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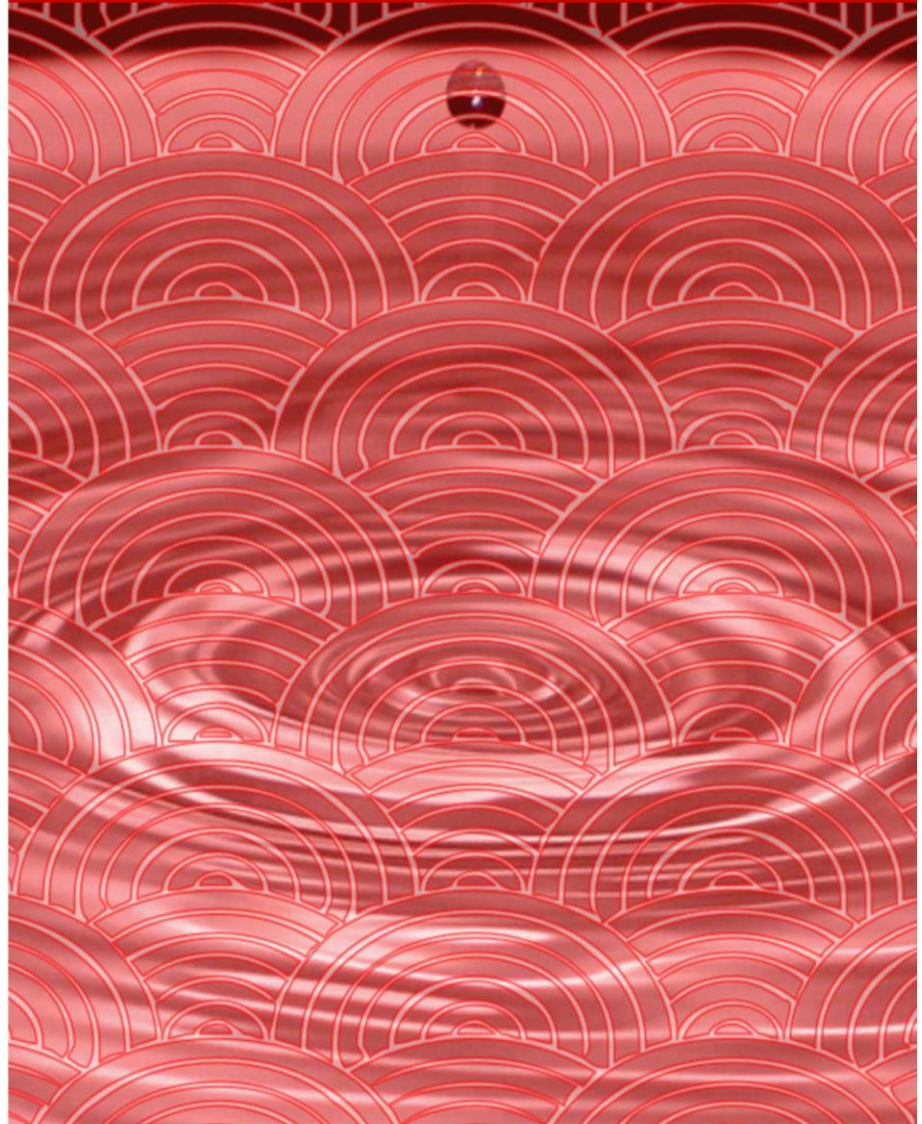
GeoPatterns

University of Bucharest

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Summary

Agent-based modelling – a new method for investigating environmental problems

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Abstract. The agent-based modelling (ABM) represents a newly emerged domain with multiple applications. They started to develop in late 1940's and they reached maturity in 2000's – 2010's. Nowadays, more and more studies are being made using ABM, proving that they are a powerful tool in exploring patterns, interactions and behaviours. As their name suggest, they rely on *agents*. There is still no formal definition for agents, but they are considered to be autonomous entities, capable of having a certain behaviour and to interact with other agents and/or with the environment they belong to. The environment, the agents and the interactions established form the ABM. Even though this type of models has evolved from mathematics, thanks to computer development, and especially computer graphics, they now offer the possibility to visually explore certain behaviours and to identify a pattern. Also, of great importance and contributing directly to the ABMs application expansion, is the development of a variety of toolkits used for designing agent-based models. Many of the toolkits are open source and continuously implement more simplified programming language. These are the main reasons for which ABMs are used nowadays in a very wide range of domains – from ecology to healthcare and medicine, from archaeology to stock markets, from combats and air traffic control to emergency situations, from social and natural sciences to robotics.

Keywords: *agent, model, computer simulation, behaviour, social*

1. INTRODUCTION

An agent-based model (ABM) is a computational simulation in which different agents act and interact, having a certain impact on the whole system they belong to. The name 'agents' is given to any entity – individual or collective – capable of acting in a certain way, thus having a certain behaviour. The agents are capable of decision-making, their actions and interactions with other agents and/or the environment being limited by a set of rules previously established. As mentioned, 'agent' is a generic term used to define entities that can interact with other entities and/or with the environment. Agents can be people, plants, animals, vehicles, institutions, organizations, different groups of people, departments, companies, etc. There is no formal definition for the agents (Orsi, 2018a), but they do have some specific characteristics like (i) autonomy, in decisions and in acting, (ii) heterogeneity, even though they belong to a certain group, every single agent is unique, (iii) agents can learn and adapt, (iv) they can interact with other agents and/or the environment and (v) they can be mobile.

The intelligence level of the agents, translated in their behaviour, depends on the power of computers and on mathematical models (Bonabeau, 2002).

ABM is capable of 'translating' in a visual way the mathematical equations that govern certain behaviours, for example, people moving in a museum, birds flocking through cities, bears avoiding humans in touristic mountainous areas etc. ABM is used to make predictions about possible attitudes given some rules and to establish patterns in different contexts. ABM can help in identifying the connections between two or more agents or the interactions between agents and/or the environment which they belong to. It can be used in a wide range of fields like social and natural sciences, resource allocation, location of facilities, route planning, public services, military and public policies. When

the focus of the analysis is on the interactions and/or dependencies between agents, ABM will provide a suitable insight of the analysed phenomenon. For this reason, it is widely used in ecology, biology and agriculture.

2. DEVELOPMENT AND TOOLKITS

The early development of the ABM dates back in the period between 1940's and 1960's, when the first idea of the concept emerged – *the von Neumann's machine*. The machine was designed by John von Neumann and it was named '*the universal constructor*' because of its designed capability to replicate itself. Von Neumann designed it to have three main components: (i) a memory tape, where the indications for building the machine were stored, (ii) the constructor, that read the memory tape and was able to interpret it and (iii) a construction arm, that built the machine, according to the instructions (von Neumann, John, Burks, 1966; Orsi, 2018a). The universal constructor was based on *cellular automata*, an invention of a Polish-American mathematician, Stanislaw Marcin Ulam. Cellular automaton is a collection of cells with a certain property organised in a grid and which evolves through a number of discreet time steps, according to a set of rules, the cells being capable of adaptation. In the von Neumann machine, the cells could take on 29 different states at any moment and they could update their status depending on their neighbour's state (Orsi, 2018a). The work of von Neumann was continued and extended over the years. In 1966, John Burks published a book based on the work and designs of John von Neumann after the latest's death in 1957.

Another milestone in ABMs development was another cellular automaton designed by John Horton Conway, a British mathematician, in 1970, called *Game of Life*. Game of Life is an infinite, 2D grid, consisting of square cells with only two possible states – dead (unpopulated) or alive (populated). The cells can interact with all eight surrounding neighbours. The rules set were (Orsi, 2018a): (i) any live cell that has less than two neighbours dies (by underpopulation), (ii) any live cell that has two or three neighbours survives (the next generation), (iii)

any live cell that has more than three living neighbours dies (by overpopulation) and (iv) any dead cell that has three neighbours gets back to life (by reproduction). The first generation of cells are considered seeds and they will apply the four rules, resulting in new generations that are identical to the previous ones (Gardner, 1970). The breakthrough of Life consisted in the way that patterns can emerge, and was of great interest for the scientists of the time from different fields like physics, mathematics, biochemistry, philosophy, computer science etc. Martin Gardner, in his article from Scientific American from October 1970, said that *this game belongs to a growing class called 'simulation games'* (Gardner, 1970). The game was developed before the wide use of computers, but for many years it presented a lot of interest and so it was in the public's attention when the first generation of inexpensive computers appeared on the market. This resulted in implementing the game on computers that could run the model for multiple times. By performing the game, some patterns could be established. Thus, the main patterns identified were *still* (Cook, 2003), *oscillators* and *spaceships* (Adamatzki, 2010), the former being observed before the use of computers.

In 1971, Thomas Schelling published a paper called '*Dynamic Models of Segregation*' in which appeared one of the earliest concepts for ABM. Schelling was an economist and a professor at the University of Maryland, his main field being public policy (arms control, national security and foreign policy). His background in social-related domains allowed him to draw into attention the mechanisms of segregation. In his paper, mentioned above, he states that '*This paper, then, is about those mechanisms that translate unorganized individual behaviour into collective results*' (Schelling, 1971, p. 145), the unorganized individuals are actually agents and the collective results are the system, both elements of the agent-based modelling. The models explored in his work are the spatial proximity model and the bounded-neighbourhood model, using as agents' stars and zeros. In the first one, the entities perceive the 'neighbourhood' based on their location, in the second one, the neighbourhood is defined and has boundaries. First, he assumes a linear distribution of 70 entities, represented

graphically by 35 stars and 35 zeros. In a first assumption the entities are happy to live together in a ratio of approximately 50:50. By adding more rules – like the perception of the extend of the neighbourhood, the preference that a certain number of neighbours to be the same, the percentage of each entity in the total population, the direction and length of movement, the entities move on the line. Even though none of the entities know a priori the next movement of others, following the rules, will result in cluster formation and then in segregation. Introducing a movement restriction, some concerted and anticipatory movement can be identified in the actions of the entities. Another distribution explored in the paper is the areal one. It starts with a finite board in which two entities are randomly distributed. The starting rule is that the entities can move only on vacant cells, and by moving they create a new vacant cell that can be occupied, every entity being surrounded by eight neighbours. By introducing a new rule – if an entity is surrounded by certain percentage of entities belonging to other group, the entity will move to another location. The results showed that even in case of high tolerance, segregation patterns may appear. The work was of great importance because it focused not on the social dimensions of the segregations, but on the interactions of the neighbours and their behaviour.

