

Digital Earth - Young generation's comprehension and ideas

T Bandrova^{1,3}, M Konecny²

¹ Department of Photogrammetry and Cartography, University of Architecture, Civil Engineering and Geodesy, 1, Chr. Smirnenki Blvd. 1046 Sofia, Bulgaria

² Laboratory on Geoinformatics and Cartography, Department of Geography, Faculty of Science, Masaryk University, Kotlarska 2, 611 37 Brno, Czech Republic

E-mail: tbandrova@abv.bg

Abstract. The authors are experienced in working with children and students in the field of early warning and crises management and cartography. All these topics are closely connected to Digital Earth (DE) ideas. On the basis of a questionnaire, the young generation's comprehension of DE concept is clarified. Students from different age groups (from 19 to 36) from different countries and with different social, cultural, economical and political backgrounds are asked to provide definition of DE and describe their basic ideas about meaning, methodology and applications of the concept. The questions aim to discover the young generation's comprehension of DE ideas. They partially cover the newest trends of DE development like social, cultural and environmental issues as well as the styles of new communications (Google Earth, Facebook, LinkedIn, etc.). In order to assure the future development of the DE science, it is important to take into account the young generation's expectations. Some aspects of DE development are considered in the Conclusions.

1. Introduction

Digital Earth (DE) concept was brought to scientific society in 1998 [1]. Fifteen years later, the International Society of Digital Earth (ISDE) stock of the status of development and seeks to formulate further developments DE, mainly deals with the aim to bring value to many users. Digital Earth ambassadors would also like to promote the DE idea in a more attractive way. Thus, the concept will be adopted and followed by more people. Based on their input, a new paradigm will be created in order to solve many problems of the contemporary world. Achieving this target and finding better solutions require making Digital Earth useful mainly to young people. During the last two years ISDE established two groups targeting young people: Youth Commission and the Young Scientist Committee. Both are working together in defining and implementing the future vision of ISDE although the 2 groups have different tasks.

Another aspect of the paper points up one of the most important questions in the field. The role, the comprehension and the ideas of the young generation in the process of acceptance, development and improvement of Digital Earth challenges is analyzed. In 1998, the US Vice-President Al Gore gave a speech at the California Science Center where, for the first time, he formulated and described DE idea, giving also definition of DE: "multi-resolution, three-dimensional representation of the planet, into which we can embed vast quantities of geo-referenced data". It implies also a new framework for integrating a wide variety of geo-referenced data, including natural, cultural and historical components, not limited to 3D space, but also able to deal with time; more, excellent for modelling processes, be it short term hazards, or long term climate change, geological processes, etc. [1].

In the same speech he highlighted the role of DE for education and research purposes giving the example of virtual walk of a girl.

³ To whom any correspondence should be addressed



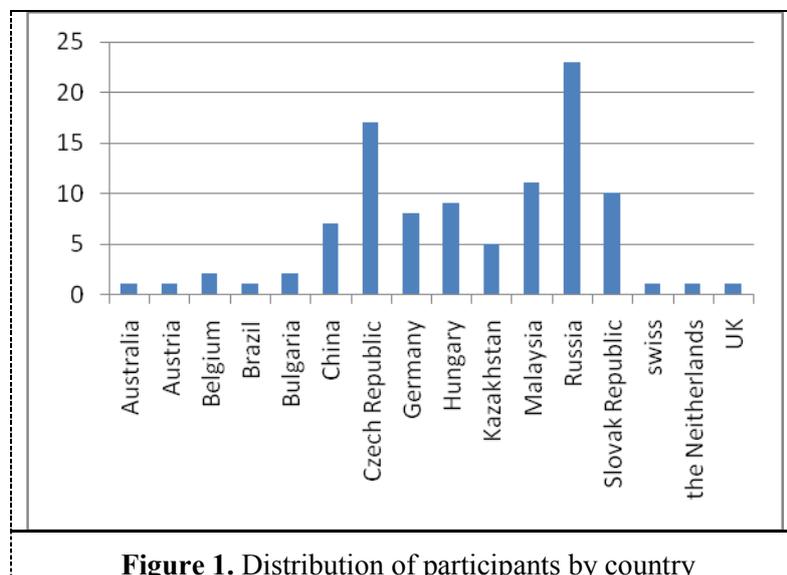
“Imagine, for example, a young child going to a Digital Earth exhibit at a local museum. After donning a head-mounted display, she sees Earth as it appears from space. Using a data glove, she zooms in, using higher and higher levels of resolution, to see continents, then regions, countries, cities, and finally individual houses, trees, and other natural and man-made objects. Having found an area of the planet she is interested in exploring, she takes the equivalent of a "magic carpet ride" through a 3-D visualization of the terrain” (Gore AI, 1998).

