

Human's Digital Space in a Digital City

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1 ABSTRACT

The major idea of this paper is to discuss a question about free space around a human from a computer science point of view. As we well know, every animal has its own 2D or 3D region of freedom. If something or somebody tries to go inside or cross a border of this area, in most cases, it will be defined as an intruder. We will not discuss philosophical or humanitarian aspects of human freedom in this paper. We will speak about problems regarding the digital world of each of us only. In case we are going to talk about human's digital space (HDS) let us first investigate the phenomenon of the digital world. If we take a look at linear algebra we can find definitions such as "space" and "subspace". Therefore, the major idea of our discussion is to determine space and subspace in HDS and to introduce some measures for dynamic HDS borders and other properties that can be calculated by different methods. Another question concerns the interference of personal HDS.

According to a HDS idea, a Digital City (DC) is a special terrain or a limited digital world. This world (DC) contains a number of humans and many of them (not everybody) have their own HDS.

The major theoretical idea of the proposed paper is to discuss two phenomena, Digital City and Human's Digital Space.

2 INTRODUCTION

What means HDS as a subject of research? Let us go back (or go ahead, nobody knows exactly which) in to the early stages of our civilization. Free space around an animal or a human played a key role from different points of view as follows:

- safety reason as a most important thing for the animal world and early people
- Information retrieval around conditions such as trees, hills, mountains, and rivers etc.
- Warming, fresh water and air conditions and many other features.

Most of them remain valid in our days but we have other not typical but not less important things for humans in our days. It is very hard to imagine a modern city or village without cell phones, TV, credit cards, Wi-Fi, etc. On the one hand, such possibilities bring us many positive properties but on the other hand it is a way of intrusion into private space of all people.

What is a private space? In a physical world, it is practically evident because it is as a rule a distance. However, what about a digital not physical world?

3 DIGITAL WORLD

The word combination "Digital World (DW)" could be understood by everyone of us from everyday life level to scientific level. In our days, a drift from the real world to the abstract world can be created inside DW space. Dependence on digital devices such as cell phones, tablet PS, social networks, credit cards, etc. forms a special abstract space for every human who is using up to date digital devices and technology. In addition, from year to year it is very hard to avoid being in touch with DW because everyday life is a part of activities inside of DW. As a rule people receive money only by credit card, and often can make purchases in different stores also by credit cards. Some operations we can make only by credit cards: control bank accounts, internet payments, etc. Possibilities, dependence and vulnerabilities inside a DW forms a special digital space (DS) for every active actors inside DW. Moreover, we have a rather big set of such actors. Most important among them are:

- sources of energy: energy understood in common sense (food, electrical power, gas, oil, etc.);
- friends, satellites, members of social groups, etc.;

- neutral subjects and existences;
- enemies, predators, and some other actors.

4 DIGITAL SPACE

Digital Space (DS) is a part of DW. DS belongs to DW. The main difference between DS and DW is the possibility to present or describe DS by some theory or by model. DW could not be presented by one model or by one theory. For example, an ocean is a world; channel for sound distribution in the ocean is a space.

In historical retrospective, not a bad example could be a specific tactic of German submarines during the Second World War, a tactic called “pack of wolves”. A key characteristic of this tactic is for a submarine to understand in which of the four subspaces she is located. For more details see [http://www.u-boote.ru/operate/areal_w.html], for example.

If we take for investigation a world of humans, it is also impossible to develop a unified theory or model. This is also true for a human as a subject of research. Around a human, we have philosophy, anthropology, medicine, and many other subject domains. According to this idea, human's digital space (HDS) is a part of the digital world around a human. DHS can be investigated by theory or by model, as is not the case with DW.

5 HUMAN'S DIGITAL SPACE

Let us see what is a digital space around a human. If we try to present a list of features that belongs to digital it will be not enough all the time. The world IT industry develops new devices, technology and utilities for everyday using, scientific research and other applications. Every human has two sides of life, physical and social ones. It is easy to see that up to date IT infrastructure influences both sides, physical and social. According to this the contemporary human fully depends on IT. Physical influence is a direct intrusion into physical health of humans. They include phenomena such as: microwave, Wi-Fi, Bluetooth, cell phones, PC and many other radiations. In case of social life, human dependence on DW is more evident. Most important things of DW influence are as follows: Internet in common case (social networks & groups, news pages, information and data resources, etc.); bank systems and credit cards support; e-money and e-bay systems; local networks and Intranet; cell phones, tablet PC, PC as devices for communications and as tools for work and pleasure.

