

Smart Cities Need Smart Citizens, but What About Smart Children?

Sabine Hennig

(Dr. Sabine Hennig, IFFB Geoinformatics - Z_GIS, Schillerstr. 30, 5020 Salzburg, sabine.hennig@sbg.ac.at)

1 ABSTRACT

Citizens are a key component of the smart city concept. Understanding citizens allows creating sophisticated services and outcomes that are tailored to their needs. This refers also to children and the youth who are an equally important part of society. But, even though singular initiatives can be found that put interest on children and the youth, there exists a gap between knowledge required and knowledge existing on how young people act, move, and live in cities and which urban infrastructure, facilities, and services including ICT they consider important. This owes to the fact that the needs of children and the youth - as for instance outlined in literature - are determined mostly by adults, while the perspective of the youngsters themselves has been less considered. Thus, there are several open questions on smart cities regarding children and the youth: Why at all is it important for smart city initiatives to pay attention to children and the youth? What are relevant aspects to take into account by smart cities in order to become (more) child- and youth friendly? These questions are discussed based on experience gained by work done in the project Youth Map 5020.

2 INTRODUCTION AND RESEARCH QUESTION

The continuing urbanisation trend, the pressing need for sustainability, and their increasing level of complexity are great challenges for today's cities. At that, cities, i.e. due to their development, must meet the following demands (Meijer & Rodríguez Bolívar 2013): produce more wealth including other public values (e.g. solve environmental problems, guarantee safety), involve social issues (e.g. integrate growing populations from different ethnic, religious, and socio-economic backgrounds), trigger structural transformation in society (i.e. include stakeholders and citizens in urban governance), and foster cultural development (e.g. arts, museums, and education), to create a vibrant cultural climate.

In order to respond to these tasks, the smart city concept has been developed. Very roughly described, this concept is a strategy for working with cities supporting them to fulfil the objectives outlined above. For it, the needs of citizens are put first, whereas solutions not only base on intelligent management and active citizens participation, but also increasingly rely on the use of ICT (see e.g. URL 1).

Concerning detailed definitions on the smart city concept, it has to be underlined that different definitions exist. Furthermore, it is a fuzzy concept that is not used consistently and for to describe it similar terms such as intelligent cities, virtual cities, knowledge-based cities, digital cities, or information cities have emerged (Meijer & Rodríguez Bolívar 2013). Nevertheless, representative for others, two definitions are presented here:

Caragliu et al. (2011:70) consider a city smart “ (...) when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.

Giffinger et al. (2007:11) define smart cities as “(...) a well performing city built on the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens.” To identify and assess smart cities, he stresses a set of six characteristics (see Table 1): social and human capital, competitiveness, participation, transportation & ICT, natural resources, quality of life.

Characteristics of Smart Cities			
smart	people	Social/ Human Capital	Affinity for life-long learning; participation in public life; creativity & flexibility
	economy	Competitiveness	Innovative Spirit; productivity; flexibility of labour market
	governance	Participation	Participation in decision-making; transport governance
	mobility	Transportation & ICT	Local accessibility; ICT infrastructure; sustainable, innovative, safe transport system
	environment	Natural Resources	Attractive natural conditions; environmental protection; sustainable resource management
	living	Quality of Life	Cultural facilities; health conditions; housing quality; Social cohesion

Table 1: Criteria of smart cities (adapted from Giffinger et al. 2007; URL 1)

Regardless the definition, citizens (the human capital) are highlighted as a key component for the concept of smart cities. Several authors such as Hemment & Townsend (2013) and Meijer & Rodríguez Bolívar (2013) argue that (smart) citizens are necessary to make smart cities. For developing smart cities they ask for putting people first: As our cities are becoming instrumented, interconnected and intelligent, and enabling to create

new opportunities to improve the performance and efficiency of city systems, it requires, being fully aware of the citizens and their way of life which triggers certain needs and requirements. This refers, on the one hand, to city's endowment of urban infrastructure, facilities, and services, and, on the other hand, it encompasses the application of digital technology (i.e. ICT) to city systems (availability and quality of knowledge communication, information infrastructures etc.). Both are related to multiple key areas (as listed in Table 1) focusing on economy, mobility, environment, living, and governance.

So, to foster smart cities, understanding citizens and having information about their preferences and needs is considered reasonable (Tratz-Ryan 2013). Citizens, therefore, may be segmented by a myriad of different profile characteristics such as age, ethnicity, abilities or disabilities, gender, level of affluence and state of health. Also, ICT use variables should be taken into account to get a better picture. This includes for instance, information on interaction type referring e.g. to request for information, application for services, channel for the service request/transaction (e.g. telephone, face-to-face, web). Such profiling of citizens supports to create services and outcomes well-tailored to the needs of particular target groups (Thacker 2009). However, such knowledge, beside its relevance to smart city development, can impact city planning initiatives as well as design and development of information and communication infrastructure.

