. Villages

Käesolevaga kinnitan, et olen korrektselt viidanud kõigile oma töös kasutatud teiste autorite poolt loodud kirjalikele töödele, lausetele, mõtetele, ideedele või andmetele.
Olen nõus oma töö avaldamisega Tartu Ülikooli digitaalarhiivis DSpace.

Karina Laaneots.