CSIS Discussion Paper No. 134 (University of Tokyo)

Turning towards quality: a Japanese-Hungarian comparative study of the unequal usage of geographical information technologies

ÁKOS JAKOBI

Department of Regional Science, Eötvös Loránd University, Budapest, Hungary
jakobi@caesar.elte.hu

September 2014

Abstract

General theories explain the altering role of the influencing effects of ICT-related inequalities by diffusion models, in which differences of accessibility slowly turn to inequalities between users in the quality of usage. This paper is focusing on this latter and newer form of inequalities, by examining what differences appear between people in using a specific type of qualitative information, the spatial information. The presented study has chosen Japan, an advanced country, and Hungary, a follower country, to introduce how geographical information technology is used. In the paper outcomes of a comparative survey are presented, focusing on the Japanese and the Hungarian peoples' relation to map-information applications and services. According to the results it is assumed that Japan entered the "quality phase" of ICT development earlier, but later Hungary mirrored also good numbers on qualitative information usage. In Japan location based services and geolocated searching are unambiguously more common, which is a result of larger numbers of geo-equipped smartphones. The usage of modern devices may have deliberated users from spatial bounds of location; which has already signs in Japan. On the other hand small differences between the two countries are better to be explained by local specifications than by ICT development differences.

Keywords
Geographical information technologies, inequalities, GIS, ICT, Japan, Hungary, smartphone

Introduction

As an affect of the technological change many examples can be cited from location aware smartphones to map services of the internet, which represent how peoples' opinion on the everyday role of geographical information could have altered. Indirectly geographical information systems (GIS) slowly and invisibly got diffused in everyday life, just think about the spreading of GIS-based web mapping, Google Maps and other Digital Earth solutions, GPS-related activities, location based services or other geographical extensions of virtual or augmented reality in cyberspace.

Although the spread of innovations associated with geoinformation services was quite fast and global sized, it seems that market possibilities of this sector is largely dependent on location, not just by the reason of different business environments, but also due to diverse attitude, intention and possibilities of people of adapting new innovations.

Present research was aiming to test the above-mentioned hypothesis by comparing Japan, an advanced country of information technologies, and Hungary, a member state of the

EU with different backgrounds and opportunities of information and communication technology (ICT) development. As a co-operation between the *Center for Spatial Information Science at the University of Tokyo*, the *Ritsumeikan University in Kyoto* and the *Eötvös Loránd University in Budapest*, questionnaire surveys were made to compare how Japanese and Hungarian people are using map-information based personal applications and what is their relation to geoinformation services.

The Japanese society represents one of the most sophisticated usage of ICT tools and one of the highest level of technological development in the World, hence it is also expectable to offer wide range possibilities to access the information stores of the modern age. The almost everywhere detectable presence of the information economy and society has expanded the possibilities of accessibility in this country, which provide the chance to see the real "working" spatial information technologies. From a European point of view it is by all means instructive to explore an environment, where the usage of spatial information has been made possible by the satisfaction of variant social and economic needs with the most diverse technological solutions of the 21st century.

The Hungarian way of using information and communication technologies (and also the usage of geoinformation technologies) supposed to be slightly different from the Japanese one. Hungary is among those European Union member states, which understood the importance of the Lisbon Strategy, announcing that information technology development, and the enhancement of the information economy and society is an essential factor of the global European competitiveness, and also important for the national development. Since Hungary is not a significant participant of the leading technology-oriented group of countries, but considered to be a developed country (i.e. Hungary is a member of the OECD), this country is among the second group of the followers of new innovations. It is assumed that Hungary has also high values in indices of using ICT, however, not as high as some advanced countries.

The growing importance of map-information technologies

Spatial processes of the diffusion of information and communication technologies largely influenced the economy and society of the 21st century (Karlsson et al. 2010). In the last couple of years, a new motive of ICT-based inequalities seemed to appear that could have been connected to the usage of geographical information, since the progression of information technologies influenced also the diffusion of information having geographical content. Recently, significant growth is shown by certain circles of industries and services attached to information technology tools, which provide geoinformation – namely information made up with spatial, geographical substance – to users in a direct or indirect way. The "geoinformation business", therefore, gained an increasing share in information economy.

Examinations of the usage habits of information with geographical content make it possible to describe the newest demand of the modern age society. One can define geography as the service provider (or vendor) and the society as the customer with formulated demands, thus in line with this approach the task is to explore production and consumption characteristics. By analysing recent processes of the usage and access of geographical information a very up-to-date topic would be possible to understand. Nothing better can illustrate the actuality and usefulness of the topic then that a couple of years ago the relevant terms and technological handholds of this question were almost unknown in professional circles, and knowing that technology is changing rapidly the understanding of ongoing processes is perhaps urgent and vital. We could just think on that the number of selling of geo-application equipped smartphones is becoming larger than that of traditional mobile phones both in Japan and in Hungary, resulting that mobile phone manufacturers like Nokia – which had until 2014 a large assembly factory in Hungary – lose markets, or should

restructure production activities both technologically and geographically. The understanding of the guiding principles of a new technology that is significant for the future makes it possible to forecast development paths and processes. The practical market usefulness of the research can be seen mainly in the recognition of international trends and in the determination of national possibilities, since it is assumed that "geoinformation business" would be a dynamically developing and increasingly important service.

Although geoinformation business is known already for some decades (Frank 1997) it gained a new momentum in the last couple of years by the revaluation of GIS, webmapping, GPS, navigation, LBS and other popular applications and technologies. Since it is a rather technology oriented issue, primarily the regions and countries have taken the chance to enter the markets, which had apparent advantage in the production or consumption of the related goods, and hereby had a rather adaptive and innovative society and economy. Japan could be mentioned among these countries, however, certain regions, especially the United States was well ahead of Japan in the segment of geoinformation business. The nowadays best-known online mapping services like Google Maps, Bing Maps etc. or the leading GIS software companies (e.g. ESRI, Mapinfo) and many others are all located in the USA, while Japan has not many globally known GIS enterprises. It is typical that Japan is an adaptive country in this sense, however, it has many innovative geoinformation companies as well, which have brand new geoinformation solutions for the market. The Japanese geoinformation business is preferably focusing and concentrating on domestic demands, which is large enough and also rapidly increasing and giving new chances for entrepreneurs and investors. An interesting and successful example of the domestic geoinformation business is Navitime, a company, which provides "all-in-one route search" services for mobile phone users. Since the majority of mobile phones in Japan is equipped with positioning devices (GPS), the popularity of such integrated navigation-information services is quite large. This reflects that in a society, which got accustomed to technological thinking, it is easy to disseminate a geoinformation related innovation.

In Hungary the popularity of mobile phones is quite high. At the moment the number of mobile phone subscriptions is higher than the total number of people living in the country. Following Japan, also the same trends are observable in Hungary: the number of smartphones is rapidly increasing, making it possible to disseminate smartphone-based geoinformation applications for all. On the other hand there are measurable inequalities in the society and the economy in the context of geoinformation business. It is assumed that GIS and geoinformation are still mysterious words for the ordinary people, while some have already discovered the opportunities in this field. The company Nav N Go (NNG) is a prosperous geoinformation company, with many services and products for mobile phones and car navigation systems, additionally this company has business connections with various automotive companies, which reflects that geoinformation business can be successful in this country as well. This is however not the typical case: Hungary is usually adapting technologies from abroad.

Development differences of the Japanese and Hungarian information societies

The spatial information culture of Japan, namely the disclosure of data enabled with spatial information is built upon the widespread usage of information and communication technologies. In this society the usage of ICT is specifically developed not just because of the broad and internationally well known supply side (just think on the several brands of electronic products), but also due to the observable and manifested demand side of its local population. Indeed one criterion of the "active" information society is that the society itself

puts up for information, content and services, which seems to be a real demand generating factor in Japan.