Even though, the smart city approach asks for considering everyone, some parts of society are still left behind. This is even truer for children and the youth (see e.g. Zeising & Katterfeldt 2013). Literature highlights the need to improve services and outcomes to fit the needs of children and the youth (URL 18).

But, even though singular initiatives (e.g. European Network Cities for Children: URL 19; Child & Youth Friend Strategy of the city of Surrey; URL 15), and projects (child health: URL 8; school and teaching: URL 20, Noling 2008) exist, which directly or indirectly provide some information on how children and the youth act, move, and live in today's cities and which urban infrastructure, facilities, and services including ICT they deem important, there is a gap between knowledge required and knowledge existing.

Among others, this owes to the fact that requirements of children and the youth rely mostly on what adults determine as such (e.g. society relevant aspects such as education, health), on insights gained by people observing their own children, on knowledge delivered by what others say, i.e. general assumptions on how kids and youngsters supposedly behave, and on what children (probably) consider relevant (URL 2; URL 5). Regarding the perspective of children and the youth themselves less attention has been paid until now. Hence, there are several open questions on smart cities concerning the very point of view of children and the youth: (i) Why is it at all relevant to pay attention to children and the youth when developing smart cities?, (ii) Which urban infrastructure, facilities, and services are used and regarded important by children and the youth?, (iii) What about the use of modern ICT infrastructure and services on the part of this user group?, and (iv) In a nutshell, what are relevant aspects to consider by smart cities in order to become (more) child- and youth friendly?

These questions are discussed based on experience and results gained from the project Youth Map 5020. Even though the project is still under way, work done until now, already produced a wide range of information on children and teenagers interesting also for smart city initiatives.

3 THE PROJECT YOUTH MAP 5020

Youth Map 5020 (<http://www.youthmap5020.at>) is a project funded by the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT) in context with the FFG program "Talente Regional" (<https://www.ffg.at/talente-regional>). The project, which started in May 2013 and which will end in October 2014, aims at creating a dynamic, interactive web map for the city of Salzburg (zip code 5020) well-tailored to the requirements of children and the youth (user interface, map content, map design, range and properties of functions). The Youth Map 5020 will be implemented as ArcGIS online web map application. Moreover, based on the experience gained while designing and implementing the web map 'Youth Map 5020', recommendations will be elaborating providing support to others creating such web map applications. As this includes suggestions on map content focussing on urban infrastructure, facilities, and services, as well recommendations on ICT-related issues (device, user interface design, interaction mode etc.) results offer useful input for child- and youth-friendly (smart) city initiatives as well.

To gain such insight, the approach of participatory design is applied. Literature highlights participatory design as an approach specially valuable and useful when it comes to work with children and the youth, and

to involve them in design processes (see e.g. Kaufman 2011; Muller & Druin 2012; Sanders 2002). In consequence, i.e. to be able to directly and actively involve kids in the web map development process, the Youth Map 5020 consortium includes adults plus children and teenagers. Hence, partners, besides coming from the scientific sector, public administration, and the business domain, are eight schools located in Salzburg. Table 2 outlines the tasks performed by the students within the development process of the web map application ‘Youth Map 5020’.

Partner		Description on tasks and role
Scientific	IFFB-Z_GIS, University Salzburg	project lead, scientific support
Public administration	City of Salzburg, youth office	real-world project- and product connection (and dissemination)
Business	SynerGIS	technological support (ArcGIS online)
Schools	Handesakademie 2	development of the YouthMap 5020 web map application: requirements specification, data collection, processing, management, map design and implementation, testing and optimization
	Bundesrealgymnasium	
	Akademisches Gymnasium	
	ABZ St. Josef	
	Sonder-Pädagogisches Zentrum 1	
	PH Praxis-Volksschule	

Table 2: YouthMap 5020 project consortium

4 CITIES, CHILDREN AND THE YOUTH YOUTHMAP 5020

As already outlined above, (smart) citizens are central to the operation of smart cities (Hemment & Townsend 2013; Meijer & Rodríguez Bolívar 2013). While, the elderly has been getting a lot of attention lately (see e.g. Hennig et al. 2012; Tratz-Ryan 2013), a segment of society that too often has been left behind regarding the development of smart cities are children and the youth. But, this needs a change. This is further underlined by several authors who stress the relevance of children and teenagers for smart city conceptions:

“In view of the demographic changes taking place, policies designed to create a more conducive environment for children, young people and families should form the focus of municipal action if our cities are to be competitive and maintain their vitality in the future.” (URL 19)

“(…) this year’s Summit particularly focuses on the theme of ‘Knowledge Cities for Future Generations’. (…) we believe that on the one hand, knowledge can be generated and then used for building a sustainable future for our children, and on the other, it can also be created by the involvement of our children.” (Abdoullaec 2011)

Moreover, reasons, why situation and requirements of children and the youth should be known and heard in mind concerning the development of smart cities are numerous:

(1) children and the youth are an equally important part of society inhabiting our cities, using urban infrastructure, and transportation systems, needing natural resources such as water, air, energy etc., participating in public and economic life (UNICEF 19998; URL 15).

(2) In city planning, children and the youth are considered as one big part of social planning, since cities must be great places for children and youth to live, learn and play (URL 18).

(3) Youth culture works is a trendsetter, which refers primarily to three main topics: fun sports, music, and computer. Großegger (2006) points out: The zeitgeist is framed by youth culture! (‘In der Jugendkultur formiert sich der Zeitgeist’).

The relevance of integrating the needs of children and the youth in city development finds embodiment in numerous child- and youth-friendly city strategies. Determined characteristics presented in these strategies provide also a framework for integrating child- and youth related demands in smart city creation. Thus, for instance, UNICEF (1989) promotes the concept of a child- and youth-friendly city which guarantees the right of all young citizens to: (i) influence decisions about their city, (ii) express their opinion on the city they want, (iii) participate in family, community and social life, (iv) be an equal citizen of their city with access to every service, regardless of ethnic origin, religion, income, gender or disability, (v) receive basic services such as health care, education and shelter, (vi) drink safe water and have access to proper sanitation, (vii) be protected from exploitation, violence and abuse, (viii) walk safely in the streets on their own, (ix) meet friends and play, (x) have green spaces for plants and animals, (xi) live in an unpolluted environment, and (xii) participate in cultural and social events. While these aspects represent quite general, high-level criteria specified from adults, the question arises on what is missing with regard to the opinion of kids and youngsters.

Working with young people, it has to be emphasised that this target group is quite heterogeneous covering a wide age span, including children and teenagers from different development stages and with different levels of skills and knowledge. As several developmental leaps might occur during few months' time only, the target group is split into narrow age groups related to main development stages (URL 5; URL 6; URL 13):

- children in strict sense (3 – 12 years old) encompassing
 - young children (3-5 years old),
 - mid-range children (6-8years old),
 - older children (9-12 years old), and
- teenager (13-17 years old).

Due to children's different development stages, it is a very challenging task to fit their needs and requirements regarding urban infrastructure, facilities, and services as well as ICT. Nevertheless, because of reasons such as being allowed to move around cities independently, to use the Internet self-determined, and availability of own (mobile) devices, it seems to be reasonable, to primarily focus children being at least 12 years old (i.e. older children and teenager).

This is underlined by the following numbers and statements: Regarding the situation of owning a smartphone, statistics show that from the age of 12 years, percentage of children owning a smartphone is almost 100% (e.g. Germany for 2011; URL 16). Further, literature differs on the age from which children start using the Internet more or less self-determined: Some highlight that already five year old kids are fascinated by the Internet (Seltmann 2008; URL 2); others state that kids start using the Internet from the age of 7 (URL 10). But, since Internet use requires certain reading abilities as well as more skilled motoric capabilities for e.g. (fully) using mouse, keyboard etc. (URL 2), this puts certain age-related and development stage related constraints. It asks for children being at least 12-13 years old (secondary education equivalent age).