Next step in ABM's developing was registered with the gaining popularity of the mathematical analysis of human behaviour. This new emerged direction of using mathematics dates back in 1940's when the mathematician von Neumann and the economist Morgenstern wrote the book '*Theory of Games and Economic Behavior*', along with other strategy works that were published after the World War II. The book of von Neumann and Morgenstern explored the use of *game theory* in order to identify optimal strategies for military (Copeland, 1945). The game theory is a branch of Applied Mathematics which explores the strategies adopted or that should be adopted by two or multiple players following a strict set of rules, the main objective being obtaining the highest gain/score (Myerson, 2013). The game theory is in fact a study of human behaviour from a mathematical point of view. Today, the applications of the game theory transcend mathematics, being used in social and

computer sciences, focusing on logical and rational decision-making. The scientist who made the leap from the game theory to agent-based modelling was Robert Axelrod. He was intrigued by a game called *Prisoner's Dilemma*. In this game, two prisoners were given the chance to betray or to remain silent with respect to the other fellow prisoner. If they betrayed each other, both would be convicted to two years of prison, if one betrays, but the other remain silent, the one who betrayed would get free and the one who stood silent would spend five years in prison and if both remained silent, they would each spend four years in prison. Axelrod organised two tournaments in order to identify the best strategy for winning the game, the scope being obtaining the lowest conviction. During the tournament it was observed how the cooperation between two rational entities would work (Rapoport, Chammah and Orwant, 1965). Starting with these tournaments, Axelrod continued to develop agent-based models in political and human-related sciences (Axelrod, 1997, 2006).

In the late 1980's, computer graphics are starting to add to agent-based modelling, which now gains a visual component as well, not only logical and mathematical ones. For this period, the work of a computer expert, Craig Reynolds, is important for the development of ABM. Observing the behaviour of some live biological creatures, he worked on modelling the flocking behaviour of biological agents, being one of the pioneers in biological agent-based models (Reynolds, 1987).

Starting with 1990's ABM expanded, since more and more specific software appeared. The first applications were StarLogo, Swarm and NetLogo, followed by AnyLogic and GAMA. Today there are more than 100 applications/toolkits on the market, the majority of them being open source.

After a decade from the first computer programs specially designed for ABM, it started to appear a wide range of tools, that permitted the users to create their own codes and thus, their own models. This period was the point from which mostly anyone could create a code for modelling, not only mathematicians or computer experts. Depending on the software used, some programming skills are required, but the use of these is not limited to the experts anymore. Today, there are many tools

available, based on different programming language, designed for wide-range applications or for specific ones. In the table below, the existing open source toolkits are presented.

Table 1 Existing open source toolkits
(Abar et al., 2017)

	ABM Toolkit	Programming Language	Platforms	GIS integration	Field
1	Agent Cell	Java	PCs, workstations		Biology
2	Agent Factory	Java	PCs, mobile phones		Social Network
3	AgentScript	Java	Desktops, smart tablets		Social Sciences, Education
4	AOR Simulation	Java	Desktops		Management, Economics, Social Sciences, Biology
5	Ascape	Java	Desktops		Wide-range
6	BehaviourComposer	Java	Desktops, smart tablets		Wide-range
7	Brahms	Java	Desktops		Social
8	Breve	C++	Desktops		Artificial life
9	Bsim	Java	Desktops		Biology
10	CloudSim	Java	Desktops		Cloud computing infrastructures and services
11	Cormas	Smalltalk	Desktops		Natural renewable resourses, GIS, marketing, ecology
12	CRAFTY	Java	Desktops, workstations		Land use, logistics
13	Cynbele Pro	Java	Desktops, workstations		Industry, Communications, Transportation
14	Echo	C	Desktops, workstations		Ecology
15	EcoLab	C++	Desktops, workstations		Complex simulations
16	Envision	Windows Visual C++	Desktops	Yes	Planning, Environment
17	Eve	Java	Desktops, workstations		Wide-range
18	FLAME	C	PCs, workstations, supercomputers		Wide-range
19	FLAME GPU	C for CUDA	PCs, workstations, supercomputers		3D simulations in Biology and Medicine
20	GAMA	YourKit Java	Desktops, workstations	Yes	Wide-range
21	GALATEA	Java	Desktops		Wide-range
22	GridABM	Java	Supercomputers		Biology
23	GrowLab	Java	Desktops		Social phenomena
24	HLA_Agent	C++	Desktops, supercomputers		Wide-range
25	HLA_Repast	Java	Desktops, supercomputers		Wide-range
26	IDEA	Java	Desktops		Applied Sciences
27	Insight Maker	JavaScript	Desktops		Biology
28	JAMEL	Java	Desktops		Economy

29	JAMSIM	Java	Desktops, workstations		Social and public services
30	Janus	Java	Desktops		Wide-range
31	JAS	Java	Desktops		Social systems, neural networks
32	JASA	Java	Desktops		Economics
33	JAS-mine	Java	Desktops		Wide-range
34	jES	Java	Desktops		Management
35	LSD	C++	Desktops, workstations		Social science, Economics
36	MASON	Java.net	Desktops, workstations		Wide-range
37	MASyV	C	Desktops, workstations		Cellular automata
38	MATSim	Java	Desktops, workstations, supercomputers	Yes	Transport
39	Mesa	Python	Desktops		Artificial life
40	MOBIDYC	Smalltalk	Desktops		Wide-range
41	Mobility TestBed	Java	Desktops		Transport
42	NetLogo	Scala code compilation to Java byte-code	Desktops		Wide-range
43	PDES-MAS	C++	Desktops, supercomputers		Wide-range
44	PedSim	C++	Desktops		Social
45	PS-I	C	Desktops		Social sciences
46	Repast-J	Java/C#	Desktops, supercomputers	Yes	Social network
47	Repast HPC	C++	Supercomputers		Complex simulations
48	Repast Simphony	Java	Desktops, workstations		Wide-range
49	SeSAm	Java	Desktops		Social sciences, Education
50	SimAgent	Poplog	Desktops, workstations		Social sciences, Education
51	SimJr	Java	Desktop		Military
52	SOARS	Java	Desktop	Yes	Wide-range
53	Sugarscape	Java	Desktop		Social sciences, education
54	Swarm	Java, Objective-C	PC, workstation, supercomputers		Wide-range
55	TerraME	C++/Lua	Desktops, workstations	Yes	Wide-range
56	UrbanSim	Opus, Python, Numpy	Desktops, workstations		Wide-range
57	Xholon	Java	Desktops, workstations		Wide-range

From the existing toolkits for ABM use, two thirds are open source and only one third are proprietary software (based on Abar et al., 2017). From the table above, it can be observed that almost 60% of the open source toolkits are based on Java programming language and more than 85% of them are designed to be used on desktops and personal computers, which are the most popular platforms. Regarding the field for which they were designed, 34% have a wide-range use and only 11% have GIS capabilities integrated.

3. DESIGNING AN ABM

The agent-based models have three components (Macal and North, 2010): *the environment*, *the agents* and *the interactions* – between agents and between the environment and the agents (Fig. 1). The agents are defined by their attributes and behaviour and the interactions are established through a topology of connectedness. All these are part of the set of rules that the developer has to establish.
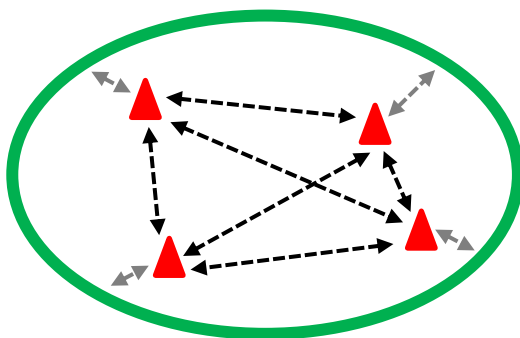

Figure 1 *The components of an agent-based model (Legend: green circle – the environment; red triangles – agents, black dashed arrows – the interactions between agents; grey dashed arrows – the interactions between agents and environment).*

There is not a definition for agents, but, based on the practice, they seem to have some essential properties (Macal and North, 2010): (i) are self-contained and unique, despite the fact that it belongs to the same group and this also leads for them to be heterogeneous; (ii) are autonomous, having behaviours that they enable by themselves; (iii) they have a state that it can change over time; (iv) are social, being able to interact with other agents; (v) they may be adaptive, learning by experiences; (vi) they may be goal-directed. The agents interact mainly with their neighbours and they change their behaviour based on these interactions.

When designing an agent-based model, the *conceptualisation* phase of the model is of great importance (Castle and Crooks, 2006). In this first step, the developer must establish the objectives of the model and must understand the system and its characteristics in order to define its elements – the attributes of agents, their behaviour and interaction rules, but also the environment.

According to Castle & Crooks (2006), the next step after the conceptualisation is the *formalisation* of the model. In this phase, the attributes for the agents must be thoroughly established, as well as their behaviour and interactions (Fig. 2). Also, of equal importance as introducing the agents in formalisation, is the environmental setting. The formalisation corresponds to the effective development of the model. Before taking into considerations the results emerged after running the model, there is a need to verify the inner function of the model, meaning it should be verified if the model functions as expected (Castle and Crooks, 2006). This step should be followed by *calibration*, which is a way of testing the model's capacity to simulate the real world (Orsi, 2018b).

Figure 2 *The steps of designing an agent-based model (after Castle and Crooks, 2006)*

Before implementing or before taking into consideration the results from the model, it must also be validated. But, in many cases, models are constructed in order to prepare or to foresee the development of a phenomenon that will take place in the future. Thus, validating this kind of model is not always possible. In these cases, a sensitivity analysis can be used instead (Castle and Crooks, 2006; Orsi, 2018b). A sensitivity analysis tests the robustness of a model, meaning it 'measures' to what extend is the model sensitive. The most used method for sensitivity analysis is changing or

varying some parameters in the model. Sometimes, even for simple models, with a limited number of parameters (or set of rules), testing the sensitivity means combing the parameters' modifications and this can result in a large amount of combinations. These combinations would require further investigation, meaning more resources allocated and more time spent. For these situations, the model developer relies on his intuition, his expertise or on expert knowledge in order to make the combinations which are more susceptible to be sensitive. If the outcome of the model changes significantly when varying the initial conditions by a small amount, it means that the model should be reconsidered.

4. APPLICATIONS, BENEFITS AND LIMITATIONS

The applications for agent-based models are extremely wide. Starting with computer-related use and finishing with healthcare, teaching, stock markets, military-combat, they expand and grow in popularity. The applications for ABMs are synthetized in the table below, some references being also given as examples of use.