From then on, all documents created by ISDE emphasize the fact that the young generation is important for DE development and is considered a core element of the concept. The main aims of the present paper are to reveal and analyze the real opinion of young people and to examine students’ vision for DE, a vision that according to some DE ambassadors is still not achieved [2]. Although the research scale is relatively limited, the results give some important signals and directions for further development of DE idea.

2. Questionnaire and participants

Using free web-based survey solution, we compiled a questionnaire with nine questions to find young generation comprehension of DE concept. The questions are multiple choice questions with possibility to select more than one response and add additional free text comments. Only the last question is free text question. Results analysis could have different interpretations depending on the experts by different specialists. Our aim is to boost DE development and its opening towards students and children. This is the only way to assure that DE efforts will fully respond to all interested groups of society.

Questionnaire was completed by 100 students (bachelor, magister and PhD). Their average age is 24. We need to highlight the international aspect of the research. Participants represent 16 countries, mainly in Europe and Asia: Australia (1), Austria (1), Belgium (2), Brazil (1), Bulgaria (2), China (7), Czech Republic (17), Germany (8), Hungary (9), Kazakhstan (5), Malaysia (11), Russia (23), Slovak Republic (10), Switzerland (1), the Netherlands (1) and UK (1) (see Figure 1).



3. Definition of Digital Earth

Based on Al Gore speech, Wikipedia gives a short description of DE “the name given to a concept by former US vice president Al Gore in 1998, describing a virtual representation of the Earth that is georeferenced and connected to the world’s digital knowledge archives.” [3].

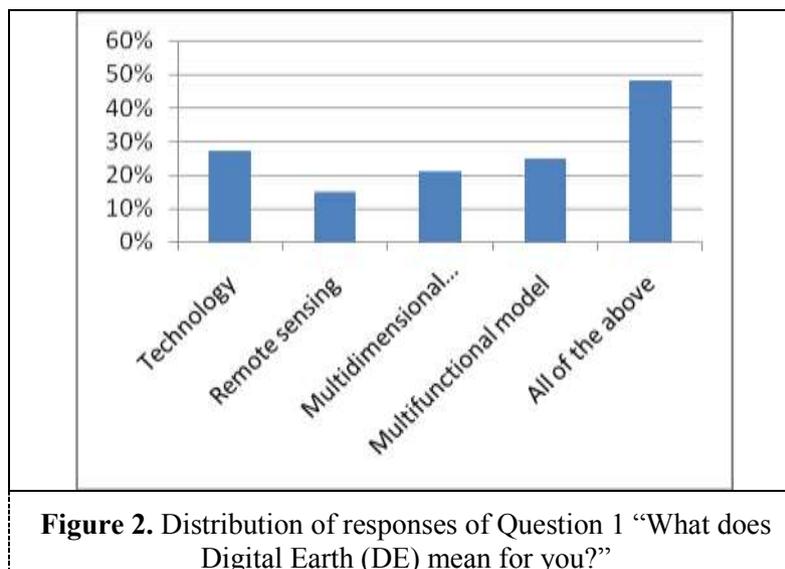
Later, in 2009, at the 6th Symposium of ISDE more detailed definition was given: "Digital Earth is an integral part of other advanced technologies including: earth observation, geo-information systems, global positioning systems, communication networks, sensor webs, electromagnetic identifiers, virtual reality, grid computation, etc. It is seen as a global strategic contributor to scientific and technological

developments, and will be a catalyst in finding solutions to international scientific and societal issues" [4]. Another interpretation of the potential usage of DE concept in Europe is elaborated by [5].

Using these definitions as well as articles concerning concepts and vision of DE we asked students to share their thoughts on the meaning of DE. The proposed responses were technology (27%), remote sensing (15%), multifunctional model (25%), multidimensional model (21%) or "all the above" (48%). The most popular response was the last one while "Remote sensing", the main "engine" of contemporary DE development, received the lowest percentage (15%). We could conclude that DE is perceived as a complex concept where the remote sensing is only a small part of. (see Figure 2).

The participants had the possibility to give alternative response but we received only two definitions: "Earth science" and "Digital earth is a flag which politicians wave it for promoting the societal informatisation. It is not an academic term".

All above show that students accept the definition of DE and give a priority of multi-functionality and multi-disciplinarily aspects of DE and also they find their place and understanding in it.



4. Necessity of DE

The second question aims to understand if students find their place in ISDE and why they need it. They had the possibility to choose more than one answer. Two responses received scores near to the 50 %, "For modeling real environment systems" (48%) and "For using it as a data source" (46%). Other two responses receive lower score: "For using it as orientation tool" (23%) and "For making decisions in different situations" (20%). The option "All of the above" receives 34%. Only one free text response is given: "It is for introducing concept of information society". This answer points out the strategic purpose of ISDE. As scientists, it is surprising for us that students don't see the role of DE in decision making process. The reason could be that participants are not in the position of decision makers.