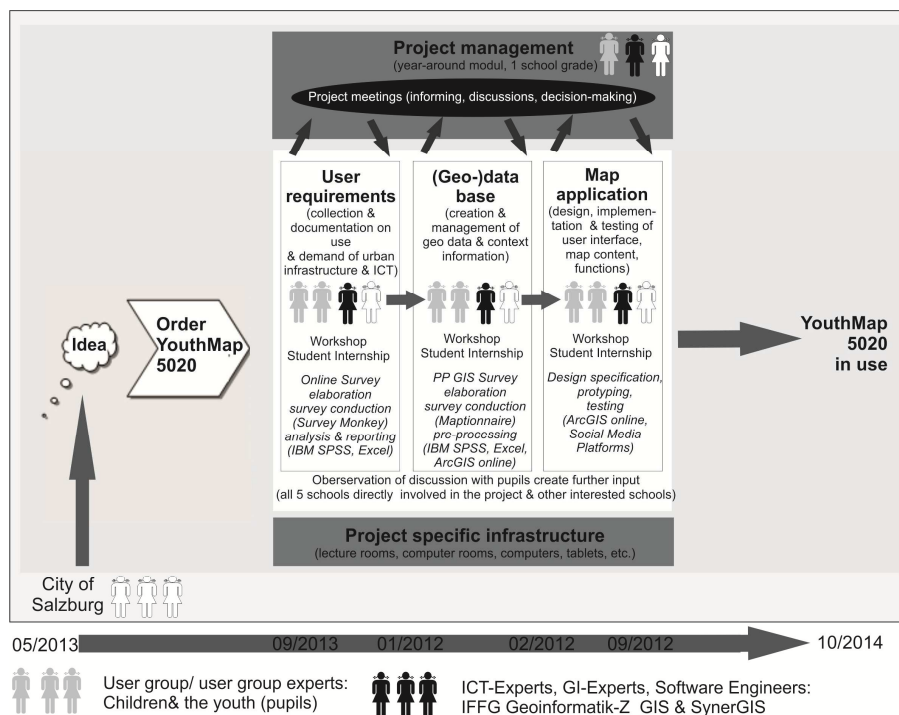


Fig. 1: Youth Map 5020 development process and applied methods and tools

5 METHODS APPLIED FOR THE DEVELOPMENT OF ‘YOUTH MAP 5020’

Today, products and applications must be tailored to meet user requirements (see e.g. Tsou & Curran 2008). Well-grounded knowledge on the intended user groups and their requirements is asked therefore. This is even true for youth-centred products, i.e. applications, such as the web map application ‘Youth map 5020’.

As literature highlights youth-centred design as a remedy to engage young people actively and directly in the design and development process (URL 2), the ‘Youth Map 5020’ development strategy relies on

participatory design in line with well-known software development processes, whereas methods commonly used in both realms are applied (see Fig. 1).

5.1 Design and development strategies

5.1.1 Participatory design

By definition, participatory design is a form of user-centred design. It is a method which not only attempts to understand user needs but also encourages the direct participation of users in the entire design process. Involving users in assessing, designing, and developing a system, it tends to help ensuring that the product design meets the needs of the user group and is usable to them (URL 3; URL 4).

Regarding the involvement of children and the youth, the approach aims at engaging young people to take place in the design and development process of a project or product. This allows to inform program design and implementation as well as to guarantee that activities are responsive to the needs of young people and their on-the-ground reality (Kaufman 2011). This has been gaining interest in different domains. Thus, with the belief that more appropriate solutions can be found, researchers seek to give children a voice in the design of new technologies by using the participatory design approach (Muller & Druin 2012).

5.1.2 Software development process

Design and implementation of the web map application ‘Youth Map 5020’ follows well-known and broadly used state-of-the-art software development processes, which are broken down in several stages encompassing IT project management, conception, design, creation as well as implementation (Balzert 2000; Sommerville 2007). The dissection into separated phases provides the advantage that particular attention can be paid to identify, outline, and fully recognize user requirements. This is even more relevant since analysing users and their requirements is seen as a crucial issue for defining product characteristics in detail, and fosters to develop user-centric, i.e. usable software applications. At that, user requirements show effect on the entire development process and trigger on all further development steps. Methods to gather user requirements encompass e.g. user surveys, interviews, observation, running through scenarios of use, task analysis, studies and analyses of documents, and analogue methods (Nielsen 1994; Richter & Flückigner 2007).

5.2 Applied techniques and methods

In order to get to know the target group and to better understand how children and the youth act, move, and live in today’s cities, from the wide range of methods available in the context of participatory design and software development (requirements engineering), several were applied. This was closely related to undertake workshops, meetings and pupil internships as presented in Fig. 1.

5.2.1 User questionnaires

Main information source for the ‘Youth Map 5020’ web map is a user surveys conducted in autumn and winter 2013/2014. The questionnaire was implemented as an online survey using the Internet survey tool SurveyMonkey (www.surveymonkey.com). It consisted of 26 questions that besides socio-demographic data (age, sex, school education, and place of residence) focused on relevance of urban sites, infrastructure, facilities, and services, as well as ICT related aspects such as application design, range and properties of functions.

The survey was not only created, but also spread by students (school partners) using numerous communication channels (face-to-face, email, Facebook, events etc.). The data collected was statistically analysed by the students (using MS Excel and IBM SPSS) and a report documenting the results was prepared by them.