Table 2 Applications of agent-based models**Main field**	**Application**	**References - examples**
Medical-related	Medicine	Baldazzi, Castiglione and Bernaschi, 2006
	Epidemiology	Marshall and Galea, 2015
Natural sciences	Biology	Walker *et al.*, 2004; An *et al.*, 2009
	Ecology	Recknagel, 2003; Grimm *et al.*, 2010
Social sciences	Sociology	Macy and Willer, 2002
	Psychology	Epstein, 2002
	Politics	Cederman, 2001; Lustick, 2002
	Archaeology	Axtell, 2000; Gumerman *et al.*, 2003
Economics	Economy	Tesfatsion, 2002; Chan and Steiglitz, 2008
	Stock markets	Campbell and Cochrane, 1997; Chen and Yeh, 2001
	Business	Chen *et al.*, 2008
	Marketing	Delre *et al.*, 2007
Spatial-planning and landuse	Urban planning	Brown and Robinson, 2006; Gaube and Remesch, 2013
	Mobility planning	Dia, 2002
	Land-use	Brown *et al.*, 2004; Valbuena *et al.*, 2010
Education	Education and teaching	Railsback, Lytinen and Jackson, 2006
GIS	GIS	Heppenstall *et al.*, 2012
Transport and Logistic	Ground transportation and traffic situations	Dia, 2002
	Aviation and air-traffic control	Yue Xie, Shortle and Donohue, 2004; Weiss, 2008
	Logistic	Ito and Mousavi Jahan Abadi, 2002; Trappey *et al.*, 2003
Industry	Manufacturing	Monostori, Váncza and Kumara, 2006; Leitão, 2008
	Supply chains	Jiao, You and Kumar, 2006; Akanle and Zhang, 2008
Military and Security	Military	Cares, 2002)
	Combat	Woodaman, 2000; Cederman, 2003
	Air-defence	Tumer and Agogino, 2007

The main benefits of ABM are that it can explore emergent phenomena, it can be used to describe systems that are composed by behavioural entities and it is flexible (Bonabeau, 2002).

ABM is recommended to be used when human behaviour is involved. The best cases in which to use it are (Bonabeau, 2002): (i) when there are complex interactions between different agents – shopping in a mall, evacuating a room, etc.; (ii) when the agents can move and the space is limited – traffic, evacuating a building; (iii) when the interactions between agents are complex – village dwellers and wild animals, civils in conflict areas; (iv) when agents can learn and adapt.

The limitations of ABM (Bonabeau, 2002) refer to the fact that they are individual, a certain model

cannot be copied for other similar problems. The model can be reproduced and adapted, but not copied. Other limitation is the scale of the modelling – a regional analysis differs from a local one due to the details needed. The behaviour of the agents at a regional scale can be different from the one of a local scale and the set of rules that must be previously introduced can differ. ABM is more suitable to be used at a local scale. Also, it is very difficult to oversee all the possible actions of a human-related agent in a given context, so the rules that must be introduced in the beginning of the modelling can sometimes be inaccurate or incomplete. And this leads to another issue, which is the result. Depending of the complexity of the problem and/or of the agents, the results can be more qualitative, giving only an insight of the problem and in other cases, the results can be quantitative and can be used in decision-making and implementation.

The validation is another issue of these models (Orsi, 2018a) due to the fact that they are built to predict something that will happen, so it is very difficult to validate the model, e.g. the number of casualties resulted in case of a wildfire evacuation. They also present a high sensitivity to parameter variations and a lot of guessing is needed in setting the parameters (Orsi, 2018a).

Even though the limitations seem to be more numerous than the benefits, because the ABMs can deal with the behaviour of the agents, gives them a high advantage comparing to other models. And sometimes, only ABMs can be used in a certain problem, especially when human behaviour is implied.

CONCLUSIONS

Despite the fact that the agent-based modelling has evolved from mathematics, their use in social sciences is now preferred to the mathematical theories. The latest used to be the 'standard' in modelling a social behaviour. ABMs rely on computer simulations, that present several benefits regarding to mathematical theories. These benefits are (Castle and Crooks, 2006): (i) programming languages are less abstract that mathematical

equations; (ii) the computers can deal with several simultaneous processes; (iii) when using a computer simulation it can be introduced in the model various types of agents and (iv) computer software can be organised in modules, so when a modification is needed, it can be done without perturbing the whole programme.

Even though the agent-based models are used as tools in order to investigate a certain problem, we can say that they are a 'problem' per se. The process of developing a model requires many knowledges, not only in the specific field of its application, but also in using an ABM toolkit, for choosing a proper toolkit for the purpose of the model, for using a programming language, for inner verification of the model, for calibrating and validating it etc. After making sure the model is suitable for use, it can be run, and the results can be relied on.

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Subsidence determined by InSAR – a review

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Abstract. Multi-temporal interferometry or InSAR allows monitoring of a deformation phenomenon at millimetre level, via the generation of mean deformation velocity maps and displacement time series from a data set of acquired SAR satellite images.
The advantages of satellite radar interferometry for displacement monitoring are demonstrated in cases of monitoring man-made structures (e.g. buildings, bridges, dams, subway lines, mines exploitation). This paper presents works in which subsidence phenomena were analyzed by InSAR technique.

Keywords: *multi-temporal InSAR; land subsidence, underground structures, deformation*

1. INTRODUCTION

Deformation of the ground in urban settings can occur through naturally induced factors, such as landslides or subsidence-uplift phenomena, and anthropogenic causes, as for the case of tunnelling excavations for urban subway lines or bridge and highways constructions. Ultimately, all these can result in serious damage to buildings. In the last years, InSAR (Interferometric synthetic aperture radar) technique has been developed for monitoring the ground movements; this technique represents an efficient instrument for remote sensing and measurements of surface displacements from urban settings with one centimetre to one millimetre accuracy (Bonano et al., 2014). The most known multi-temporal interferometry techniques are PS (Permanent Scatterer) and SBAS (Small BAseline Subset).

The use of PS technique in risk management analyzes depends very much on: (1) the number of data available and their temporal distribution; (2) PS density in points; (3) the motion of the targets with respect to the satellite LOS (Line of Sight); and (4) the presence of snow coverage (Ferretti et al., 2000).

For subsidence analysis, both temporal and spatial resolutions of the SAR satellite data are well suited for monitoring terrain settlement in urban areas. PS density in urban areas is usually greater than 100 PS/sq.m and thousands of square kilometres can be monitored monthly (Ferretti et al., 2000).

InSAR advanced techniques are a valuable tool in the landslide assessment because they allow remote investigation of the ground movement behaviour over long periods of time, benefiting of large sets of SAR images taken at different times that cover the same area in space. Among these techniques, the SBAS approach for surface deformation analysis can be applied to two spatial scales, i.e. regional and local scales.

2. InSAR IDENTIFIED SUBSIDENCE AT INTERNATIONAL LEVEL IN THE SPECIALIZED LITERATURE

The results obtained in the framework of the ESA Terrafirma project (www.terrafirma.eu.com) have confirmed the theoretical analysis on risk assessment. The subsidence in Rome, Italy was monitored within this project. Suburbs and even individual buildings affected by subsidence can be detected (Ferretti et al., 2000), as well as possible seasonal movements induced by the water table variations (Colesanti et al., 2003).

Many examples of PS InSAR techniques applied to subsidence studies are available at TRE web site (www.treuropa.com). Companies from the oil and gas sectors are currently the major users of PS data. Precise surface deformation fields can be very valuable for reservoir exploitation (Vasco et al., 2008) and for identification of areas in the neighbourhood of the oil or gas wells, which can suffer damages.

Subsidence induced by mining activities can be also detected by means of PS InSAR (Colesanti et al., 2005).

In the city of Paris, 2 subsidence areas can be seen by interferometric techniques. Underground works were performed in both areas during 1995-1997 (Fruneau and Sarti, 2000).

The work of Bonano et al., (2014) presents an application of SBAS-InSAR technique to the urban area of Rome (Italy), aimed at investigating the displacements that, during the last two decades, have affected buildings within the downtown area. The analysis of the SBAS results is valuable to understand the spatial pattern and the magnitude of the settlements in comparison with a geological map.

In the work developed within the framework of the DORIS FP7-EU project, there are investigated the mass movements occurred in the Umbria region (central Italy) during the last 20 years, by exploiting ERS-1/2 and ENVISAT SAR images spanning the 1992-2010 time interval. This SBAS analysis allowed the detection of active landslides over all the study area, and further giving more insights on the spatial and temporal pattern of localized phenomena (Bonano et al., 2013)

Another applied example is the one from the city of Shanghai, located in the easternmost part of Yangtze Delta in China that is one of the most developed Chinese regions. The city experiences land subsidence. Excessive groundwater withdrawal is thought to be the primary cause of the land subsidence, but rapid urbanization and economic development, mass construction of skyscrapers, metro lines and highways are also contributing factors. The paper of Shaochun Dong et al. (2014) presents a spatial-temporal analysis of the land subsidence in Shanghai. The analysis was done on twenty L-band ALOS PALSAR images acquired during 2007-2010. They were performed with the help of the SBAS Interferometric technique. These images were used to produce a deformation rate map and to derive time series of ground deformation. The results show homogenous subsidence within the research area and exceptionally rapid subsidence around skyscrapers, along metro lines and highways. The authors consider that the subsidence monitoring is warranted because groundwater exploitation and rapid urbanization are responsible for much of the subsidence in the Shanghai region (Shaochun Dong et al., 2014).

Ground deformation affecting the Umbria region (central Italy) during 1992-2000 was investigated through InSAR Interferometry. For this purpose, the SBAS technique was adopted, which allows the studying of the temporal evolution of the detected deformation at two spatial scales: a low-resolution (regional) scale, and a full-resolution (local) scale. For this analysis, SAR data were acquired by the European Remote Sensing (ERS-1/2) satellites. The analysis of the spatial and the temporal characteristics of the ground displacement allowed the formulation of a hypothesis on the landslide geometry and deformation pattern (Fausto Guzzetti et al., 2009).

PS approach was used to investigate the iron mining site of Lorena (France). In this article, a special attention was given to the Roncourt case, where precursor signs of collapse affecting an area of ~300 × 300 m^2 were identified (Colesanti et al., 2005).

The purpose of Biescas et al., (2007) paper is to describe two complementary approaches through InSAR technique. The first approach can measure slow land deformation (from a few millimeters up to some centimeters per year), and the second approach can measure fast land deformations (up to few meters per year). Emphasis is given to the description of the former approach, which requires multiple SAR images of the same phenomenon and an advanced analysis procedure. The effectiveness of both approaches is illustrated through two applications on mining areas of small spatial extent located in Spain. The white pixels indicate that no deformation estimates are available in those areas.

In Herrera et al. (2007) paper, InSAR technique has been used to study the subsidence phenomena from the town of La Union (SE, Spain) for two time intervals, from January 1998 to December 2000, and from March 2003 to December 2004. The town of La Union (SE, Spain) is located within a metal mining area that has been exploited since Roman period. This historic exploitation has left behind a high concentration of abandoned underground mining galleries. InSAR technique has enabled the detection and monitoring of different deformation processes that affect several locations within the study area. By comparing these results with the underground mining galleries map, a clear relationship between their presence and the subsidence has been proved. Deformation values retrieved with InSAR between April 2003 and December 2004 have been compared with the topographical leveling measurements performed in the same period, providing an absolute average difference of 0.7 cm with a standard deviation of 0.5 cm.

In Wegmuller et al., (2010) paper, it is shown how PS module permits the monitoring relatively fast (including rates up to > 50 cm / year) and non-uniform movements using deep-level mining. For this monitoring, TerraSAR X satellite observations have been used. In this paper, the used methodology, the obtained results and the validation of the results are described.