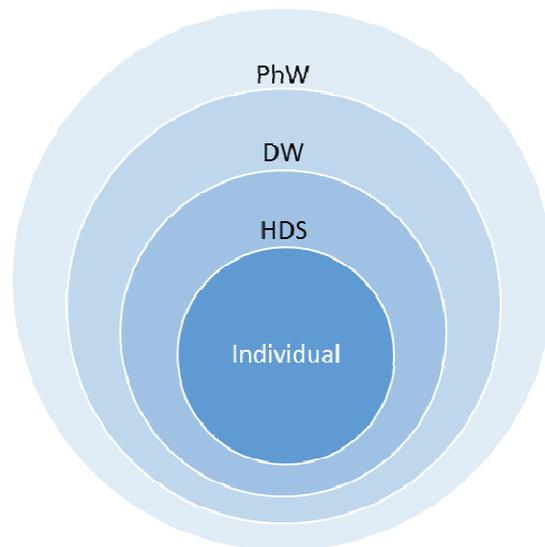


Fig. 1: Individual and World.

DW brings for humans new possibilities, life comfort and progress support. However, DW together with new possibilities are facing new demands and new problems from the two sides of human existence. At this step of investigation, it is possible to formulate an abstract statement of the problem. An abstract human interacts with an abstract existence DW. In comparison with the physical World let us determine digital space as a subspace of DW that reflects some properties of a sub world, or in other words the human's world. Why do we need to investigate DHS? Because it is a very important indicator for a human to understand his (her)

safety and vulnerability position in real life. This is a way to feel comfortable in everyday life, during work, shopping, vacations etc. It is also a method to understand what you can meet if you are doing something. Let us give some examples. Wi-fi: If you connect to or through this system, you should be sure in your firewall protection or believe in the provider of the network.

In the physical world, many things are suitable for our mentality. As an example, very typical metrics like length, square, volume etc could be used for a measure. What a thing could be used as an analog in a DW? Let us examine some ideas on the surface of the problem.

- a) Chain of IP addresses from a source to a destination. Not sure.
- b) A point and a fact for entrance into a “digital cloud”. Not sure.
- c) Quantity and type of identifications of humans (credit cards, counts in banks, payment’s procedures, different tickets obtaining etc.). More “Yes” than “No”. Nevertheless, what about the measure?

It seems to us that it is very hard or just impossible to find a single criterion and linked variables for such a human’s estimation.

The physical world around us is a rather well investigated phenomenon and every human tries to investigate it from the very beginning of his existence to the end of his life. For DW things are not so evident. The major question is what is an individual for (in) DW? In our recent research we proposed to investigate two representations of an individual: human’s digital profile and human’s digital track [3].

5.1 Human’s Digital Profile and Human’s Digital Track

Let us consider the meaning of English words “profile” and “track”, as they are defined, for example, in the system of English-Russian and Russian-English ABBY Lingvo dictionaries: Profile (noun) – «brief biography», «biographic data», «complex of parameters», «description of the system characteristics in table of graphic form»; (verb) «give brief biographic data». Track – «line or series of marks», «course or development of events».

Based on the stated strict sense of words “profile” and “track”, we could treat “profile” as a “complex of parameters” describing an individual biography, and “track” as a “complex of parameters” describing an array of consequential events in an individual life with a linkage of these events to time and place of realisation.

Such understanding of the considered terms “profile” and “track” matches well the recognition of statistic data and operational data, reviewed in section 2.

The above-stated allows us to give a preliminary verbal definition of the terms “profile” and “track” of individuals (“individual profile” and “individual track”):

- (1) “individual profile” – a complex of biography parameters fixing important facts of individual history (place and date of birth, education, religion, religion changes, ethnic group and nationality, etc.);
- (2) “individual track” – a complex of parameters characterising individual behaviour with a linkage of these events to time and place of realisation (time and place of departure to a certain destination, time and addressee of the last mobile phone calls, etc.).