The user questionnaire resulted in 502 valid responds, from which 35% were delivered from male and 65% from female persons. Concerning the age structure of the respondents 37,5% were 16 years old or older, 44,2 % were between 13 and 15 years old, and 18,3% younger than 10 years old.

Since the questionnaire was developed by the students, information on the target group and their requirements was on the one hand gained through the survey itself; on the other hand, the questionnaire elaboration process (discussions, comments, decision-making etc.) revealed several interesting aspects.

5.2.2 Literature review and analysis of analogues application

On web design and usability aimed at children, not abundant, but at least some literature exists. Information on children and the youth, their characteristics, abilities, and capabilities as well as on computer and Internet use behaviour, web design recommendations etc. is available. However, by analysing analogues software, i.e. web (map) applications tailored for children, additional information was found.

For it, we took into account 13 web maps from all over the world: Austria, Germany, Spain, EU, USA, and Argentina. This referred to web map applications found searching the Web for terms like ‘youth map’, ‘kids map’, ‘maps for children’ etc.

6 RESULTS USEFUL FOR (MORE) CHILD- AND YOUTH-FRIENDLY SMART CITIES

In the following we present a selection of results gained by literature review, analyses of analogue systems, and user questionnaire, as well as discussing with the target group during workshops, meetings, and internships.

Map content	Web map applications													
	Adult-made												Youth-made	
	Salzburg (A)	Wien (A)	Heilbronn (GER)	USE-IT (EU)	New Haven (USA)	Vancouver (USA)	New Orleans (USA)	Magdeburg (GER)	Freiburg (GER)	Kaarst (GER)	Zaragoza (ES)	Buenos Aires (AR)	Hilden (GER)	Youth Map 5020
Consultation & Service														
Education & work														
Sport & fun (pools, crag, sports club etc.)														
Youth engagement & canters, boy scouts etc.														
Events & culture (cinema, theatre, library etc.)														
Child care														
Youth culture (traditions, dancing, music etc.)														
Shopping														
Organisations (church, nature, health, politics)														
Green space														
Go out for a meal														
Help (police, hospital)														
Going out/ night life/ party														
Sightseeing/ accommodation/ tourist info														
Youth specific meeting points														
Girls only														
Place of family excursion														
Transport (bus, taxi etc.)														
Areas of public Internet access														
Caution zones														
Service (cash machine, tobacconist etc.)														

Table 3: Categories of infrastructure and services provided by youth-centred maps (made by adults) and demanded by the youth, i.e. collected within the Youth Map 5020 project (A: Austria; GER: Germany; ES: Spain; EU: European Community; USA: United States of America, AR: Argentina)

6.1 Urban infrastructure, facilities, and services

As mentioned before, two perspectives on young people’s requirements and needs can be distinguished: On the one hand, there is the perspective that adults have on children and the youth; on the other hand, there is the perspective of children and the youth themselves. Based on different categories of urban infrastructure, facilities, and services, Table 3 gives insight in differences between what adults and what children and the youth consider relevant. It bases on elements, which are presented in child- or youth-centred web maps and/ or are identified by the research conducted in the Youth Map 5020 project.

Adults, primarily, see important for children and the youth features such consultations services (carer choice, family problems), schools and places of work, child care centres (incl. after school supervision), recreation sites (sports, play), centres for youth engagement, culture and events. Several of these aspects are also considered relevant by children and the youth. But, they also put focus on youth-specific meeting points, shopping facilities, location for going out and nightlife as well as areas of public Internet access.

Surprisingly, the youth shows high interest in knowing green areas, police stations and hospital, public transportation system including taxi ranks, banks and cash machines, as well as caution zones, i.e. indicating different levels of feeling of safety.

Ranking sites and infrastructure by relevance (done by the target group), the following situation was found: Children and the youth enjoy the most to stay at home (26,2% of the respondents), second and third most important are shopping malls (16,4%) and nature sites, i.e. parks (14,7%), a little bit less important are public sites (11,6%), Salzburg historic city centre (10,9%), inns including fast food restaurants (9,4%), and sports ground (8,1%).

Regarding mobility, the overwhelming majority of the target group (47,6%) uses public transportation system. Therefore, they consider especially important to have at their fingertips information on the actual schedule, location of the closest bus stops (distance) and how to get there the best. Surprisingly, few make use of bicycles (11,3%).