According to data of the International Telecommunication Union (ITU) 86% of the Japanese population, that is 109 million subscribers had mobile broadband access, with that Japan has the second largest consumer group after the United States, which has 123 million subscribers (39% of the population). A definite character of the Japanese ICT usage is that Japanese population applies information services mostly through mobile phones. Interestingly the usage of PCs, and the access to internet with desktop computers and notebooks is less frequent then expected, although still favourable in a global context. The annual ICT development index of the ITU consequently takes into account more aspects when estimating the development level of the information society (see ITU 2012). According to the rankings for 2011 Japan has the 8th highest index among the 155 observed countries. In the top 10, where only European countries are taking place, the only exception is South-Korea (that is the first in ranking), which has an ICT profile much like Japan (with also significant mobile broadband subscriber shares). In this ranking Hungary is at the 41st position. In case of Japan the consideration is probably true that the high volume of using information tools, or in other words the regular usage of computers by wide circles of the population and especially the large numbers of mobile devices, just because of its volume had stimulated the economy and society or the supply side participants to develop abundant and adequate quality services, with satisfactory profile and content. After all it is not surprising that internet technology makes it easy to manage everyday matters, and widely assists shopping or entertainment activities.

The above mentioned numbers already suggest that there are measurable inequalities between the two analysed countries. Japan seems to gone further in information society development, while Hungary appears to play a follower role. This can be traced well with time-series of basic ICT indicators. Figure 1. depicts two examples of the lagging of ICT innovation diffusion in Hungary as compared to Japan, however, Hungary is also well ahead of many countries in the world, that is reflected in the higher than world average penetration rates. Both broadband subscription data and internet user rates were always higher in Japan than in Hungary in the years between 2000 and 2013, however, the relative gap between the countries was continuously decreasing. The trends are following typical saturation curves, which suggest altering of ICT inequalities in time.

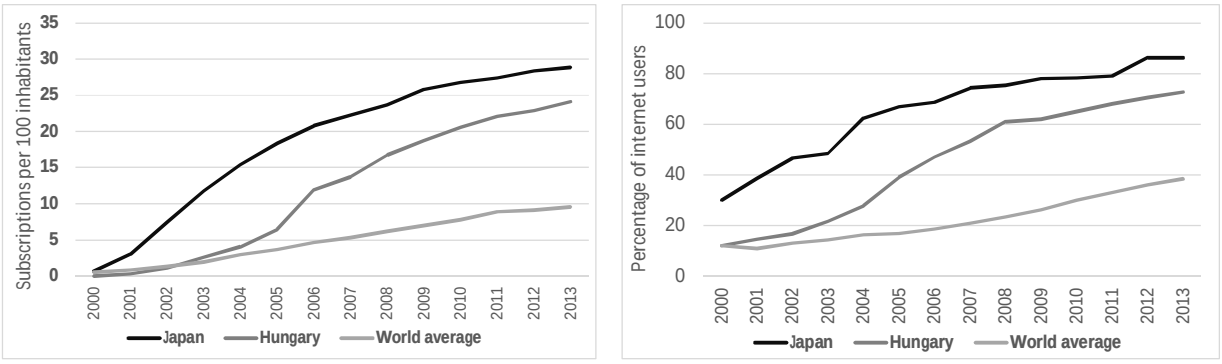

Figure 1. Fixed (wired)-broadband subscriptions per 100 inhabitants (left) and percentage of individuals using the internet (right) in Japan, Hungary and in the World (2000-2013, source of data: ITU)

All of that falls in line with theoretical concepts of the changing nature of ICT-related inequalities. Researchers basically explain the altering role of the influencing effects of factors related to inequalities of information society by diffusion models (Hüsing et. al, 2001; OECD, 2001), primarily starting from that inequalities are fundamentally determined by the

adaptation level of ICT. Social and spatial diffusion in time is characterised by a logistic curve, which shows a time-lagged S-shape depending on the development level of the analysed entity (social group, region, country etc). As a result of later adaptation certain groups are becoming relatively lagged behind, which can be realised in social and spatial inequalities. In phases of the adaptation process different types of inequalities can be discovered. In early adaptation phase, when only few applies ICT, differences can be seen in accessibility, in the phase of diffusion differences are between users and non-users, while in the phase of saturation differences in quality can be emphasised (Hüsing et. al, 2001). As a result, ICT-based inequalities can be more or less measured by the society's adaptation level.

By looking on trends of main ICT indicators of Japan and Hungary it can definitely be declared that both countries are over the early adaptation period, and also – in many respects – they are almost passing or have already passed the second phase of diffusion, too. Consequently, it is assumed that these countries are entering or have already entered the third saturation phase, where quality plays the main role in information inequalities. Since in this third phase the main accessibility disparities are decreasing or dissolving and the usage differences remain as inequality motives with quality differences, we have to take not just infrastructural and penetration factors into consideration when drawing the picture of inequalities. Technically – on the one hand – this phase is the most difficult to measure, since there are only few regional datasets about the quality of ICT usage. In order to test quality-based regional inequalities – on the other hand – the examination of spatial information usage can be a very good choice. We think that spatial information is somewhat special in term of quality, therefore if we experience higher volume of spatial information usage, we would assume higher level of ICT development in a country or in a social group. Also the lower level or the lack of usage refers to a backward situation in ICT development. In the following we try to compare the level of spatial information usage in the two countries. We assume that although the differences between Japan and Hungary are decreasing in terms of infrastructural and penetration factors, the quality based inequalities are still significant. It is also assumed that Japan entered the "quality phase" of ICT development earlier, but later Hungary mirrored also good numbers on qualitative information usage.

Increasing usage of qualitative spatial information

The increasing usage of the qualitative spatial information can be confirmed by many evidences. In the background we found that the development of services based on information and communication technologies notably enlarged the range of spatial information solutions. The Japanese "mobile society" is getting familiar with the usage of spatial information by the application of new smartphones and related technological achievements, thanks to different spatial positioning equipments (e.g. GPS). Since the disclosure of location information has become technically simple and daily, the range of services and applications based on it has considerably been enlarged. One of the most interesting services, which applies spatial information, is attached to the solutions of the personal or pedestrian navigation systems (see Arikawa et. al. 2007). This service is eventually a public transport based navigating and route guiding system for mobile phones that was built upon sophisticated usage of spatial data besides geographical positioning. The background of the system is supported by the accurate and precise Japanese transport system, in which spatial information of schedules and networks are available in large amounts and in an authentic form. In an imperfectly operating system itineraries and other spatial information derived from the schedules are ultimately useless, in predictably operating systems, on the other hand, fast growing user demand might appear. The popularity of the service is already incontestable in the last years, which resulted sometimes the change of habits in using space, or occasionally even the formation of partial

dependence from spatial data. In a country, which was organized in a relatively complicated system of spatial orientation, spatial data collected from the ether of information are very useful for the users, and it is often the case that users are fully entrust themselves to this device. An important part of the spatial data culture, therefore, the alteration of using space and the change of using spatial data.