Raucoules et al. (2009) article presents the results within PSIC4 project. The project was based on the validation of the PS data with respect to leveling data on a subsiding mining area near Gardanne, in the South of France. The subsidence velocity intercomparison results obtained from PS data showed a standard deviation between 0.6 and 1.9 mm/year between the 8 teams. The velocity validation against rates measured on the ground showed a standard deviation between 5 and 7 mm/year. A comparison of the PS time series and leveling time series shows that if the displacement is larger than about 2 cm between two consecutive SAR-images, PS-InSAR starts to deviate seriously from the leveling time series. This point illustrates the importance of having ground information and a strong interaction with the end-user of the data, in order to understand properly the type and speed of the deformation that will be measured, and thus determine the applicability of the technique.

Herrera et al. (2008) analyze the subsidence in Murcia, Spain, by means of PS time series. Two PS methods (PS and SBAS) are compared in their study, and measurements are validated with the extensometers.

Ferretti (2007) paper analyzes the subsidence in the mining exploitation area from the East of France with InSAR data.

The Satellite Radar Interferometry reveals subsidence occurring in an area of about 2 km by 2 km inside the city of Naples, in the South of Italy. The observations show a maximum (vertical) displacement of about 5-6 cm between 1992 and 1996, while the deformation signal decreases between 1996 and 1998. The study demonstrates the high correlation between the observed deformation and the construction of a new underground railway line carried out between 1992 and 1995. The analysis from this study suggests a direct connection between the subsidence detected and the underground works evolution. This article demonstrates the measurement capacity by interferometric radar techniques of subsidence in urban and densely populated areas (Berardino et al., 2002).

Wegmüller et al. (2008), Wegmüller et al. (2010) and Colesanti et al. (2007) have described the subsidence determined by the existence of mining areas in their works.

The landslide activity in the area of Bolshoy Sochi (Big Sochi), situated at the Black Sea coast of the Great Caucasus has been studied using PS-InSAR method. Comparative investigation of surface displacements obtained from three has been performed from January 2007 to September 2012. Analysis of the time series allowed to determine periods of activity and relative stability of landslides (Kiseleva et al., 2014).

The InSAR time series analysis coming from the ERS1 (1992-2000) and RADARSAT-1 (2003-2007) satellites highlighted a significant ground displacement in Naro region (Italy), due to the instability caused by the phenomenon occurred in February 2005. Through the InSAR analysis, it was

established that the displacement rates were up to 6 mm/yr^{-1} in 2003-2007, followed by a post-event stabilization. Through the integration of InSAR data and conventional field surveys (geological, geomorphologic), the causes of instability were attributed to tectonics (Cigna et al., 2011).

Three complementary GPS, LIDAR and InSAR methods have been used to study the surface deformation from Houston Metropolitan area. This study found a strong correlation between fluid withdrawals and subsidence because of a 4 m/year water level decline in the area of highest subsidence (Shuhab et al., 2014).

Yu and Wang (2015) paper studied the subsidence in the Gulf of Mexico region, formed in the Gulf of Mexico Coast and 20 US states of the Gulf appeared during 2005-2014 by using long term remarks from almost 450 GPS (CGPS) continuous stations. This region has been the heart of the US energy industry because of substantial oil and gas deposits along the coast. Furthermore, it is heavily populated and vulnerable to local ground deformation and relative sea-level rise.

Fuhrmann et al. (2012) present in their paper the measurement of 3D displacement by analyzing the GNSS measurements, leveling and InSAR data. In 2008, GNSS network was made from 80 permanent stations in Germany, France and Switzerland. The leveling measurements in the URG (Upper Rhine Graben) area were carried out by the ordinance survey of Germany, France and Switzerland, along leveling lines. These leveling lines were measured up to 5 times in the last 100 years. Therefore, at discrete benchmarks, a detailed assessment of surface displacements could be carried out. As leveling and GNSS are point-wise measurement techniques, the spatial resolution of estimated surface displacements is poor. Therefore, InSAR data is used to fill the gap in the future. A short outlook will point out the possibilities and limitations on the combination of GNSS, leveling and InSAR data for an accurate solution aiming for horizontal and vertical surface displacements in the URG.

Because the preparation of reliable landslide hazard and risk maps is crucial for hazard mitigation and risk management, Ping Lu et al.,

(2013) have introduced in their study a novel approach for updating landslide hazard and risk maps based on PS InSAR. The study was performed in the Arno River basin (central Italy), where most mass movements are slow-moving landslides, which are properly within the detection precision of PS point targets. In this study, the previous hazard and risk maps were updated using PS point targets processed for 4 years (2003-2006) of RADARSAT images.

InSAR time series are important to support civil protection activities in the framework of geological risk management and mitigation. The study areas are as follows: Agrigento and Naro (Italy). These areas are affected by ground instability respectively due to land sliding and tectonic forces. The study of past ground deformations provided valuable insights into the spatial and temporal patterns and behaviors of these phenomena, helping local civil protection authorities to focus the resources on the areas of maximum needs and to identify the most appropriate mitigation measures to reduce the impacts on elements at risk (Cigna et al., 2010).

In addition, InSAR data can provide effective information related to seismic risk management. InSAR data have demonstrated to be very valuable in the assessment and prevention phase, concerning scientific activities as hazard assessment, mitigation and preparedness. The main fields in which the InSAR-derived ground deformation is important are as follows: the parameterization of the seismic sources, the definition of the deformation rates related to the seismic cycle, the partitioning of strain among different faults, the improvement of tectonic models etc. In the warning and crisis phase, concerning all activities needed to promptly and effectively respond to the effect of an earthquake, InSAR data have also a good potential in activities such as earthquake source identification, urban damage assessment, and assessment of environmental effects of earthquakes. Salvi et al. (2012) have demonstrated the importance of InSAR data in the seismic risk management by using the Sentinel 1 satellite data.

The subsidence movements over the Shangyu District, on the south coast of the Hangzhou Bay, Zhejiang Province, China, have been monitored

using PS InSAR data. Twenty-four scenes of COSMO-SkyMed images acquired between 2013 and 2015 have been used. The spatial pattern of the land subsidence obtained by the PS-InSAR and DS InSAR (Distributed Scatterers Interferometric SAR or interferometric distributed SAR) coincides with each other, but the density of the DSs is five times higher compared to the permanent scatterers (PSs). These data have been validated by precise leveling data, performed in the same period. The land subsidence in the Shangyu District is mainly distributed in the urban areas and industrial towns, with a maximum subsidence rate of 30.2 mm/year. The analysis of geological data, field investigation and historical reclamation data indicates that human activities are major causes of the detected land subsidence (Peng Han et al., 2017).

Poenaru et al. (2015) paper assesses lands by means of Synthetic Aperture Radar techniques. The subsidence from Ocnele Mari salt extraction area have been determined with RADARSAT2 dual polarized data acquired in the SOAR-16605 scientific proposal framework covering the July to December 2014 period.

Numerous studies on the subsidence monitoring and seismic activities have been performed in the salt extraction area (Zamfirescu et al., 2010; Trifu and Shumila, 2010; Poenaru et al., 2011).

As a result of the implementation of the strategic plan regarding safe exploitation and rehabilitation of the salt mining area adopted in 2007, degradation phenomena decreased in intensity, so that the study area became relatively stable in time (-2, -4 mm/year subsidence) (Poenaru et al., 2013).

The results of this study confirm that subsidence levelling measurement trends can be influenced by atmospheric conditions and soil moisture content (Poenaru et al., 2015).

Ground level subsidence analysis determined by InSAR data analysis have been also presented in the papers of Hsieh et al. (2011), Massonnet et al. (1993), Helleno et al. (2011), Hung et al. (2011), Vilhardo et al. (2009), Stramondo et al. (2007), Chatterjee et al. (2006), and Minxue et al. (2014).

Table 1. Classification of international-level subsidence displacements identified by InSAR applications, with references from the international literature

Main classes	Data source and references
Mining	Colesanti et al., 2005 Biescas et al., 2007 Herrera et al., 2007 Wegmuller et al., 2010 Raucoules et al., 2009 Ferretti, 2007 Wegmüller et al., 2008 Wegmüller et al., 2010 Colesanti et al., 2007 Poenaru et al. 2015 Zamfirescu et al., 2010 Trifu şi Shumila, 2010 Poenaru et al., 2011 Poenaru et al., 2013
Groundwater abstraction/recharge	Colesanti et al., 2003 Shaochun Dong et al., 2014 Shuhab et al., 2014
Petrol and gas abstraction	Yu şi Wang, 2015
Reservoir	Vasco et al., 2008
Flood risk	Bonano et al., 2013 Fausto Guzzetti et al., 2009 Cigna et al., 2010) Kiseleva et al., 2014 Ping Lu et al., (2013)
Urbanization	Ferretti et al., 2000 Bonano et al., 2014 Shaochun Dong et al., 2014 Berardino et al., 2002 Peng Han et al., 2017
Subway construction	Fruneau şi Sarti, 2000
	Herrera et al., 2008 Fuhrmann et al., 2012 Poenaru et al., 2015 Hsieh et al., 2011 Massonnet et al., 1993 Helleno et al., 2011 Hung et al., 2011 Vilhardo et al., 2009 Stramondo et al., 2007 Chatterjee et al., 2006 Minxue et al., 2014
Earthquake	Salvi et al., 2012 Zamfirescu et al., 2010 Trifu şi Shumila, 2010 Poenaru et al., 2011

3. InSAR IDENTIFIED SUBSIDENCE IN BUCHAREST CITY

There are also several studies about the subsidence in Bucharest. In Dănişor, Fornaro and Dătcu (2016) paper, three tomographic algorithms are compared and applied to a dataset of 32 SAR images to generate the elevation map of dominant altitude from Bucharest. The results of those three spectral estimation methods (Beam-Forming, Least-Squares optimization and Capon filtering) have been evaluated by representing the elevation maps of the dominant scatterers, the immediate conclusion being that the main difference between these techniques is connected to the noise filtering capacity.

Pătraşcu, Popescu and Dătcu (2016) paper presents a comparative assessment of Synthetic Aperture Radar interferometric techniques (InSAR) that allow the detection of deformation models along the line-of-sight of the radar. Given the susceptibility of these methods to several limitations that act as noise effects in the interferograms, known as decorrelation phenomena, multi-temporal InSAR techniques have been issued for the exploiting of phase information acquired over long time intervals.

This article aims to perform a complete analysis of the deformations, which affect the area of Bucharest, using both PS InSAR and SBAS techniques. A comparison of the results has been performed. The proposed methodology has been applied on a set of 32 TerraSAR-X images, acquired over the South-Eastern area of Romania. The image stack covers a period of 16 months, from July 2011 to December 2012. A descending orbit characterizes all acquisitions (Pătraşcu, Popescu and Dătcu, 2016).