6.2 ICT use

ICT is a relevant aspect to smarter cities (Hoon Lee et al. 2013; Walravens 2012). Washburn et al. (2010) describe smart cities as the use of smart computing technologies to make urban infrastructure components and services (e.g. administration, education, healthcare, public safety, real estate, transportation, and utilities) more intelligent, interconnected, and efficient. A variety of ICT elements such as unified communication, digital services, green technologies, smart utilities, and security services are used to provide smart buildings, smart transport, and smart public service planning. Due to the rapid development of geospatial technology, the use of spatial data, geovisualisation and geocommunication plays an increasing role, too (Roche et al. 2012). Further, smart city applications claim for being developed as user-centric tools (see e.g. Thacker 2009). This means that they must be well-tailored to particular user groups regarding e.g. devices, application design as well as the range of functions.

Concerning the target group of children and teenager, little is still known about how they use ICT or how to design applications that will be easy for them to use. Most of the information available originates from a study done by the Nielson Usability Group (URL 5; URL 6). But, two facts are for sure: First, children and teenager use applications in a way different from how adults do, and, second, their requirements differ remarkably from those of growing up people (Friedrich 2000; URL 2; URL 5; URL 10).

6.2.1 Use of devices

Today, smart cities more and more use digital devices. In this context, the questionnaire results confirm - as outlined in literature (see .e.g. URL 16) - that the target group to almost 100% owns smartphones, whereas the majority has a Samsung HTC (54,3%).

Children labelled as “digital natives” or generation smartphone are keen to leverage ICT (IEB 2009). Thus, it is not surprising, that children and the youth as using these devices several times per day consider their use as supplementary acting in order to support them in all kinds of activities. Not per se they regard the use of smartphones or desktop-PCs as a particular activity they spend their time with like meeting friends, listening to music, making sports.

6.2.2 Applications design and range of functions

Kids and teenagers are described by specific characteristics, abilities and capabilities: This refers to (over)confident in their web and computer abilities, not fully developed motor capability, long reaction time, reduced attention span, and insufficient reading skills, as well as less sophisticated research strategies. Moreover, being assessed as quite impatient, i.e. judging sites quickly and leaving a site immediately if no good without coming back again or having fun while using the application (URL 5; URL 6; URL 9), it is necessary to convince these users at first view. All this asks for a youth-centred design: providing simple and consistent application structure, clearly laid out and well-arranged design, and well-structured content.

Regarding the design, it is well-known that children and the youth like it colourful. This matches web design guidelines for children which highlight that kids like colours (bright, vivid colours) as well as images and pictures (URL 7; URL 11). This is underpinned by the user questionnaire, too. Despite the desire for a cool looking design and a “snappy” application look (deemed not boring by kids), it must be guaranteed that symbols are easy to understand and easy to identify (URL 2; URL 6; URL 14).

While pictures are highly desired, web links are less popular. This might owe to the fact, that children have difficulties to recognize links as such. For them, blue underlined text does not vary from other text (URL 2). Hence, information required should be presented in a more suitable way. Further, all textual information should be presented in understandable text, short sentences and abundant paragraphs not using too tiny font sizes (URL 2; URL 6; URL 12; URL 14).

6.2.3 Properties and range of devices

Implementing functionalities, one must be aware, that children and the youth prefer simple, straight forward processes such as point and click (URL 2). The mouse is the preferred device (URL 17).

Regardless the application domain or task, to call the interest of young people, the provision of social networking services is highly required. This conforms to findings on kids' Internet use: The target group like forms for providing feedback or asking questions, online voting, features for sharing pictures and stories, message boards (URL 6; URL 9). This is also confirmed by the questionnaire: 60% of the respondents consider the availability of social media functions, i.e. social networking services, as relevant or very relevant. Despite this, the youth does not like to create own profiles (growing awareness on security of personal data). This is a tendency also underlined in literature: Children do not want to register or create profiles as prerequisite for using applications.

7 CONCLUSION AND OUTLOOK

The Youth Map 5020 project is still in progress. But, work that has been done till now already delivered interesting results regarding use and design of web maps tailored to the needs of children and the youth. It also provides background valuable for smart city initiatives regarding (more) child- and youth-friendliness. Due to the method to actively and directly involve the target group in the design and development process of the "Youth Map 5020" application (participatory design), the project fully benefits from today's shift in attitude from designing for users to approaches which focus on designing with users (Sanders 2002).

As this approach pays particular attention to the perspective of children and the youth, instead of focussing on the perspective of adults with regard to urban infrastructure, facilities, and services including ICT, this can be considered as a starting point to allow developing smart child- and youth-friendly cities. This is outlined by two examples, which also indicate the need for further research:

(1) Regarding mobility, even though the bicycle has gained in importance as transportation means across society, this is not true for children and the youth. Reasons therefore still need to be investigated. To introduce children and the youth to use bicycles, it might be interesting to provide a map application fitting the demands of children, i.e. particularly focusing on the mobility behaviour of children and the youth (e.g. including caution areas, areas with traffic risks) and also taking into account their demands related to ICT use.