Another nice example of spatial information management is connected to the refinement of the Japanese transport system as well. The research team of the Center for Spatial Information Science of the University of Tokyo created a transport modelling system to examine commuting and space-using habits and flow trajectories of local residents based on data of transport schedules and traffic information (People Flow Project)(Usui et. al. 2010, Nakamura et. al. 2010). The model is really interesting because of its spatial information basis. On one hand it is constructed from large amounts of published data of public transport schedules, on the other hand the project tried to involve direct and individual spatial data of the participants. Among others one solution was to use spatial digital footprints of people. The transport system in the Tokyo agglomeration is operated by an electronic payment system, which records with the user's chip-card the place and time of entry in the transport network, and also the moments of passing through transfer points in the system. Hence the electronic transport payment system collects huge amount of spatial information on the transport habits of the population. By the combination of different spatial data the above mentioned modelling system became aware to create spatio-temporal data sets making it possible to analyse spatial trajectories and the peoples' habits of using space. The digital footprints left behind the clientele are typical examples of the information society's newly emerging and spatially relevant information. The utilization of these chances is a big task for regional scientists. It is a new tool for understanding the spatial behaviour of the society, which was already and initially been applied in Japan.

The serving of the society with information of spatial content and the accessible information's spatially interwoven nature is often invisible from the user's point of view. Solutions of location aware computing and location based services are already widespread, regardless of whether the user knows or not the possibilities of positioning. It does not really matters, since the transmission of location information is often automatic; what more important is the quality of information the customer might have access to at a certain spatial point or in connection with a given regional object. The range of such location based services is rather wide (e.g. information on the local neighbourhood of the user, or access possibilities of the nearest post office etc.), furthermore the circle of service users is considered to be also broad, which also reflects the relatively advanced level of using spatial data. And in order to manage location based services a lot of place-based information or in other words spatial information is required. The increased needs for information is partially fulfilled by modern data-collection technologies of public or private companies, and also by the population itself, when local people or local communities play the role of information providers. Volunteered geographical information (VGI) systems are built up from information uploaded by the users, and if a system could have many enough users in the background, then sooner or later an alternative or supplementary version of the accurate professional systems might develop. Compared to the spatial data sets of traditional geographical information systems the quantity of volunteered geographical information can be many times higher, which can result significant improvement of the observed phenomenon's spatial resolution. In Japan many examples can be found, of those the services in relation with local weather conditions are among the most common ones. The virtual community service of "weathernews.jp" collects and provides in addition to the official weather information also volunteer based innovative weather information, quasi-individual weather reports, measurements, cloud images and other data useful to the community organized on a regional basis. The system is used and eventually

managed by approximately 10 million people, making it possible to operate with much more spatial data than the majority of the usual weather services have. Obviously many question the authenticity of data, but on the one hand the users are aware of the reliability of the published information, and on the other hand it became clear that the system can only operate for long, when disclosed information are effectively not far from truth and reality. In spatial data culture, just like in Japanese culture, "honesty" is important and typical, so that reliability of data in virtual communities is noticeable among given limits.

Comparative analysis of the usage of map-information services

In the last couple of years growing number of services and applications appeared globally, which became well known in no time for wider or narrower circles of the society. Their usage gives, however, not the same possibilities for everyone, and is not the same important for all. Presumably it is different by countries, social groups, or individuals. This assumption was in the focus of the research, in which the Japanese and Hungarian populations' knowledge and habits of using map-information services were compared in an experimental survey. The small sample comparative survey generally examined how GIS influenced Japanese and the Hungarian people's relation to space, their habits of using space, and to what extent the access to spatial information has changed their daily life. The aim of the examination was to discover how Japanese and Hungarian people are turning towards the qualitative information, namely what do they know about and how do they use spatial information, and what differences are there between people of the two nations in that sense.

The survey was carried out in 2011-2012 in Japan and in 2012-2013 in Hungary in several time-periods. We presume that there are differences between the two countries, however, the short time-lag between the surveys of the countries may have resulted, that Hungary had meanwhile caught up in some respects and the differences between the countries have become smaller. Analyses were based on the evaluation of a questionnaire containing a total of 12 professional and 7 supplementary questions. The questionnaires were filled out by both Japanese and Hungarian respondents. The questions were completely the same for both countries, even though certain notions and phrases were locally better known or even unknown, or had different meanings. The research, however, had directly this aim; namely to find the main motives of content, usage or other differences of geoinformation services between the countries.

The survey has a total of 640 collected questionnaires, of them, however, only 421 respondents have comparable data. The rest of data are only applicable for national analyses (therefore not presented in this study). The final dataset contains answers of 189 Japanese respondents and 233 of Hungarian ones. All the respondents are between 18 and 39 years of age, since our primer goal was to grab the main and most active adult group of ICT usage; that is the young and young-middle generation (see Albert et al. 2008 for further connections between age and ICT usage). The questionnaires were collected both paper-based and in online form in the two countries. The survey was carried out by the assistance and participation of the Center for Spatial Information Science at the University of Tokyo, the Department of Geography at Ritsumeikan University in Kyoto and the Department of Regional Science at the Eötvös Loránd University in Budapest.

The collected sample is geographically disperse, although, urban areas are naturally overrepresented according to the place of residence of the respondents. In Japan, most of the data were collected in Kanto and Kinki regions, larger number of respondents were registered in Kyoto and Tokyo agglomerations (Figure 2). In Hungary the region of Central-Hungary has the largest numbers including Budapest, where also data from districts with different social characteristics were collected (Figure 3.). Both the Japanese and the Hungarian dataset

contained answers of respondents from suburban towns, smaller cities or villages, too; with a share of 30% in Japan and 12% in Hungary. Naturally, due to very different settlement characteristics of the two countries, those cities are difficult to compare. The grouping is rather applied for comparison of core-urban and suburban or peripheral settlements within the country.