5. Future development of DE

One of the most important questions to young people is the development of the DE in near future. We proposed three options. One of them received more than 2/3 of the votes. Digital Earth will be accessible via a multi-touch globe that will provide real time data about every region on the Earth (76%). Other possible options were "Every object on the Earth will be represented in scale 1:1" and "Digital Earth will provide answers to all questions related to the Earth". They received 34% and 25% respectively.

The students' interest and serious approach to the topic is visible through the free text responses: - A lot of people use DE for navigation and routing purposes in our days, but in future we will use DE for engineering and fundamental works of geodesy.

- Digital Earth will become a regular thing like a computer and the Internet.

- I think it would be a great improvement, if it would change (select) the visualized objects to the desired occasionally use field.

- It will be moving towards the above goals but won't reach them in 10 years.

- Scholars need to tell clearly about the concept of DE in academic, not just put everything into it.

These responses are influenced by students' education. When analyzing the responses it is visible that these young people study geodesy, geography, cartography, GIS. The most important conclusion is that they connect their future works and vision to the DE ideas.

6. International capacity of DE

As an International organization, ISDE is looking to solve global environmental problems. The option "Disaster management" received the most responses - 57%. In contrast to the responses to Question 2, where the need of DE defined as "For making decisions in different situations" received the lowest result, here the DE is viewed as source of decision power. The discrepancy is probably due to the lack of professional practice and experience of the students. "Sustainable development" is ranked second with 29% and "Improved living standards" is last with only 10%. "All of the above" received 19%.

7. Covered areas by DE

ISDE is a society that attracts multi-disciplinary experts. The professionals represent different areas – from computer science to social and environmental disciplines. Nowadays, many decisions depend on the input and the conclusions made by specialists of different branches. That is why we expected equal distribution of the responses of the next question. However, "Modelling cities and environment" received 70% of the votes. The second and the third ranked choices also deserve attention. "Climate change" and "Global sustainability" received 45% and 39% respectively. "Energy" (17%), "Social and cultural exchange" (17%), and "All of the above" (13%) are not consider highly influenced by DE (see Figure 3). The results show that students are able to see the impacts of DE on their professional field but not on other domains.

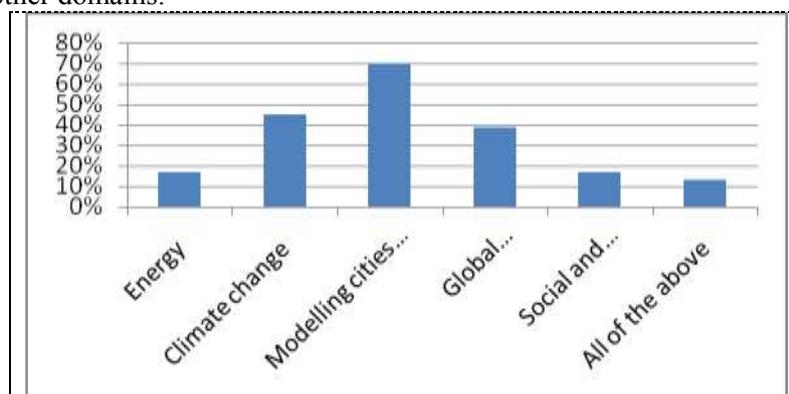


Figure 3. Distributed responses of Question 5. "Which area do you consider most likely to be influenced by DE?"

8. Relation between DE and Media

Internet and digital media changed our life and work style last decades. We expected that students will link DE to a various online applications and media. However, Google maps and Google earth stand out with 79% of the votes. Internet is ranked next with 52%. All other options received few votes: Social networks - 17%, Wikipedia and All of the above – 8%. Only one free text response was received: OpenStreetMap. We consider it as relevant example. We suppose that the results would have been different in case the same experiment involved students with liberal art background (Communications science, PR, Literature, etc.)

9. Digital Earth for education

Only 4% from participants consider that DE is not important for education. Two options received the majority of the votes: "Yes, DE will provide the basic data for my investigations and research" (68%) and "Yes, DE will encourage me to develop my personal knowledge base and research" (63%). The option "Yes, DE will allow me to connect more efficiently to other professionals" received only 24%

of the votes.. Again, it is visible that students relate DE mainly to their education and professional field.

10. Security in Digital Earth

Security in the digital world is one fundamental issue and sensitive topic for many organizations. Security of data and information is often regulated by government and institutional laws. We considered important to ask the students what kind of personal data they consider acceptable to be used for DE purposes without being afraid of data misuse.” Two options are supported by the majority of the participants. “High resolution satellite images” received 87% of the votes (this is the leading percentage of all responses in the questionnaire) while “Street cameras pictures / video” received 74%. All other options gather between 3% and 16%.