(2) Children and the youth rank the existence of nature and green space and spending time there as very important. However, due to the relevance of natural resources for smart cities, it might be an interesting aspect, based on the pivotal role nature plays for young people, to sensitize this target group – as tomorrow's decision-makers – for topics such as environmental protection, and sustainable resource management. But, which kind of suitable action to take, this requires for more research work. For sure leveraging mobile devices and the possibilities of social media what be helpful, to inspire children and the youth.

The work presented in this paper must be seen as a starting point to get to know how children and the youth act, move, and live in cities and which infrastructure, facilities, and services including ICT they consider important and how to design and implement sophisticated applications and service. However, more research on smart children and youth is needed to more integrate young people in smart city initiatives.

8 REFERENCES

- ABDOULLAEC, A.: A Smart World: A development Modell for Intelligent Cities". The 11th IEEE International Conference on Computer and Information Technology (CIT-2011 . Pafos, Cyprus, 2011.
- BALZERT, H.: Lehrbuch der Software-Technik, Spektrum Akademischer Verlag, 2000.
- CARAGLIU, A; DEL BO, C. & NIJKAMP, P.: Smart Cities in Europe. In: Journal of Urban Technology, 18(2), 65-82. 2011.
- EINFALT, L.: Vorhandene Karten von Kindern und Jugendlichen. Bericht unveröffentlicht. Salzburg, 2013.