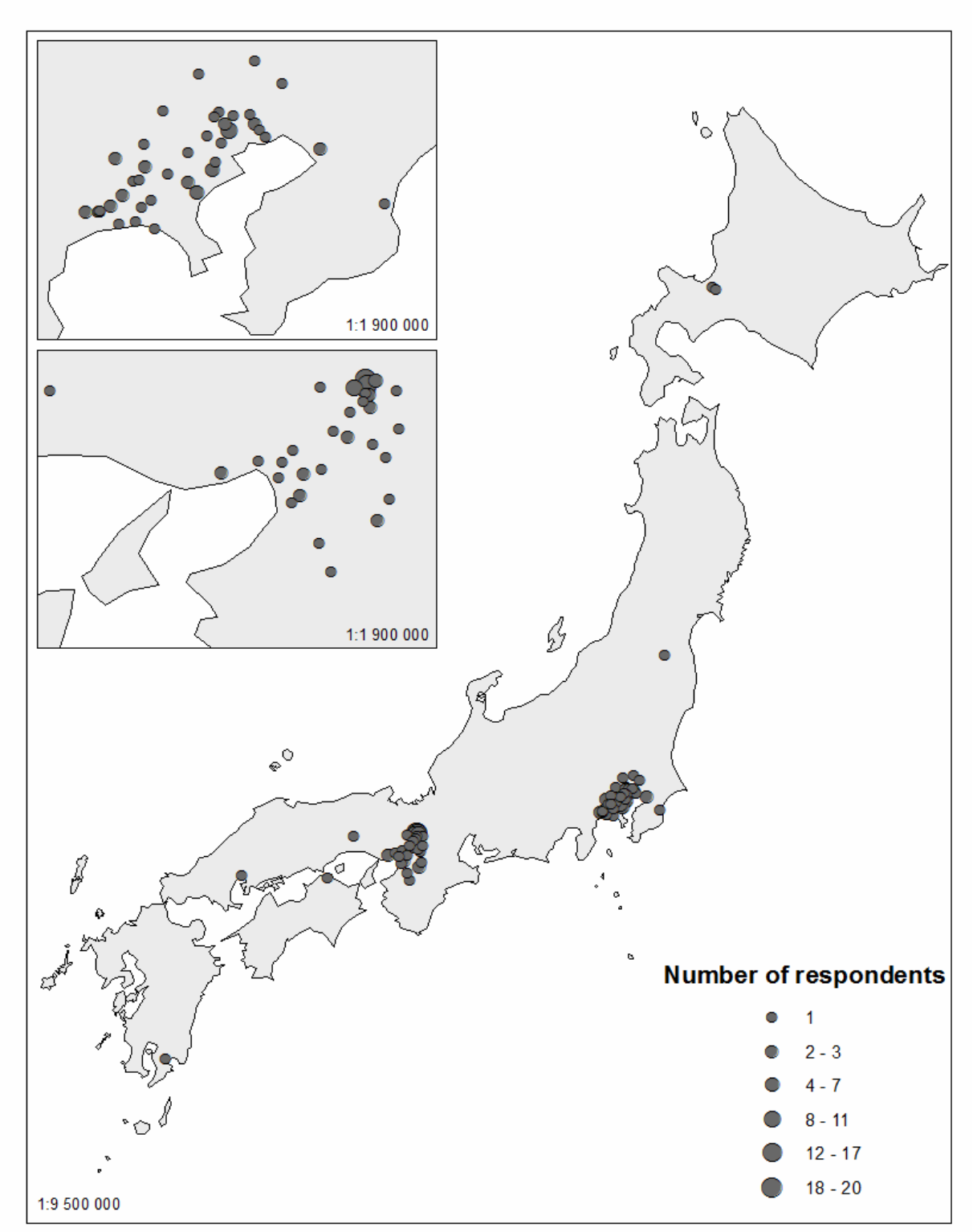

Figure 2. Number of Japanese respondents according to their place of residence (with detailed map of the Kanto and Kinki regions)(N=189)

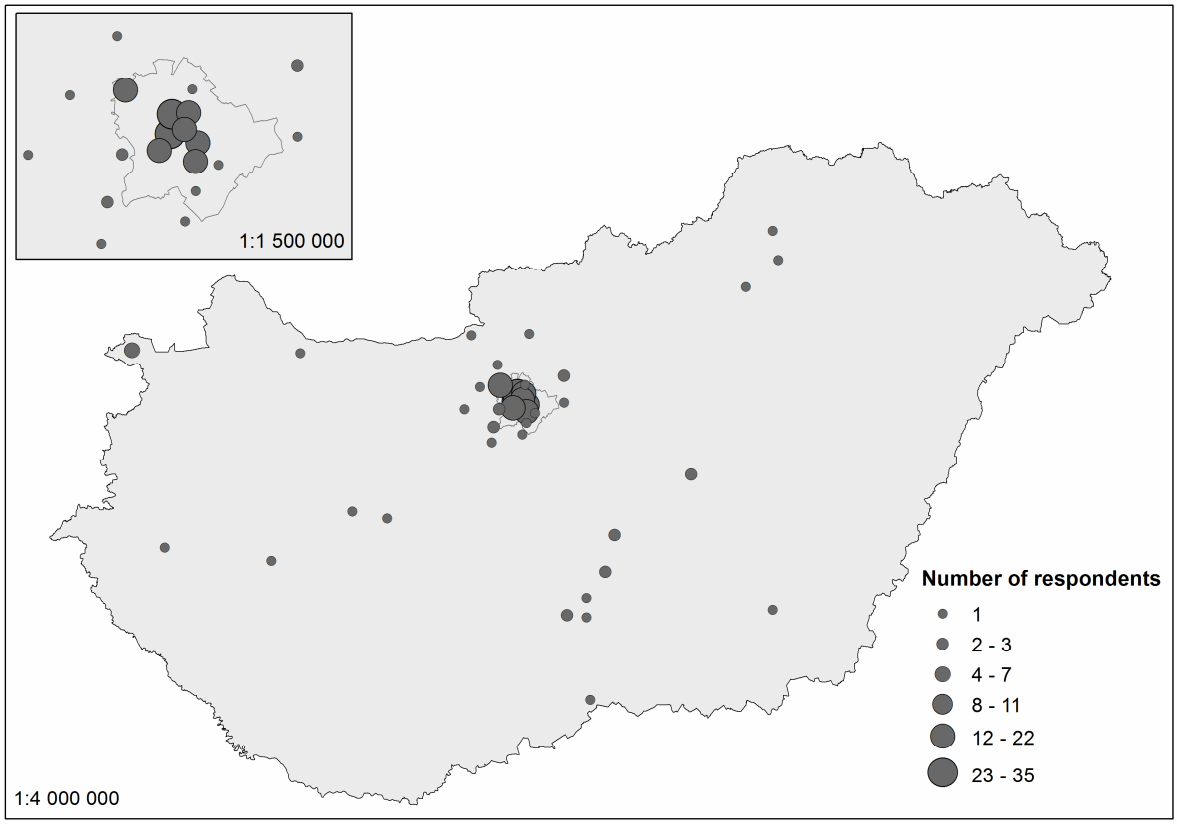

Figure 3. Number of Hungarian respondents according to their place of residence (with detailed map of the Budapest agglomeration)(N=189)

At first, we aimed to determine what knowledge the respondents have on map-information applications and services. As per the results of this section of the questionnaire there are similarities as well as dissimilarities between Japanese and Hungarian respondents (Figure 4). Both groups mentioned car navigation applications with the highest rate, while augmented reality (AR) applications happened to be the least known. Hungarian respondents mentioned more dominantly the mobile compass applications or the knowledge of real time traffic information services, the latter result can probably be originated from the unequal Hungarian and Japanese interpretation of this term. The Hungarian category may cover broader ranges of applications, while Japanese people interpret public transport and road or rail traffic information separately, since the latter ones are usually considered to be an integrated part of the navigation services, they mark it perhaps at that category. As per the results of the answers of the Japanese respondents significantly larger awareness was shown in connection with geolocated searching, local pollen information or various digital tracking services. These answers suggest that location based services are unambiguously more common in Japan, though for example local weather information services are well known in both countries.

The next question examined what kind of services have ever been tried or used by the respondents (Figure 5). The results show that among Hungarian respondents many people have used car navigation and real-time traffic information services, while the Japanese have mentioned digital tracking applications, pollen information services and especially the geolocated searching applications with significantly higher proportions, which coincides with the results of the previously mentioned knowledge analysis. Japanese people definitely seem to be more advanced users of geolocated searching, which presumably reflects the fact that such services are diffused much broader in Japan.