The quality of multi-temporal InSAR techniques is very difficult to assess without the existence of an a priori knowledge about the deformation in the area. This result shows a significant narrowing for equally sized sample sets. The estimated displacement rates for both methods are highly correlated, proving the similarity of displacement trends and values. Following the data analysis, a small deformation trend in the W-E direction was detected. A preliminary analysis of the average

displacement rates [meters/year] for the TerraSAR-X image stack has allowed the identification of four regions of interest (Pătraşcu, Popescu and Dătcu, 2016).

Armaş et al. (2015) paper presents the use of three sets of single polarized synthetic aperture radar (SAR) satellite data and InSAR methodology to determine the spatial evolution and ground displacement trends of several industrial parks located in the metropolitan area of Bucharest. Consequently, 20 large industrial parks were selected for analysis and interpretation. InSAR analysis used SAR data acquired between 1992 and 2014 by ERS-1 /-2, ENVISAT and TerraSAR-X satellites. Ground movement patterns identified before and after 2000 were linked to groundwater table investigations based on 25 water wells located on or in the proximity of these areas. Estimated displacement rates over the last 24 years indicated that the surface of Bucharest is relatively stable. Although the estimated mean velocities are very small, the estimated patterns over the industrial areas were slightly distinct from their surroundings. Overall, the analysis shows that immediately following the communist era, an era characterized by intense exploitation of the groundwater resources, slow uplifting occurred over these industrial parks. This may be the result of closing the main industrial consumers, which decreased the water needs, followed by a come back to the zonal dynamic pattern. An exception was the continuous subsidence trend noted over the Berceni industrial area, one of the few industrial parks that not only continued to exist over time but also became more active in the last decade.

In Gheorghe and Armaş (2016) paper, two algorithms for InSAR data processing were compared. The obtained results emphasize the differences between the two algorithms. With an average velocity of -2 mm/year up to 2 mm/year for PS and -1.6 to 1.6 for SBAS analysis, these values do not indicate an extreme case of subsidence in Bucharest.

During 2002-2009, lifting movements (a slight increase) were observed, while in 1992-2000 the movement was mainly subsidence. This could be caused by variations in groundwater level, but no

testing measurements were available to verify this hypothesis (Vijdea et al., 2013).

Using InSAR PS data: 43 ERS-1/2 images acquired between 1992-1999, 34 Envisat ASAR scenarios between 2003 -2009 and 32 TRS-X Scripmap images between 2011 – 2012, a historical assessment of the city of Bucharest land was achieved and the subsidence areas were determined. Subsidence observed during 1992-1999 and 2003-2009 is explained by the accentuated compaction of the anthropogenic deposits on which the constructions were built. An analysis was also started on the area where a new metro line is currently located (Figure 1.10). Metro line monitoring activities began in March 2014: hydrological level (underground water table), geometric leveling, and inclinometric measurements (Poncos et al., 2014). A subsidence of over 10 mm/year was identified on a small surface (of almost 600 m) in the Eastern side of Bucharest (Figure 1.11.), where a supermarket is built (Poncos et al., 2013).

The objective of Necşoiu, Armaş and Gheorghe (2013) research was to detect and monitor ground deformations in Bucharest, using InSAR data from TerraSAR-X (TSX) satellite.

Specifically, the short-time window of analysis (2011-2012) revealed ongoing processes along the rivers and on slopes at the micro relief level. Because of this short-term analysis, it was obtained a snapshot of the ground deformation during 2011-2012, possibly caused by various geomorphic and hydrologic processes (Necşoiu, Armaş and Gheorghe, 2013).

Point subsidence motions were also identified at the world's largest civilian building (i.e., Palace of the Parliament). In the case of the building, local compaction appears, based on a similar process as noted by Tosi et al., (2010) in areas located in the Northern Adriatic coast. Some historic fills and brick clay quarries also seem affected by downward motions. Subsidence motions have been noticed at the base of the river beds (Necşoiu, Armaş and Gheorghe, 2013).

Armaş et al. (2017) paper aimed to identify trends in Bucharest's ground displacement dynamics by analyzing three sets of synthetic aperture radar (SAR) over a period of 20 years:

ERS-1 / -2, ENVISAT and TerraSAR-X (TSX). InSAR estimates were compared to diachronic analyses based on detailed historical maps (i.e., Borroczyn map,1852; Szatmary map, 1864; Bucharest City Plan, 1911, 1921, 1940; topographical map, 1980) and orthophotomaps (2006, 2008 and 2010), ground measurements and traditional geological and traditional geomorphological investigations. The results suggest consistent displacement patterns over the city.

The subsidence areas from M5 metro line from Drumul Taberei neighborhood, city of Bucharest (Figure 1), have been determined at the CRMD (Center for Risk Studies, Space Modeling and Dynamics of Terrestrial and Coastal Systems). For this study, InSAR data were processed by PS technique from 24 TRS-X images, descendent, 27 TRS-X images, descendent, respectively, processed by SBAS technique for 2011 – 2014 period.

***Figure 1**. Study area*

InSAR points obtained by PS, SBAS technique, respectively, inside a 200 m buffer were selected to determine subsidence motions. Almost 22000 points were obtained by PS technique in the 200 m buffer, which follows the M5 metro line on its both sides in the study area, and almost 16000 points, by SBAS technique. A statistical analysis was applied on these buffer points regarding the motion velocity during one year and the maximum subsidence areas were obtained. It should be noted that the subsidence areas coincide with the areas where works were performed during 2011-2014. Figure 2 shows the presence of 2 areas were subsidence motions occurs.

Figure 2. Deformation velocities in the M5 metro line area from Drumul Taberei

Therefore, the subsidence movement areas are:

Area 1 between Drumul Taberei (North), Târgu Neamț Street (East), Pașcani Alley (South) and Cetății Street (West).

Area 2 between Ana Davila Street (North), Gheorghe Marinescu Street (East), D. Bagdasar Street (South) and N. Păulescu Street (West).

Tabel 2. Classification of the city of Bucharest subsidence displacements identified by InSAR applications, with reference from the international literature

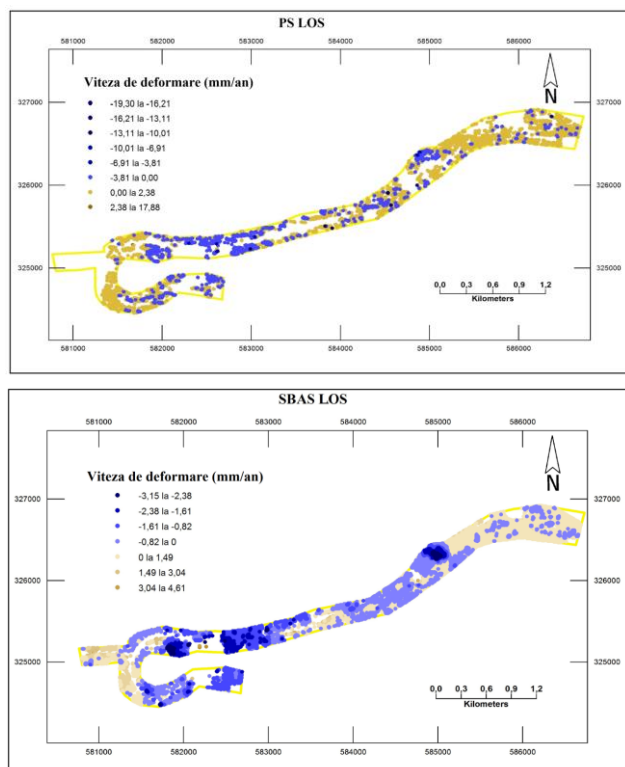| Main classes	Data source and references
Groundwater abstraction/recharge	Vijdea et al., 2013 Necșoiu, Armaș and Gheorghe, 2013
Urbanization	Dănişor, Fornaro and Dătcu, 2016 Pătraşcu, Popescu and Dătcu, 2016 Armaș et al., 2017
Industrial areas	Armaș et al., 2015
	Gheorghe and Armaș, 2016 Necșoiu, Armaș and Gheorghe, 2013
Subway construction	Poncos et al., 2013) Poncos et al., 2014

4.   CONCLUSIONS

This article attempted to synthesize and demonstrate the utility of InSAR technique in studying the subsidence analysis. An important advantage of InSAR techniques is that they can be used for monitoring individual structures, but also to provide information at regional level and at larger scales.

All studies show the ability of InSAR to detect ground displacements that have occurred over hundreds or thousands of square kilometres and even at a national scale can be extremely useful in characterizing and addressing areas prone to subsidence caused by natural or anthropogenic causes.

InSAR limitations are related to temporal and geometric decors and atmospheric inhomogeneity. Although SAR sensors provide the advantage of SAR image acquisitions globally and at predefined time intervals, most of them provide relatively low resolution images.

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Mapping Swabian migration in the 18th century to NW Romania (Sathmar county)

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Abstract. The paper presents field and literature investigations to the places of origin and end for the Swabian migration in the 18th century, from the space between Ulm and Lake Constance to the NW Romania (Sathmar county). Soon after the departure of the Swabians, the place was marked by some of the most notable Baroque religious architecture, built heritage today. In the new home, the count of Károly let churches be built, some of which were destroyed totally or partially in the 1834 Érmellék earthquake. Long term goal of this research is to map this gradual construction and reconstruction with the methods developed by the author in a larger project.

Keywords: *18th century, earthquake impact, mapping*

1. INTRODUCTION

The paper investigates the way a digital model of the impact of the 1755 earthquake on Lisbon developed previously (Bostenaru and Panagopoulos, 2013) can be adapted to the situation faced by Swabians migrating from South-West Germany to Transylvania. Such one may regard the impact of the 1834 earthquake on the Sathmar area, where some of these settled. We intend to adapt the digital model developed for an urban area (the interwar centre of Bucharest, Fig. 1, see methodology in Bostenaru and Armaș, 2015) to a geographic region.

Karlsruhe celebrated in 2015, 300 years since foundation. 3 years before, Danube Swabians celebrated also 300 years since immigration to Eastern parts of Europe. Both events are in the 18th century, which was marked by the Lisbon earthquake, which made a shift in understanding of catastrophes also including a philosophical and humanities point of view, in the age of Illuminism. Therefore, the period presented at the city manifestations on the 300th anniversary of Karlsruhe has built an excellent basis to investigate the historical conditions of Swabian migration. Field

trips accompanied the investigation, and a book of the author on the Lisbon earthquake (Boștenaru and Panagopoulos, 2014) was discussed with knowledgeable librarians. Several years ago, in 2005, the 250th anniversary of the Lisbon earthquake was an occasion for Europe wide events, not only in Portugal but also under the auspices of Academia Europea at the Geoforschungszentrum in Potsdam. On this occasion the engravings, which were later replaced by photography in the history of disasters, such as the ones contemporary with the one considered for this research, were presented. While the images of disasters in drawing have been the subject of many projects, the history in photography is ongoing and few initiatives are known, one being a doctorate at the State School of Design Karlsruhe, in association with the Centre for Art and Media (ZKM), by Jacob Birken. Investigation in the library of the State School of Design will continue this research. The ZKM museum in Karlsruhe is a unique museum in the world for digital art and digital art conservation. Karlsruhe has a strong tradition in investigating and implementing digital methods, and this is relevant for some of the methods used in this research.