Therefore, though differing by its content and means of gathering, individual profile and track data conform to the same mathematical form – a form of a vector $x=(x_1, \dots, x_n)$ of parameters x_1, \dots, x_n , where each parameter is measured by the certain scale (nominal, order, numeral, etc.). Consequently, using the same mathematical methods for processing both individual profile and individual track data is reasonable.

Since our goal is the feature detection of the individual potential vulnerability in the DW, all data considered should disclose relevant, i.e. to the point of purpose, essential information. This relevant data condition could be stated as follows: every parameter x_1, \dots, x_n , combined into profile and/or track is necessary, and all of them taken together are sufficient for the definition of intrusion in a private life activity.

If the mentioned condition of the parameters x_1, \dots, x_n relevance is met, then one could consider an individual profile and individual track, or in other words, the person's profile and the person's track.

The stated similarity of the mathematical form of the individual profile and track representation as a vector of values of a specific set of characteristics allows us to combine the methods of individual "track" identification and individual "profile" identification.

In other words if we have definitions of a "track" and "profile" of an individual we know what we should protect in DW from hostage activities or intrusion.

5.2 Situation Awareness and Situation Assessment

Every individual that has some electronic device such as cell phone, credit cards etc. has a reflection in DW by its profile and track. Such reflection can be called a situation. Moreover, it does not even matter, whether an individual knows it or not for a situation to exist. In some subject domains similar situations have a special name: "tactical situations". A tactical situation is regarded as a combination of some parameters, expressly or by implication defining the explored system state at a given moment of time under a defined goal. A human digital tactical situation (HDTs) is regarded as a tactic situation in the system of defence against DW malicious threats.

The classification of the HDTs itself should be performed in addition to gridding (area coordinates, coordinates of supposed electronic devices (ED) carriers or ED itself) and definition of every other tactic situation component. TS should be also correlated with the available analytical and decision-making tools, keeping in mind quantitative or model analysis.

Tactical situation assessment (identification) is the key problem during situation analysis in the interests of making decisions about a digital threat character.

Time is a determinant parameter for making a decision in real-time systems, such as a system of defence against a digital threat. As a result, one inevitably comes to the idea of preliminary development of TS variants (creation of so-called "TS library") which could occur in the responsibility area of any given control, and TS assessment automation.

It should be noted that this is only a theoretical discussion and no real work applications or tools exists yet.

6 DIGITAL CITY

The digital city exists in abstract and physical forms, no doubt. It seems to us that in our investigation, the digital city (DC) can be a restricted area of DW. On the one hand, however, it is not so simple, because DC is not a typical city with borders, internal law conditions, communities etc. The Internet in the common sense, cell networks, satellite networks are not windows but fields in to other worlds, in short worlds which are wide ways to go in to the DW. On the other hand, DC forms a physical, technological and political background to form HDS. In addition, the position of DC has to be understood within a region and a country. It is evident that a region and a country influence DC, but for us the only important thing is DC's direct influence on HDS.

The digital City involves networking activities (based on a variety of e-devices). Each user has his (her) network based on a list in the personal address book. The concept of the network functions includes network security, which consists of the strategies directed to prevent and monitor unauthorised access, to support authentication, encryption, etc.

It should be useful to implement Social network analysis (SNA) to investigate networks structures using network and graph theories to trace human movements. Such data sets are usually obtained from cell phone or GPS data. In city space, humans and the communication tower might be only a few hundred meters from each other. Therefore, there is a high degree of accuracy to locate a person using cell phone data. Network analysis is closely connected to the research of a set of personal networks which create a cloud of intersected networks in DC.

7 CONCLUSION

Our investigation is in a very early stage. Introduced abstract conceptions "Digital City" and "Human's Digital Space" will be investigated in algebraic form and will have numerical expression by PC. Freedom was and is the most important thing for the individual during the long human history and in our days its importance is not less than in previous years.

According to this it is very important to understand the meaning of well known conceptions such as a City and an individual in our digital world.

8 REFERENCES

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