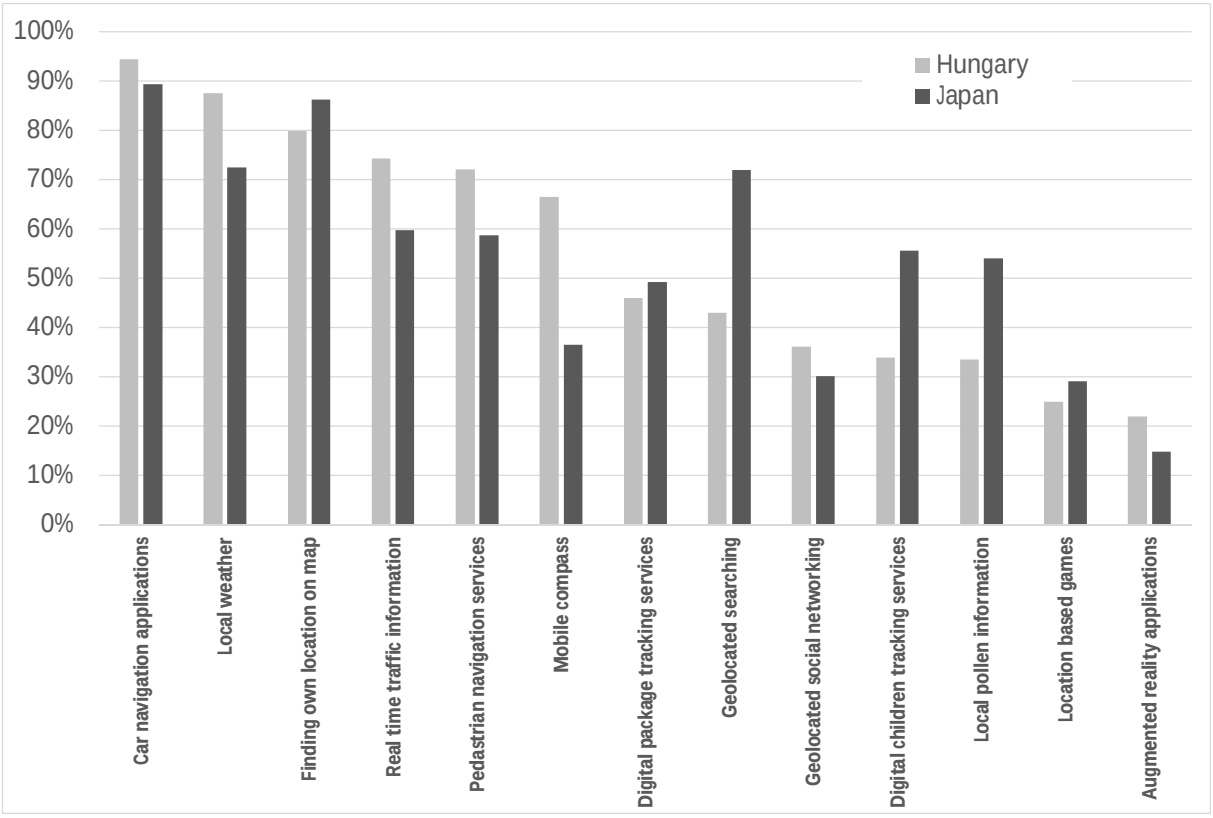

Figure 4. The knowledge of map-information applications and services according to the Japanese and Hungarian respondents

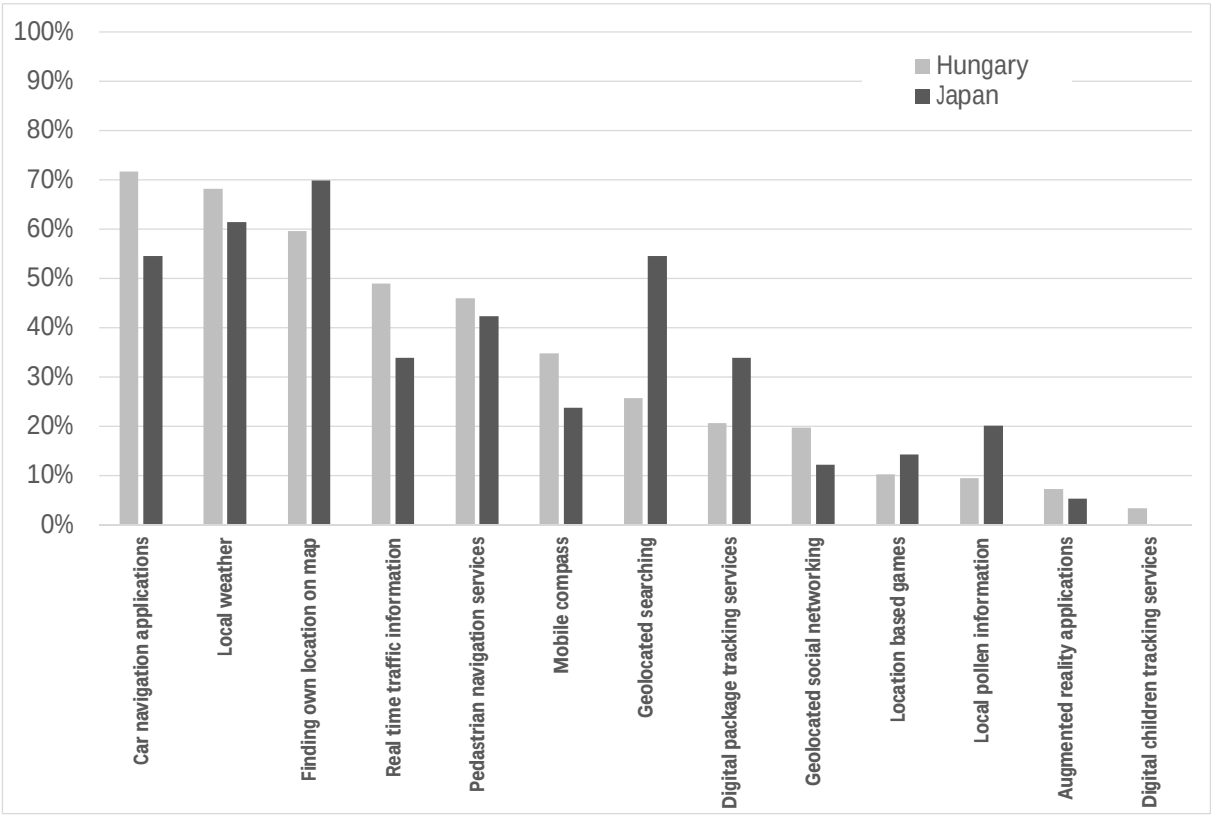

Figure 5. The share of tried or used map-information applications and services according to the Japanese and Hungarian respondents

In connection with knowledge and usage of map-information applications and services there are naturally several dimensions of inequalities, of them the difference between the two countries is only one issue. The following tables reflect also gender, income or residence-based inequalities. It seems in both countries that male respondents have somewhat wider knowledge and experiences of using spatial ICT tools; which is reflected in the results of the higher average number of known or used map-information apps and services (Table 1). The two countries have almost the same average numbers in that sense. It is, however, different if we would look at the average results for core-urban and out of core suburban cities. In Hungary respondents from suburban or peripheral areas have somewhat higher average knowledge and usage numbers, than those living in core-urban areas. In Japan, the situation is just the opposite. Finally, the income level categories were analysed. Although many of the respondents did not answer the question on income or had no income at all, the results reflect insignificant connection between self-estimated income categories and knowledge of map-information. We measured significant connection between income level and usage experiences only in Hungary.