Figure 1. Overview of scales at urban level on Bucharest, Magheru boulevard (within built protected zone 04 http://www.pmb.ro/servicii/urbanism/zone_protejate/docs/bratianu.pdf): the collapsed buildings in a GIS application (in pink) and one such collapsed corner building (Wilson building) in an archive drawing.

The research on the Swabian heritage was started in frame of a POSDRU structural funds funded project at the University of Bucharest with field trips in the Sathmar area, finalised with a conference communication (Bostenaru, 2014), and to Germany, Karlsruhe (see acknowledgements). The research is currently continued with a DOMUS scholarship of the Hungarian Academy of Sciences (https://sites.google.com/view/domusszulofoldioszt ondij/home), which funds some more field trips to both areas. 2018 is the European Year of Cultural Heritage and under these auspices the Europeana online archive is researching stories of migration, see at https://www.europeana.eu/portal/de/collections/ migration, where the author submitted family stories (https://www.europeana.eu/portal/de/record/208400 2/contributions_7f32d500_b664_0136_e11c_6eee0

af68b02.html?q=bostenaru#1543670064599) regarding the region investigated in this article.

2. STUDY AREA AND RESEARCH BACKGROUND

The area proposed to be investigated is that of the German settlement around the city of Carei, in Sathmar county, Romania. In this area, Swabians (Germans) settled starting 300 years ago (2012 was the anniversary). Literature on their stepwise settlement has been consulted. Carei was the headquarter of a mighty count. In the year 1834, a strong earthquake occurred, affecting the area. The count called Miklos Ybl, who was to become the most significant Hungarian architect, to reconstruct some of the landmarks, including churches (Fig. 2). This was the start of his career. The year 2014 was in Hungary the national Miklos Ybl year, but the works on today's territory of Romania, such as in and around Carei, are less known.

To accomplish this, a new method of mapping is necessary. Starting with Renaissance, the mapping methods of Nolli (the plan of Rome) are outstanding in the level of detail for representing strategic and common buildings. This can be well integrated into today's strategic planning, in which not all areas are treated equally, but depending on their strategic role. More recent mapping concepts in the physical space support this approach. Such are those from the 1960s: Kevin Lynch's approach (1960) and Guy Debord's derive (1955). They are relevant in reconstruction after disasters, in keeping the mental map of heritage habitat. This is a concept employed in the doctorate work of Bostenaru (2012), in the analysis of reconstruction after disasters of Modernist neighbourhoods. In this ongoing research, the mental map is given by the analysis of the settlement history of the villages around and the city of Carei (Fig. 3a), as well as by field investigation. In this way, landmarks (according to the method of Lynch, 1960) such as churches are recorded.

Approaching physical vulnerability in earthquake scenarios, the team around Lagomarsino (1998) proposed a methodology for monumental buildings, including churches. Studies on the impact

of the 1834 Érmellék earthquake, which affected Carei, include the effect on common buildings (Zsíros, 1983), but studies on the records in churches in the area are remaining at the history of architecture stage (Bara, 2013). Other records are the church records, for example on which the work of Merli (2007) is based. The innovation compared to the main site in the project is the geographical scale of the investigation: instead of treating an urban area, it will deal with the regional scale of a city and the neighbouring villages, with typical Swabian houses (Fig. 2a). The zoom level will be given by landmarks such as churches and castles.

The 1834 earthquake has been put in context of the 19th century photography of disasters investigated at the Canadian Centre for Architecture. For Romania, there aren't such depictions of the area. The 19th century and the early 20th photographers such as Carol Popp de Szathmary and Willy Pragher, the photographs of whom were useful in the analysis of Bucharest, or István Kováts, based in another region, have been considered from the photographers of the time.

During the stay in Karlsruhe, two aspects related to the development in Northwest Romania were studied:

1. The origin localities of the Swabians in South East Germany (Fig. 3). In the Upper Swabia (Oberschwaben) region an intense construction activity took place in the 18th century, generating what is called today the "Swabian baroque street". Places visited included some in the county of Ravensburg, namely Bad Schussenried with a remarkable library and Weingarten with a remarkable pilgership church. Through the existence of monumental church buildings from the time of the emigration, which define a cultural route which can be a mental map, a link is given to the churches in Sathmar. A research question is how far is pilgership connected to emigration.

2. The development of South West Germany in the 18th century. The host city of Karlsruhe was founded 1715, celebrating 2015 its 300th anniversary. Almost contemporarily, 1712, the Swabians started to emigrate to Western Romania. The count of Karlsruhe also gave rights to settle in the city (as documentation in exhibitions showed), and it is a question why immigration was chosen over the

close settlement. In the city of Karlsruhe remarkable architecture was done as well, and documentation was made with exhibition, book and lecture about classicist architecture of Friedrich Weinbrenner.

Figure 2a. The places of immigration of the Swabians: Typical vernacular Swabian building (bottom, report prepared for http://www.world-housing.net/) 2b Church in Capleni, reconstructed by Ybl Miklos (top). Photos: M. Bostenaru, 2014.

Figure 3. Baroque architecture in the places of origin of the Swabians: pilgrimage basilica in Weingarten. Photo: M. Bostenaru, 2015.
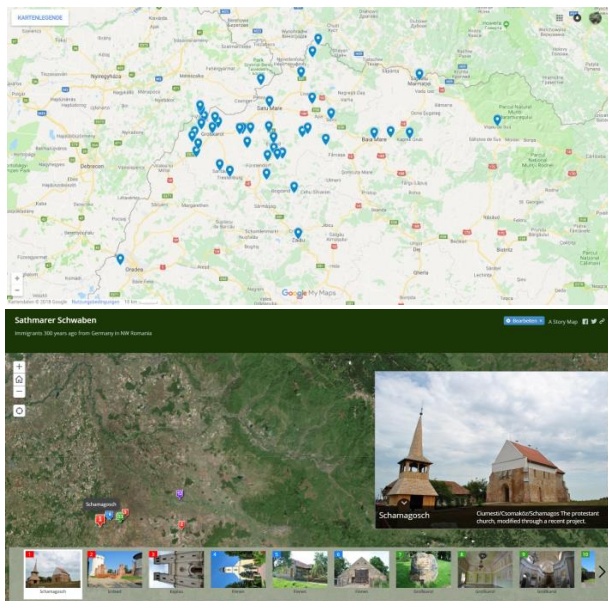

Figure 4a. *Swabian localities of immigration in Sathmar county (top). Full map*
https://www.google.com/maps/d/embed?mid=1VojsRwl
B1L94UsoziNgTxyQMVG-bzVuH. *Same map on ArcGIS fully available at* https://arcg.is/1S099q

Figure 4b. *Story map of the Sathmar Swabian landmarks in Sathmar county in the localities visited so far in frame of the field trips (bottom). Full map at*
https://arcg.is/18nXyD

Figure 5a. *Swabian places of emigration: The Upper Swabian Baroque street (top). Full map*
https://www.google.com/maps/d/embed?mid=1Opuf31R
pffbWxlOSkijOP2vkPZ0aoJwc

Figure 5b. *Story map of the Swabian localities visited so far (bottom). Full map* https://arcg.is/jmeiv

Figure 6. Swabian places of emigration: Places of emigration with Baroque heritage (orange) and all places (rosa).

The routes of migration and the differences in architectural development in the two settlements (Fig. 4-6) are a good subject for psychogeographic representation such as in the approach of Guy Debord.

The method applied for mapping started to be developed by Bostenaru and Panagopoulos (2013) and was continued as a cooperation between Bucharest and Karlsruhe in 2014 and 2015 (Bostenaru and Dill, 2014) for the main test area. This research is a continuation of the initial model by Bostenaru and Panagopolos (2013), which investigated the impact of the 1755 Lisbon earthquake.

Reconstruction in Lisbon was classicist, not baroque, such as the buildings in Karlsruhe. In the context of the city celebrations, the research on the reconstruction of Lisbon post 1755 earthquake and its way of mapping (Bostenaru and Panagopoulos, 2014) could be discussed well at the site of the stay abroad in frame of the POSDRU project.

The relationship between the 18th century Karlsruhe and the 18th century Lisbon does not stop here. Before the 1755 earthquake, Swabian architect Johann Friedrich Ludwig designed the monumental complex of Mafra (monastery, basilica and royal palace) near Lisbon, which is related to a certain extent to the Upper Swabian complex of Wiblingen near Ulm (monastery with library such as the one in Bad Schussenried). After the 1755 earthquake, the basilica in Mafra served as a model to the basilica of Estrela in Lisbon, one of the landmarks included in the Bostenaru and Panagopoulos (2013) study.

Upper Swabia is not only characterised by the presence of Baroque heritage built shortly before or during the time of emigration of the settlers which built the oldest cultural route of Germany, the Upper Swabian Baroque Street (Oberschwäbische Barockstraße). It is also characterised by the presence of notable rural heritage which permits us to compare another type of architecture in the places of origin as opposed to the places where the migrants settled. One item of rural heritage are the historical mills on the 10 years old Upper Swabian Mills Street (Mühlenstraße Oberschwaben) (Fig. 7). Such rural heritage is investigated and conserved in Romania by the ASTRA open air museum in Sibiu and got the golden medal at the Denkmal 2018 Leipzig for quality in conservation. The ASTRA open air museum, visited in frame of the research, features as "Street of ethnic minorities", funded by EEA grants, including a Swabian horse mill from Banat, but none of the heritage of Sathmar Swabians. In Germany, open air museums conserve rural heritage of Swabians in the past 3-5 centuries at three locations: Kürnbach (Bad Schussenried), Wolfegg and Illerbeuren (Fig. 8). By investigating this heritage (a study visit to Museum Kürnbach is planned, and literature was researched on the museums in Wolfegg and Illerbeuren) lessons can be learned on how the rural house changed with migration. In Sathmar, besides numerous houses conserved in situ (such as that in Fig. 2a), in Petrești a Swabian house has been transformed in a museum and a visit is planned.

Figure 7. Oberschwäbische Mühlenstraße (Swabian cultural route of mills, brown), superposed to baroque heritage (green) and to places of emigration (purple). Full map here https://drive.google.com/open?id=1drJnxBFNzh49sGf9T UjNyHblTrlQUpxF&usp=sharing

Figure 8a (top). Origin places of rural housing in open air museums on Swabian heritage: Museumsdorf Kürnbach (brown), Museum Wolfegg (blue), Schwäbisches Bauernhofmuseum Bayern (black). With yellow are marked the localities from where also emigrants started.
Figure 8b (bottom) Places with baroque and mills heritage, and from where emigrants started. Full map at https://drive.google.com/open?id=1nnAJ_RS51oxYni80_ Lt8SvsA7Z6SpW7J&usp=sharing

Looking to the maps it can be observed that while numerous locations of emigration display Baroque or mill heritage or both, numerous ones also do not display this. From here we draw the conclusion that the settlers came from localities with more or less wellbeing.