- FRIEDRICH, B.: "Wien für Kinder" – Entwurf eines Kartographischen Informationssystems für eine spezifische Benutzergruppe. In: J. STROBL, T. BLASCHKE G. GRIESEBNER (eds.), *Angewandte Geoinformatik 2000*, Herbert Wichmann Verlag, VDE VERLAG GMBH. Berlin/Offenbach, 2002.
- GIFFINGER, R.; F. C.; KRAMAR, H.; KALASEK, R.; PICHLER, M. & MEIJERS, E.: *Smart Cities: Ranking of European Medium-Sized Cities*. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology. 2007.
- GROSSEGGER, B.: *Jugendkultur-Medien – Institutionen*. Kulturarbeit für „Szene-Kids“ – ein Widerspruch? http://www.kulturundoeconomie.ch/forum06/referate/Grossegger_Teil1.pdf. 2006.
- HENNIG, S., OSTENBERGER, A., NEUSCHMID, J., WASSERBURGER, W. & SCHRENK, M.: Providing web maps for everyone. Understanding users and their requirements. In: M. SCHRENK, V. V. POPOVICH, P. ZEILE, P. ELISEI (eds): *REAL CORP2012*. 17th International Conference on Urban Planning, Regional Development and Information Society. 14-16 May 2012, pp. 627-635. Schwechat, 2012.
- HEMMENT, D. & TOWNSEND, A. (2013): *Smart Citizens*. In: Future Everything Publications. 2013.
- HOON L.J. H.; PHAAL, R. & LEE, S-H.: An integrated service-device-technology roadmap for smart city development. In: *Technological Forecasting & Social Change*, 80 (2), pp. 286-306. 2013.
- IEB INSTITUTE OF ELECTRONIC BUSINESS E.V.: *Digital Natives – Generation Internet*. Berlin, 2009.
- KAUFMAN, L.R.: *Community Youth Mapping. A Tool for Youth Participation and Program Design*. Education Development Center, Inc. 2011.
- MULLER, M.J. & DRUIN, A.: Participatory Design; The third space in HCI. In: J. Jacko (ed.): *The Human-Computer Interaction Handbook*, Hillsdale, NJ, Lawrence Erlbaum Associates. 2012.
- MEIJER, A. & RODRÍGUEZ BOLÍVAR, M. P.: *Governing the city: Scaling-up the search for socio-techno synergy*. 2013.
- NIELSEN, J.: *Usability Engineering*. Morgan Kaufmann Publishers, San Francisco, 1994.
- NOLING, J.: *Smart City. A financial literacy and philanthropy interactive web adventure for grades 2 – 5*. Teacher guide. Delaware, 2008.
- RICHTER, M. & FLÜCKINGER, M.: *Usability Engineering kompakt*. Spektrum, München, 2007.
- ROCHE, S.; NABIAN, N.; KLOECKL, K. & RATTI, C.: Are „Smart Cities“ Smart Enough? In: *GSDI World Conference (GSDI 13)*. Québec City, Canada. 2012.
- SANDERS, E.: From User-Centred to Participatory Design Approaches. In: J. Frascara (Ed.): *Design and the Social Sciences*. Taylor & Francis Books Limited. 2002.
- SELTMANN, S.: *Kindgerechtes Webdesign und Usability*; Masterthesis. 2008.
- SOMMERVILLE, J.: *Software Engineering*. Pearson Studium. 2007.
- THACKER, M.: Customer profiling to target service delivery. In: *Smart cities Research Brief No. 2*. 2009.
- TSOU, M.-H. & CURRAN, J. M.: User-Centered Design Approaches for Web Mapping Applications: A Case Study with USGS Hydrological Data in the United States. In: Peterson, M.P. (ed.): *International Perspectives on Maps and the Internet*. Lecture Notes in Geoinformation and Cartography, pp. 301-321. 2008.
- TRATZ-RYAN, B.: *Smart Citizen Need to trust the Internet of Things in Smart Cities*. <http://blogs.gartner.com/bettina-tratz-ryan/2013/11/28/smart-citizen-need-to-trust-the-internet-of-things-in-smart-cities/>. 2013.
- UNICEF: *The Convention on the Rights of the Child*. 1989.
- WALRAVENS, N.: Mobile Business and the Smart City: Developing a Business Model Framework to Include Public Design Parameters for Mobile City Services. In: *Journal of Theoretical and Applied Electronic Commerce Research*, 7 (3), pp. 121-135. 2012.
- WASHBURN, D.; SINDHU, U.; BALALOURAS, S.; DINES, R. A.; HAYES, N. M. & NELSON, L. E.: *Helping CIOs Understand "Smart City" Initiatives: Defining the Smart City, its Drivers, and the Role of the CIO*. Cambridge, MA: Forrester Research. 2010.
- ZEISING, A. & KATTERFELDT, E.-S.: Where is the 'like' button? Going beyond usability when designing for and with teens. CHI'13, April 27 – May 2, 2013. Paris, France, 2013.
- URL 1: http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/; last accessed: 18.2.2014
- URL 2: <http://www.drweb.de/magazin/kids-usability-websites-kindergerecht-gestalten/>; last accessed: 18.2.2014
- URL 3: cpsr.org/prevsite/program/workplace/PD.html; last accessed: 18.2.2014
- URL 4: edutechwiki.unige.ch/en/Participatory_design; last accessed: 18.2.2014
- URL 5: www.nngroup.com/articles/childrens-websites-usability-issues; last accessed: 18.2.2014
- URL 6: www.nngroup.com/articles/usability-of-websites-for-teenagers; last accessed: 18.2.2014
- URL 7: www.smashingmagazine.com/2009/11/27/designing-websites-for-kids-trends-and-best-practices; last accessed: 18.2.2014
- URL 8: <http://smartcitieshealthykids.com/>; last accessed: 18.2.2014
- URL 9: www.usability.ch/bn/news/usability-ux-news/detail/alertbox-teenager-usability-website-design-fuer-jugendliche.html; last accessed: 18.2.2014
- URL 10: ec.europa.eu/digital-agenda/en/creating-better-internet-kids; last accessed: 18.2.2014
- URL 11: <http://www.designmadeingermany.de/magazin/4/usability-kinder/>; last accessed: 18.2.2014
- URL 12: www.fit-fuer-usability.de/archiv/usability-kriterien-fuer-teenager; last accessed: 18.2.2014
- URL 13: <https://www.msu.edu/~webbsuza/atw/graceb>; last accessed: 18.2.2014
- URL 14: etec.citl.ubc.ca/510/wiki/Effective_Web_Design_for_a_Teenage_Audience; last accessed: 18.2.2014
- URL 15: http://www.surrey.ca/files/Child_and_Youth_Friendly_City_Strategy_City_of_Surrey.pdf; last accessed: 18.2.2014
- URL 16: <http://de.statista.com/statistik/daten/studie/1104/umfrage/handynutzung-durch-kinder-und-jugendliche-nach-altersgruppen/>; last accessed: 18.2.2014
- URL 17: <http://www.wiu.edu/thecenter/articles/engag.html>; last accessed: 18.2.2014
- URL 18: <http://www.surrey.ca/community/11212.aspx>; last accessed: 18.2.2014
- URL 19: <http://www.citiesforchildren.eu/121.0.html>; last accessed: 18.2.2014
- URL 20: <http://www.dac.dk/en/dac-cities/sustainable-cities/all-cases/energy/amsterdam-smart-city/>; last accessed: 18.2.2014