We received a couple of free text responses:

- without personal data- ID card information;
- neither – 2 responses;
- Both options only with the blurring a faces/licenses/identifiable information
- All above but also some restrictions should be applied while using the all personal data (including ID information, bank account, family information, ownership data).

11. Digital Earth Services

The last question is free text question. “How do you imagine Future (Geospatial) Services based on Digital Earth Paradigm?” The question is inspired by the memorable speech of former GSDI Association president David Colemann. He defined aspects and potential needs of the so called Millennial Generation. These characteristics are: sociable, optimistic, talented, well-educated, collaborative, open-minded, influential, and achievement-oriented; have always felt sought after, needed, indispensable; arriving in the workplace with higher expectations than any generation before them; well-connected - if an employer doesn’t match their expectations, they can tell thousands of their colleagues with one click of the mouse [6]. Implications of such situation for Future Geospatial Services: “Must be...: quick, anonymous, authoritative, delivered “Just-in-Time” (“Use it and lose it”) and easy to share on-line with friends and colleagues. At the same time are millennials expecting authoritative data, geocoding and sharing experiences, and some others [6].

Our free text question was a challenge to the participants and we received various answers. Some of them didn’t generate any particular idea while others allowed us to understand young people’s perception of future implications of DE. The main are:

- “real time and easy data access”;
- “spread widely in social network”;
- “more user friendly services”;
- “free high resolution and accurate earth surface information”;
- “more information about some less developed places available”;
- “integral part of many spectra of human activity”;
- “environmental monitoring will be at the best level”;
- “accessible for free”;
- “as a network of servers”;
- “everything organized online, social functions and skills will die away”;
- “multifunctional databases and 3D models linked with other relevant data clouds”;
- “get real time data and help people make decision”;
- “smart enough”;
- “wherever I am, I can feel the real scene of different places in the world; feel like that I'm really there. Or at least I can see what happened there”.

12. Conclusions

The results allowed us to identify trends in young people’s perception of DE. Authors will continue to analyze and investigate the topic with the aim to explore in details students comprehension and ideas.

Apparently, students have no problems to use DE concepts in their studies but few of them perceive DE as complex approach or new paradigm. Usage of DE in social media is still not enough developed.

It is also evident that youngsters' understanding of knowledge economy services evolves in conditions of new improved concepts and technologies (smart phones, mobile internet, location services, etc.).

The same experiments could be applied to another target group of users: elderly people, domain experts, children, administration representatives, etc. On the basis of similar experiments ISDE could bring special attention to specific groups in order to address their needs. The newly established Youth Commission and the Young Scientist Committee in ISDE should pay attention to specific DE topics and discover their potential in DE development: remote sensing, social media, sustainable development, and economic, social and cultural aspects.

Acknowledgment

We would like to thank all young people who took part in the survey and particularly our colleagues who encouraged their students to participate: Immelyn Domnick, Germany, Jesus Nunez Hungary, Irina Rotanova and Vladimir Tikunov, Russia, Alena Dubcová and Hilda Kramáreková, Slovakia, Paulo Menezes, Brasil, Wang Changlin, China, Chan Valerij Aleksejevich, Kazachstan, Mazlan bin Hasmim, Malaysia, Abbas Rajabifard, Australia.

References

- [1] Gore A 1998 The Digital Earth: Understanding our planet in the 21st Century. *A speech given at the California Science Center*, Los Angeles, California, on January 31, 1998 <http://www.digitalearth.gov/>, last accessed 28 March 2010
- [2] Craglia M, Goodchild M F, Annoni A, Camara G, Gould M, Kuhn W, Mark D, Masser I, Maguire D, Liang S, Parsons E 2008 Editorial. Next-Generation Digital Earth *International Journal of Spatial Data Infrastructures Research* **3**, 146-167
- [3] Wikipedia 2012 http://en.wikipedia.org/wiki/Digital_Earth, 14 June 2013
- [4] ISDE 2009 The 6th International Symposium on Digital Earth - Digital Earth in Action <http://english.ceode.cas.cn/zt/isde6en/>, last accessed 16 June 2013
- [5] Annoni A, Craglia M, Ehlers M, Georgiadou Y, Giacomelli A, Konečný M, Ostlaender N, Remetey-Fulopp G, Rhind D, Smits P, Schade S 2011 A European perspective on Digital Earth *International Journal of Digital Earth*, Abingdon, Oxon, UK: Taylor and Francis, 2011, July, 4/4 271-284. ISSN 1753-8947, doi:10.1080/17538947.2011.582888
- [6] Colemann D 2005 Geospatial Information and the Knowledge Economy *oral presentation* Map Middle East Conference, Dubai, UAE