3. SPECIFIC OBJECTIVES

The research about landmarks contributed to the main objective of the POSDRU postdoctoral project, concluded at the University of Bucharest. The dynamic of migration is one of the approaches to be followed in the future, and the landmarks identified can be investigated with the mean of psychogeography like it was done in the main site considered in the POSDRU project (Magheru Boulevard in Bucharest).

From the specific objectives of the Swabian migration project the one which involves looking into the elements of selected monumental buildings

such as churches at a bigger scale, and classifying them into elements, in ontology, contributed to the decision system to be developed. This will be the subject of a future paper. In the case study investigated in this paper it is about the simulation of a historical decision of movement of populations which could chose between a city like Karlsruhe, built at that time, and the location in Sathmar, given that financial incentives were given for both. Another objective of the project aimed to define a methodology of economics efficiency of risk mitigation in the urban areas and the building structure. In the future, we need to calibrate our models considering real examples, from the archives or from today (the later through contacts with offices). At the same time, the implication of methods from game design allows us to translate the resources needed for the building into such resources which can be taken in consideration in agent-based design (ex. device planning). In a city building game each construction is built using stylised quantities of different types of resources (brick, wood, etc.), same as for board games which suppose building something. In the approach of Bostenaru (2004) a similar method was employed for economic studies. Based on the civil engineering method of calculation, device tables were defined, including certain types of materials and of works to be performed in order to build, repair or retrofit. These devices depend only on working time and material quantities, but not on the characteristics of the market regarding salaries and material prices at a certain location. This way they can be adapted to different countries, by adding the monetary value, also for those where there are not yet databases of seismic retrofit works, as in Romania. Such databases would have been necessary for other methods.

4. MATERIALS AND METHODS

For a project regarding cross border migration 300 years ago, the multicultural context is important to be understood. In this context, several methods were used to perform the investigation:

- Field trip to the Swabian Baroquestreet, and the reference of related books and brochures.

- Visiting the exhibitions showing the 18th century background of the city of Karlsruhe, such as the one on the court of count Karl Wilhelm of Baden, the Weinbrenner architecture and the city of Karlsruhe in photography, combined with the consultation of different catalogues (Kleinmanns 2014, SAAI, 2015). The architect Weinbrenner spent some time in Rome, shortly after the time Nolli and Piranesi had drawn their innovative maps, and it is interesting to follow the lessons learned from this approach during Baroque Rome in his Classicist urban planning.
- Attendance of a lecture on the founding phase of the city of Karlsruhe and connected discussion with a sociology professor.
- Discussion with librarians on the book of digitally modelling the impact of the 1755 Lisbon earthquake.
- Visit to exhibitions at ZKM and exhibitions organised by ZKM in the city related to the anniversary of Karlsruhe: "The global", with digital means. Discussion with experts involved.

A literature review on materials prepared for the 300th anniversary of Karlsruhe, and collected during the field stay there, in frame of the POSDRU project, was performed. Preliminary literature research took place in July and August 2014, with the results being systematized in September-October 2014, as well as in June 2015.

5. RESULTS AND OUTLOOK

Towards the mentioned specific objectives, simulation of settlement structures through games (the chronological development of productive processes through the years for more households) allowed for the complex network analysis of the actors involved in decision. We run such a game for the hazard of drought in agriculture, based on the Green Revolution game (Chapman, 1973). This simulation does not include the spatial dimension, but efforts at the Ohio State University (Ahlqvist, 2011) have included GIS to create a landscape of the game. With these efforts made, the simulation goes into rural dimension. The landmarks developed in Lynch's (1960) concept are applicable to this type of geographic space as well.

In frame of the DOMUS project, the author participated in a workshop organised in frame of the Urban Eye film festival on psychogeographic investigation of Bucharest called "Playing Bucharest" (http://urbaneye.ro/event/playing-bucharest/). In frame of the workshop led by Karsten Michael Drohsel, the author participated in the creation of a new game which supposes the movement of items related to buildings from one location to another. The starting idea was the plastering of buildings, but these items can be anything what can be then shared. The game can be adapted to the migration topic considered in this article, seeing which features of churches (the landmarks) or of peasant construction were taken by the settlers across time and space.

Current research investigates the typical peasant houses (such as the Museum house in Petresti, Sathmar county) or the peasant museums (such as the one in Bad Schussenried, in Bucharest, in Sighetu Marmatiei or in Sibiu – the Astra Museum). The way of living of the typical household is important in modelling the structure and the relevant elements for the economic simulation in the game. For the open-air museum in Kürnbach/Bad Schussenried see Schmid (1976).

Figure 9 shows the zoom between scales from the map of the emigration places in the region, to the rural zone and the typical Swabian house in Romania (which is to be investigated how much it relates to the one in Germany).

Our efforts in this direction focus on the area of Sathmar county, for which we have records of settlement of peasants (Vonház, 1987), but also of the earthquake striking in 1834. Following the earthquake, the most important Hungarian architect, Miklos Ybl was employed to restore churches (ex. in Căpleni village). The archive records on the damages to churches (from art history studies, for example, Bara 2013, to name just one) can serve to establish earthquake intensity with the mentioned macro-element method (Lagomarsino, 1998), in dialogue with the seismologic studies. For example, Zsíros (1983) established the intensity based on the level of failure of common buildings out of different materials (Fig. 2). Similar recording of the states after each game round could be applied for other board games based on the city building games

principles where disasters can strike (ex. SimCity for different disasters, including the 1906 San Francisco earthquake, World without End for the pest).

Figure 9. *The scale zooms from region to building on the example of a typical Swabian house (see fig. 1a) in Foieni, Romania.*

Through the research in Karlsruhe we learned more about the history, geography and architecture of the period, and can better compare both geographic locations as well as the migration between them. Perspectives for future research opportunities are opened.

From game theory a next step can be done to drama theory (employing conflict manager software) and to analytic hierarchy in decision instead of decision tree. By these means, qualitative issues are preferred, but we need to consider that datascapes are built on quantitative aspects. Datascapes are 3D models of GIS plotted into Google Earth, where the height dimension is replaced by plotting data connected to different characteristics of the building. In an attempt to

consider such different qualitative characteristics of the buildings (for example the function of the building) data from GIS are interpreted for datascapes based on their agent-based modelling role – for example, the landmarks and strategic elements serve a certain area of a residential zone. From the measurement spaces employed for criteria at building level (Bostenaru, 2006) we go thus to measurement spaces for the urban datascapes through regression, which means using induction and deduction, around a hypothesis. The construction of economic regression method supposed the following:

- Based on case studies, we began to draw knowledge about interest groups (the actors in the decision process).
- We built a hypothesis concerning the functional structure of decision making.
- We stated goals for each actor and on each level of intervention, from urban level over building level up to the building macro-element.
- Statements on the value of the criteria to be measured were derived.

In a first methodological step, at urban level we assigned weights to the attributes of a building in GIS representing the central Bucharest site (Magheru area, Fig. 1 top). These attributes can be connected through ontology or a complex network for translation into an exploitable foreground for a computer system. In the Magheru case, the difference was given by the state of the building before the earthquake, after the earthquake and after rebuilding, rebuilding which may happen before the next earthquake. This was represented in photographs, and the complex network referred to the characteristics of the images. In case of the sites in Sathmar and Upper Swabia, the complex network connections are given by the social networks of migration, namely from which city to which city did the settlers move. The origin localities and the new settlements in Romania were mapped in the figures according to Vonház (1987).

The envisaged result will be a map including the methods of Nolli, Lynch and Debord.

The land of Baden-Württemberg in Germany, where Karlsruhe is located, is rich in institutions researching the heritage of German minorities in Eastern Europe in general, and in Romania in particular. Such ones are the Haus of Donauschwaben (House of the Danube Swabians) in Sindelfingen (one of more of this type), Institut für Donauschwäbische Geschichte und Landeskunde (Institute for Danube Swabian history and geography), Donauschwäbisches Zentralmuseum Ulm (Central Museum for Danube Swabians in Ulm) and Institut für Volkskunde der Deutschen des östlichen Europa (Institute for research of the Germans in Eastern Europe), all dealing with Danube Swabians. They expressed interest in the results of this research. In the future it is possible to do research on the topic in their image archives and their rich libraries, also involving the Danube Swabians localities in the home country.

ACKNOWLEDGEMENTS

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Adaptation, tolerance and the "smart" technology era

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Abstract: The article refers to the addiction caused by a certain part of the modern technology, commonly called smart, a modern man's invention to collect data and for simplistic entertainment. It has direct effects on the environment and daily life, as a quick way to change what would be called normal behavior and cause diseases by the attenuation / inhibition of the instincts of self nourishment, self protection, creativity, ration and authentic values. In the end, it will lead to the natural selection in the most important artificial disaster created by man.

Keywords: addiction, smart technology, disaster.

1. PREAMBLE

For the time being, the origins of the modern man are considered to be either somewhere in the Near East, or in the European Carpathian area (if we follow the path of the human development marked by writing, the Carpathian Mountain Arch 6500 b.Ch., Mesopotamia 3300 b.Ch., North Africa 1500 b.Ch.), Homo sapiens sapiens winning the battle against Homo Neanderthalis which led to the appearance of the modern races – phenomenon of man's biologic adaptation to the environment.

From an anatomic point of view, some races are obviously different, but what made them completely different is the adaptation behavior which led to different aspects (the tendency of the human bodies to get compact in the cold areas to avoid the loss of heat, respectively the elongation of the members to the opposite effect, the ocular fold to protect the eye and the predominating fat tissue to maintain humidity). The only identical part is the intellectual potential, the races belonging to a single species being proved by the possibility of the cross-breeding. As a conclusion, today we are as smart or as stupid as the first Homo Sapiens Sapiens, the difference is made by our perception, adaptation and tolerance. Then, why don't we have a Homo Troglodytes and a Pan Sapiens? Nowadays someone expects an evolutionary leap based on the smart technology, virtual, fake environment, created by the precise persons who use this environment. Will this unreal environment lead to Homo Sapiens Smarticus or to Homo Troglodytes?

There might be some to protest against this statement, bringing to attention the so-called Flynn effect (https://www. descopera.ro/dnews/ 19.12.2013). The research that has been conducted in the domain with regard to this effect has reached the conclusion that the individuals "have got better and better at solving tests. (…) people are more exposed at all types of tests. Thus, they are able to detect certain rules and to exploit them" as one of the researchers, Michael Woodley, explained. The experiment conducted by Woodley and Elijah Armstrong consisted in assessing the individuals' speed of solving 14 IQ tests by applying rules already learned at school or in other environments. When the two researchers compared the information referring to the Flynn effect for each of the 14 tests, the conclusions were astonishing: the more a test solution depend on rules, the more the Flynn effect is observable. This conclusion suggests that the Flynn effect is not caused by an increase of intelligence, generally speaking, but by a better individual's ability to solve the tests more easily by detecting the rules to be applied. The two researchers finally stated: "The existence of the Flynn effect does not mean that people become more and more intelligent, but they develop a wide range of limited cognitive specializations."