Grouping categories		HUN		JPN	
		known apps & services	used apps & services	known apps & services	used apps & services
Gender	Male	7,72	4,82	7,66	4,82
	Female	6,58	3,72	6,20	3,41
Residence	Core-urban	7,02	4,21	7,51	4,56
	Suburb.periph.	8,00	4,61	6,05	3,54
Income	Under avg.	7,35	3,89	7,98	5,21
	Avg.	6,98	4,35	7,55	4,80
	Over avg.	6,55	4,90	8,33	4,33
	No income	7,33	4,26	6,61	3,84
	No answer	7,41	4,00	6,00	3,14
Total		7,14	4,26	7,08	4,26

Table 1. Average number of known and used map-information applications and services by major categories (maximum value = 13)

Grouping categories		HUN					JPN				
		one-fourth at the most	half at the most	three-fourths at the most	more than three-fourths	total	one-fourth at the most	half at the most	three-fourths at the most	more than three-fourths	total
Gender	Male	7%	25%	40%	27%	100%	13%	23%	31%	33%	100%
	Female	13%	35%	37%	15%	100%	15%	40%	35%	11%	100%
Resi-dence	Core-urban	11%	31%	37%	20%	100%	12%	26%	32%	30%	100%
	Suburb.periph.	0%	25%	50%	25%	100%	18%	39%	32%	11%	100%
Income	Under avg.	8%	30%	35%	27%	100%	10%	26%	29%	36%	100%
	Avg.	11%	31%	37%	21%	100%	5%	35%	35%	25%	100%
	Over avg.	20%	25%	50%	5%	100%	0%	33%	33%	33%	100%
	No income	3%	36%	39%	21%	100%	18%	30%	33%	19%	100%
	No answer	18%	23%	32%	27%	100%	19%	33%	33%	14%	100%

Table 2. How many map-information applications and services does the respondent *know* from all the possibilities? (Results are presented as percentage of group total)

The picture can be detailed further if we count how many map-information apps or services an individual respondent mentioned as known or tried. According to results of Table 2, male respondents know almost three-fourths of the apps and services or more, while female respondents have a knowledge about half or three-fourth of the mentioned examples at the most (there are naturally exceptions). In Hungary suburban or peripheral residents have somewhat larger knowledge of spatial information tools, while in Japan people of core-urban areas perform better.

Grouping categories		HUN					JPN				
		one-fourth at the most	half at the most	three-fourths at the most	more than three-fourths	total	one-fourth at the most	half at the most	three-fourths at the most	more than three-fourths	total
Gender	Male	32%	48%	15%	5%	100%	38%	35%	22%	5%	100%
	Female	50%	41%	8%	1%	100%	57%	36%	7%	0%	100%
Resi-dence	Core-urban	41%	44%	11%	3%	100%	40%	38%	17%	5%	100%
	Suburb.periph.	36%	46%	14%	4%	100%	59%	29%	13%	0%	100%
Income	Under avg.	46%	38%	16%	0%	100%	33%	36%	21%	10%	100%
	Avg.	36%	49%	11%	4%	100%	40%	40%	15%	5%	100%
	Over avg.	25%	55%	15%	5%	100%	67%	0%	33%	0%	100%
	No income	42%	44%	12%	2%	100%	51%	34%	15%	0%	100%
	No answer	59%	27%	5%	9%	100%	62%	33%	5%	0%	100%

Table 3. How many map-information applications and services does the respondent *have tried* from all the possibilities? (Results are presented as percentage of group total)

Results of Table 3 mirror the dominance of lower categories, when the experiences of usage were asked. The majority of respondents both in Japan and in Hungary mentioned only one-fourth or half of the map-information applications and services as ever tried. This was the typical for all the dimensions we examined.

The questionnaire also asked the respondents to answer how frequently a tool they use. Respondents of both countries mentioned local weather information as the most frequently used map-information service. Finding own location on map, geolocated searching or real time traffic information services were also often mentioned in Japan, while real time traffic information, finding own location on map and car navigation application was the second, third and fourth most frequently used tool according to Hungarian respondents.

Also an overall average of usage frequency was measured for each individual respondent by giving a score of 1 for the least and 5 for the most frequent usage of map-information services. From the results two histograms were drawn, where the number of respondents (counts) could be depicted according to the level of usage frequency (Figure 6). By comparing the two results it can be observed that the Japanese respondents have a lower mean (1.98) of usage frequency, and a curve with more remarkable shift to the left and with rather peaked shape (see Kurtosis and Skewness results). The curve for Hungary is somewhat closer to normal distribution and less shifted toward the smaller values. Consequently we may state that although the knowledge and the experience of usage were higher among the Japanese respondents, the frequency of usage seems to be somewhat smaller in our sample. On the other hand, since the numbers are representing unweighted average of usage frequency, we do not have detailed information on the intensity of usage, which perhaps would reflect different results.

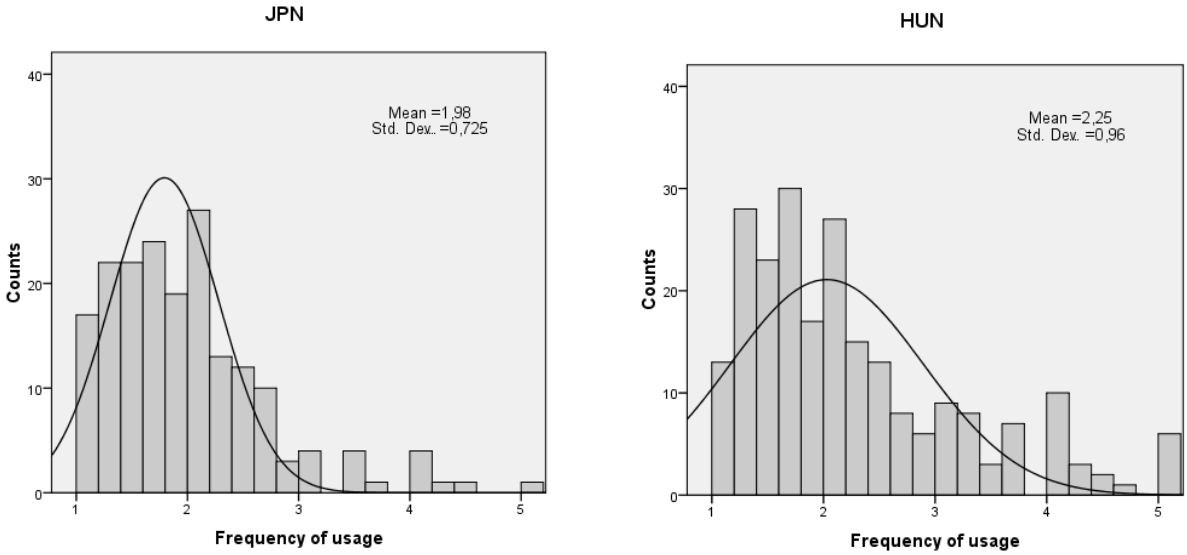

Figure 6. Histograms of the usage frequency of map-information applications and services (1=very rare usage; 5=very frequent usage) (Kurtosis: 2.566 [JPN]; 0.571 [HUN]; Skewness: 1.426 [JPN]; 1.099 [HUN]; with normal curve)

In a closed question we asked also on the activity for which any map-information services were used by the respondents. The Japanese respondents replied travel as the most usual activity, and also searching for sights and searching for restaurants as typical activities, when spatial information tools were used. The Hungarians mentioned also travel the most frequently, while public transport and commuting as second, and searching for shops as the third most frequent activity. Out of 8 possible choices of answers an average of 4 was mentioned by both country's respondents (typical was between 3 and 6) (Figure 7). In this regard only small differences can be seen between the countries. It suggests that the range of applying such tools is almost equally broad in the countries, and small differences are better to be explained by local specifications than by ICT development differences.

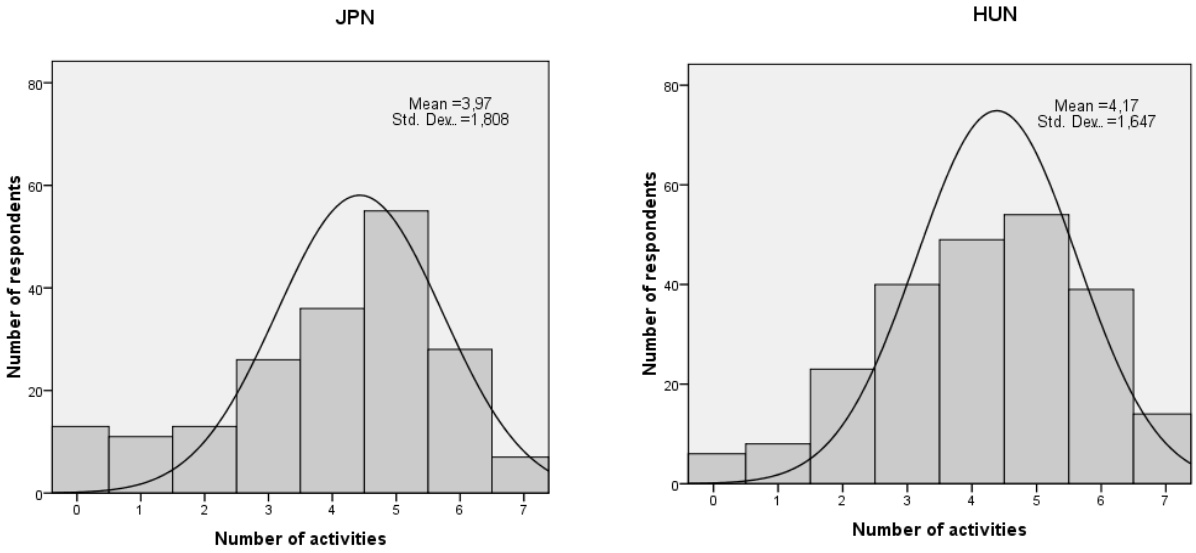

Figure 7. Histograms of the number of activities for which map-information applications and services were used (Kurtosis: -0.255 [JPN]; -0.290 [HUN]; Skewness: -0.675 [JPN]; -0.394 [HUN]; with normal curve)

The next question tried to reveal what opinion the respondents have about the importance and application possibilities of map-information tools (Table 4). According to the results Hungarian respondents mentioned traffic, navigation and local weather services among the very important map-information applications, while location-based games, AR applications, geolocated social networking applications and digital children tracking services are considered as not important ones. Japanese respondents had roughly the same opinion regarding the non-essential applications, while mentioned own location finding, car navigation and other local weather applications as important ones.

Map-information based services and applications	Not important at all		Preferably not important		Preferably important		Very important		Total	
	HU	JP	HU	JP	HU	JP	HU	JP	HU	JP
Pedastrian navigation services	21%	14%	26%	28%	39%	35%	14%	23%	100%	100%
Local weather	7%	4%	18%	15%	43%	51%	32%	30%	100%	100%
Location based games	68%	48%	28%	38%	4%	10%	0%	5%	100%	100%
Geolocated searching	28%	10%	25%	17%	33%	46%	14%	26%	100%	100%
Real time traffic information	13%	8%	14%	24%	36%	46%	37%	22%	100%	100%
Geolocated social networking	39%	25%	33%	48%	20%	21%	8%	6%	100%	100%
Augmented reality applications	57%	35%	27%	46%	14%	15%	2%	4%	100%	100%
Mobile compass	35%	25%	34%	36%	24%	26%	8%	13%	100%	100%
Local pollen information	48%	20%	25%	36%	20%	33%	7%	11%	100%	100%
Digital children tracking services	58%	31%	19%	29%	15%	26%	9%	13%	100%	100%
Digital package tracking services	38%	19%	24%	26%	29%	39%	10%	16%	100%	100%
Finding own location on map	20%	3%	22%	11%	32%	47%	26%	39%	100%	100%
Car navigation applications	15%	6%	11%	20%	36%	38%	37%	36%	100%	100%

Table 4. The importance of map-information applications and services according to the Japanese and Hungarian respondents

The opinions are, however, depending also on group characteristics of respondents. Table 5 reflects, that although similarities can be found between the answers of most popular map-information tools, there are some differences in the ranking results according to gender or residence groupings of countries. It is interesting also to see that some apps or services are not very important for Hungarian respondents, but very important for all Japanese groups. This is the case e.g. for the answer “Finding own location on map”, which was among the top 3 for all Japanese groups, but among the top 3 only for males among Hungarian respondents.

HUN			
Gender		Residence	
Male	Female	Core-urban	Suburban.periph.
Real time traffic information	Car navigation applications	Car navigation applications	Real time traffic information
Car navigation applications	Local weather	Real time traffic information	Car navigation applications
Finding own location on map	Real time traffic information	Local weather	Local weather
JPN			
Gender		Residence	
Male	Female	Core-urban	Suburban.periph.
Finding own location on map	Car navigation applications	Finding own location on map	Car navigation applications
Geolocated searching	Local weather	Car navigation applications	Finding own location on map
Car navigation applications	Finding own location on map	Local weather	Pedastrian navig. services

Table 5. The three most important map-information applications and services according to the Japanese and Hungarian respondents

The outcomes above reflect typical socio-cultural differences between the two countries, which suggest that inequalities have a complex character including social, behavioural and infrastructural components as well. A lot could be added to this statement with the next part of the questionnaire, where the role of the location of map-information usage was analysed. With the following question we asked the people to answer where and with what device they manage to use map-information services. Most of the respondents replied they have resort to such services from home PCs or notebooks (Table 6). In Hungary the share of using home computers is as high as 59%, while in Japan it is "only" 40.5%. The main difference between the two countries is observable in mobile or smart phone usage: almost 40% of the Japanese respondents access map-information services from mobile or smartphone devices, while in Hungary the share is only 23.5%. Compared to the application of home PCs and smartphones, the usage of office computers, school PCs or public internet devices for getting map-information is less typical both for Japanese and Hungarian respondents. In Japan the usage of map-information applications and services through workplace computers is exceeding 14%, while in Hungary the ratio is just over 9%.

Devices and location of map-information usage	JPN	HUN
Home PC	40,5%	59,0%
Mobile or smartphone	39,5%	23,5%
Office PC, school PC	14,1%	9,1%
Public access to internet	2,1%	2,9%
Other	3,8%	5,4%
Total	100,0%	100,0%

Table 6. Devices and location of map-information usage according to the Japanese and Hungarian respondents

Beside traditional mobile phone sales namely the sales of smartphones having integrated services is increasing globally. The selling of these latter assets exceeded that of the traditional mobile phones in 2010 in Japan, and somewhat later, in 2013 in Hungary. From the aspect of spatial sciences smartphones became others than their predecessors by means of built-in geographical positioning devices and related applications. This could have eventuated the increasing of common interest on spatial information, too.

In ICT usage with the increased diffusion of smartphones an increasing shift would possibly be experienced from personal computers to activities managed through mobile devices. Whereas real technological wave have just reached Hungary, in the somewhat more advanced stage standing Japan the above mentioned tendency can possibly have shown up already. The results of the examination partially justify this assumption as well.

Naturally there are differences between locations of using map-information services according to types of activities (Table 7). Respondents from Hungary basically still use home computers when searching for transportation information, finding services in the neighbourhood or browsing maps, as a matter of fact with simply browsing and using the internet. Japanese respondents perform the activities rather with mobile and smartphones, or at least avail themselves of such location-independent, spatially untied and more mobile forms of getting information more frequently. This channel of accessing spatial information is not prevailing in all cases of course, since for example accessing public (governmental) services or online shopping are still dominantly done through home computers according to Japanese respondents too. All in all, it can still be declared that the usage of modern devices of information and communication technologies slowly but robustfully deliberate users from spatial bounds of location; which has already signs in Japan.

Activities	Home PC	Mobile or smart phone	Office PC, school PC	Other public access to Internet	Other offline	Total
JPN						
Searching for transportation route information	35%	47%	14%	2%	3%	100%
Searching for services in the neighbourhood	33%	51%	10%	2%	4%	100%
Browsing maps	36%	38%	18%	3%	5%	100%
Accessing public services (governmental services)	45%	27%	20%	4%	5%	100%
Accessing online shopping services	63%	27%	7%	0%	3%	100%
HUN						
Searching for transportation route information	52%	29%	10%	4%	6%	100%
Searching for services in the neighbourhood	56%	25%	11%	3%	6%	100%
Browsing maps	54%	25%	11%	3%	7%	100%
Accessing public services (governmental services)	64%	20%	8%	2%	6%	100%
Accessing online shopping services	81%	12%	4%	2%	1%	100%

Table 7. Devices and location of map-information usage by typical activities according to the Japanese and Hungarian respondents

Discussion

Although our research sample was not representative in all terms, some statements could possibly be made regarding the influence of spatial information technologies on Japanese and Hungarian peoples' life. The increasing usage of map-information service perhaps started to change peoples' relation to space and also their habits of using space especially because of the growing popularity of smartphones. In our research it was better reflected in answers of Japanese respondents, but also Hungarian respondents assigned the geoinformation tools as useful and important.

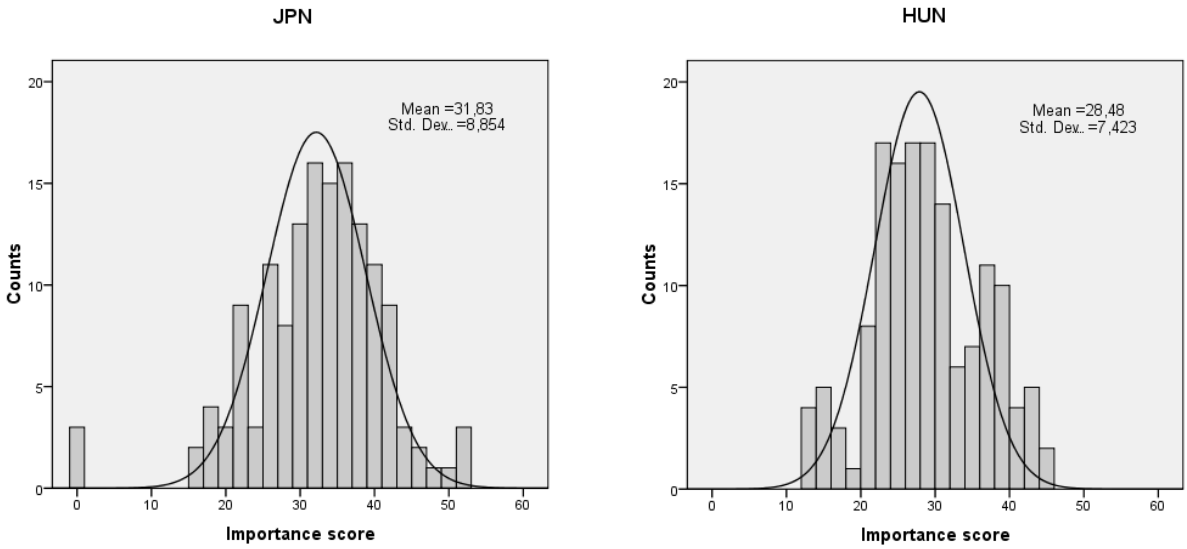

Figure 7. Histograms of the importance score about the usage of map-information applications and services (Kurtosis: 2.238 [JPN]; -0.503 [HUN]; Skewness: -0.775 [JPN]; -0.062 [HUN]; with normal curve; possible maximum score = 52)

The level of importance was measured by importance scores for all types of map-information applications and services (Figure 7). The minimum score was zero, which signified no importance for any of the map-information apps or services. The possible maximum score was 52 (13x4), which reflected that the respondent found all the apps and services very important. The average importance score was 31,83 in the Japanese and 28,48 in the Hungarian survey, meaning that people of both countries consider map-information apps and services somewhat more important than natural (the score for natural opinion is 26). The larger score for Japan additionally can refer to more positive experiences on the usefulness of such apps and services. The graphic histograms also confirm that there is a little bit more people in Japan, who consider spatial information tools as important or very important than in Hungary (see counts over the importance score value of 40). It seems that the daily experiences of using spatial information tools are already well measurable in Japan, but only started to prevail in Hungary recently. In general, it is also possible to strengthen the assumption that Japanese people have turned towards the qualitative spatial information a bit earlier than the Hungarians.

It can be already seen from the above mentioned few results that spatial information technologies and geoinformation business, as well as the usage of map-information related services and applications have some different directions in the two countries. In general it can be assumed that Japanese users are somewhat more related to applications, which have relations to private usage or directly serve their own needs, while they are less recline upon community information. In contrast, Hungarian people use more services, which provide information not personally and not only for themselves, although naturally the other services and applications are also among the used ones. In Japan the usage of location based services is well advanced, thus it has the consequence that the Japanese society may serve as a good example for the second line developed countries, like Hungary. Meanwhile Hungary has also formed its unique character in the geoinformation-world, since this country is above-average active in content providing in cyberspace, which can cause that Hungary would have good results in map-information usage statistics.

Generally speaking we could confirm the assumptions derived from the previously mentioned models of Hüsing and Selhofer (2001), namely that instead of inequalities of ICT infrastructure penetration new inequalities of the quality of information usage has to be replaced. In our case the model can be consequently modified as follows: ICT-related accessibility differences between Japan and Hungary have been changed and become supplemented by quality-based information inequalities.

Acknowledgement

The research was supported by the János Bolyai Research Fellowship of the Hungarian Academy of Sciences. The author thanks for the assistance of Masatoshi Arikawa, Shinichi Konomi, Keiji Yano, Toshikazu Seto and Katsuhiro Sasuga in data collection and Japanese translation.

References

Albert F. – Dávid B. – Molnár Sz. (2008) Links between the diffusion of internet usage and social network characteristics in contemporary Hungarian society: A longitudinal analysis. *Review of Sociology*, Vol. 14, No. 1., pp. 45-66.

Arikawa, M. – Konomi, S. – Ohnishi, K. (2007) Navitime: Supporting Pedastrian Navigation in the Real World. *Pervasive Computing*, Vol. 6., No. 3., pp. 21-29.

Frank, A. U. (1997) Geographic information business in the next century. In: Hodgson, S., Rumor, M., & Harts, J.J., (eds.): *Proceedings of Third Joint European Conference on Geographical Information, JEC-GI'97, in Vienna (April 16-18, 1997).* Published by IOS Press, Amsterdam, Vol. 1, pp. 13-22.

Hüsing, T. – Selhofer, H. – Korte, W.B. (2001) *Measuring the digital divide: A proposal for a new index*. IST Conference, 3. Dec. 2001, Düsseldorf.

ITU (2010) *Measuring the Information Society*. International Telecommunication Union, Geneva, Switzerland.

Karlsson, C. – Maier, G. – Trippl, M. – Siedschlag, I. – Owen, R. – Murphy, G. (2010) *ICT and Regional Economic Dynamics: A Literature Review.* JRC Scientific and Technical Reports, Publications Office of the European Union, Luxembourg.

Nakamura, T. – Sekimoto, Y. – Usui, T. – Shibasaki, R. (2010) A Study on Data Assimilation of People Flow in Kanto Urban Area. *Papers and Proceedings of Asia GIS.*

OECD (2001) *Understanding the Digital Divide.* OECD Publications, Paris.

Usui, T. – Sekimoto, Y. – Kanasugi, T. – Shibasaki, R. (2010) A comparison of person-trip data for five metropolitan areas and performance of spatio-temporal interpolation. *Journal of Infrastructure Planning Review*, Vol. 27., No. 3., pp. 569-577.