Let us go back to behaviors, the modality of basic adaptation of the mammals. The mammal behavior, so man's behavior, is very varied, even infinitely varied. If, at present, there is only one Noble Prize awarded for the study of the mammal, bird and insect (bees only) behavior by the researchers K. Lorenz, N. Tinbergen and Karl von Frisch in 1973, the prestigious Swedish Academy has not succeeded in awarding such excellence in the study of the human behavior up to date. Nevertheless, a multiculturalist, Singer, declared with nonchalance in his compendium that "today we know we have found the logarithm of the human behavior" (Singer, 2006). Then, what does refrain the renowned academics award him the prize for his merits in deciphering the complete human behavior? Is it exactly that the respective behavior cannot be standardized completely?

If we agree with Singer, we could formulate the complete diagram of our behavior using the smart technology. Yet, there is an unknown factor in the equation and it is given by the environment. The evolution of the human being was based exactly on the adaptation to the environment, which had as an initial result the distinction from the other primates, and later on from the other forms of Homo. Comparing the whole history of our planet with its different heating and cooling periods to the human history, the latter has a lot less experience, but a spectacular adaptation. If the human being had appeared earlier, getting more experience, maybe there would have been a different form of Homo today to defeat genetically Homo Sapiens Sapiens. Nowadays the challenge is double. In addition to our environment in permanent change (natural – the planet getting older, and artificial – industry and exploitation), there has appeared a so-called virtual, fake, artificial environment called the internet, with specific mechanisms of socializing, data communication, etc. If we also take into account that this fake environment that requires human adapting was initially created for research purposes but has turned into a weapon[1] we will have the complete picture of the present "war" of human adaptation. The first interconnection of two

computers at a distance was made in 1966 at the initiative and with the support of the ARPA Agency of the US department. A TX-2 computer from the Massachusetts Institute of Technology was connected, through the intermediary of a dedicated communication channel to a Q-32 computer belonging to the company System Development from Santa Monica. One of the first networks with commutation of messages was AUTODIN I, developed in the mid 60s by the company Western Union for the US Department of Defense.

At this point we will structure the objective of this article. We have to mention that this issue has not been discussed before, or if it has, we do not know. We could add that accusations of empiricism might be formulated with address to the author of this article. Even so, it must be admitted that the problems of our modern society as they are raised in the article can be easily noticed nowadays by a keen observer. We will continue with the chapter structure of the text.

2. WHAT IS BEHAVIOR?

Behavior is generally defined as an observable activity of an organism, an interaction with its environment. More complexly, it represents the total of the observations, analyses and conclusions about the different types of thinking, culture and reactions of people within a well-defined society. The basic behavior is studied by the science called Ethology which deals with the study of the animal behavior (skills and habits).

Mammal behavior can be extremely varied, social or solitary, active or passive, peaceful or violent, etc.[2] If we follow the most often met behavior since birth, we find the one of nourishment (food), the new born offspring looking for the mammal's glands in the first place. The next one that can be standardized is the sexual behavior, which is instinctive and appears at the weaned offspring when they reach the sexual maturity to perpetuate the species. It is a very spectacular and creative behavior including wooing, fights, races,

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[1] See www. profs.info.uaic.ro (2018) where it is mentioned that the technology based on the computer and interconnection was asked for and used by the US Department of State Defense)

[2] According to the Biology Student Book for the 7th grade (1998), ed. Pedagogica.

demonstrations of strength and color to impress the pair. These would be the two instinctive mammal behaviors. The rest of them are random and are acquired by learning. This proves that learning is not the privilege of the modern man, but of all mammals, generally speaking. The first learning-based behavior acquired during life is the self defense behavior. This behavior is the exclusive privilege of the mammals, the offspring learn it from their parents, since they are not born with already acquired instincts like the fishes, snakes, birds or insects, and they need their parents help for protection. Why have the mammals lost this instinct compared with the fishes and birds? Man can be found at the most evolved extreme of the mammals and we can understand that his protection only depends on his level of education; the "smart" technology exposes man rather than protect him. The impact with the environment, natural calamities, disasters have forced man to get permanently adapted, leading inevitably to the development of Homo Sapiens Sapiens.

Considering that the self-defense behavior is learnt the questions that arise are: how many of today's schools educate their students to such behavior? And how many of the virtual space users have acquired education for data protection?

3. FACTORS INFLUENCING HUMAN BEHAVIOR

Human behaviors are closely connected with the individual's health (physical, psychical and social) and the factors that influence a population's (formed of at least 3 individuals) health (biological, demographic, sanitary, ecologic, from the physical and social environment[3]).

Biologic factors – manifest their influence on health by the varied reactions of the individual, by the adaptation to the environmental conditions in permanent change (so human behavior is also in permanent change and adaptation), and by the heredity (normal or pathologic). The predisposing

nature of a carrier or of their family is taken into account so as to prevent hereditary diseases. The sex and age are the individual's variables which show the state of health from the point of view of the birthrate, fertility, mortality and physical development. Today it is easy to notice that the young generation suffer from diminished birthrates and fertility, disharmonious physical development, obesity. All these are the result of modern education (or even lack of education) that places the individual in the middle of their own interests, barely leaving room for another human being – a possible child - to be cared for. The financial factor is to be considered too, in the families that feel they cannot afford to offer o proper future to a possible child. Moreover, the old generation is characterized by increased mortality because of the boom of cancer cases and of diseases with unknown etiology.

Demographic factors – have a strong influence on the dynamics of the state of health of the population, considering the number, density and the degree of dispersion, but also the structure of the population and its dynamics, including the geographic and social mobility.

Sanitary factors – reflect the degree of development and efficiency of the sanitary services (which are disastrous at present because of the deficient quality of the medical treatment – precarious university education, the massive corruption, etc.). They increase or decrease morbidity according to the successes of the modern medicine, but also from the perspective of the involution of a society (technology cannot be offered to a tribal population since it will cause more harm than good). Our mentioning of these factors might cause debate given the latest progress registered in the medical field. Nevertheless, we should be fair and admit that not all countries, even regions worldwide benefit from it (what is called the "third world countries"). Even sadder, not all the people in the developed countries enjoy the medical progress, because of financial reasons.

Ecologic factors – come from the social and the physical external environments, by the adjustment to the environment and the change of lifestyle and

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[3] According to WHO http://www.who.int/publications/en (2018).

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work, but also the nature of work (the virtual environment is included here which denotes antisocial behavior, with false adaptation at an unreal environment and direct action on the individual's health).

Factors from the physical environment – are cosmic, hydro-meteorological and geo-climatic. We evaluate the so-called physic agents (radiations, dust, and temperature), chemical (aliments, gases, toxic substances) and biologic (microorganisms, parasites, viruses). They are inter-dependent with the social-economic, cultural and sanitary factors.

Factors from the social/cultural environment – the behavior is given by the social environment of the individual (drug, tobacco, coffee, energizers consumption, unemployment, illegal work, politics at the work place, the use of the smart technology, etc.). These lead to the conceptualizing of deficient behaviors and psychical disturbance taking into account the individual's culture (Devereux, 1998).

Strategies of prevention: 1. give life to the years (*measures of control of morbidity and incapacity*), 2. give health to life (*promoting a healthy behavior and eliminating the antisocial virtual environment*), 3. giving years to life (*decreasing the number of premature deaths and increasing lifespan*).

What is taken into consideration into this article: the process of acquiring the attitudes of value (models of behavior generated by universes of value) – the duty towards ourselves, others, the social or politic, etc. organization, the work colleagues, the society we come from and to extend it, the duty towards the universal society. The mechanisms involved in the state of health and disease at a behavioral level, to the psycho-therapeutic orientation are: *the psycho-dynamic approach* (psycho-analysis: Freud, Jung, Adler, Fromm, etc.), *the cognitive-behavioral approach* (Ellis, Wolpe), *the humanist-configurational approach* (Rogers, Perls).

Value behaviors get developed by *the correct definition of a situation* (which is affected by the virtual environment nowadays), *the involved values*, respected principles and setting loyalty (the disappearance of the human empathy, massive selfishness, narcissism, the disappearance of kindness) and *the logical action* (a range of activities which aim to the accomplishment of goals which appear in the subject's conscience, but are recognized by the majority of population) (Pareto, http://www. yourarticle library.com/sociology/paretos-formulation-of-logical-and-non-logical-actions-of-human).

Smart technology can affect directly human evolved behavior – taking into account the research and the psychiatric compendiums which are based on the behavior deficiencies and/or unconformable: the *behavior of knowledge and research* (the technology infers and offers false, marketing-type needs to the individual, which leads to the reduction or destruction of rational research and the overestimation of curiosity), *the affective behavior* (the introduction of selfishness and narcissism as common values in society), *the civic-social behavior* (the virtual environment is a source of the antisocial behavior), *the aesthetic/artistic/creative behavior* (the introduction of the ragged, slack, erotic dress code, considering obesity as normality and beauty, instead of being considered a disease in evolution, Predescu, 1989), *socionics* (the definition of the relations between individuals based on the personality type and their predictability) and *telepathy* (feeling from the distance and general empathy/the disappearance of the human spirit).

We follow/identify the negative lifestyle and the risk factors for the physical, psychical and social health, the alteration of the above mentioned factors, we create strategies for their control and improvement (see the phenomenon of the forbidden smoking in public spaces nowadays, but accepted and promoted in the 1930s vs. the technologic antisocial behavior (smart) – perhaps in 20-30 years control laws will be implemented), since health is promoted by behaviors characteristic to the healthy lifestyle and the formation of human evolved behavior is a prediction of the state of health (e.g. factors such as the sedentary life and unhealthy food – the exacerbation of consumption/trade as lifestyle, entrepreneurship as a way of survival under the capitalist regime, determine the increase of the cardio-vascular risk factors[4].

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[4] See the INTERHEART study dealing with the nine traditional risk factors and the specific ones or the EUROASPIRE studies I, II, III – https://www.medscape.com/viewarticle (2018)

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Human behaviors are the so-called evolved ones which help the individual relate to the realities around (real or virtual nowadays) by self-projection, attitude and preferences, so guiding his social and individual actions. This axiological base of relating represents the total of the individual mobiles and super-individual norms which are interiorized by the individual who applies the set of values. In this case we could come to the conclusion that, in fact, the evolution towards Homo sapiens was due to the crystallization of this axiological space emerging from real social actions, at the same time being their ferment. The introduction of smart technology and virtual, fake space should either crystallize a different axiological space, or develop/ inhibit the present space which led to de evolution of the human being (real valorization).

The genesis of values relies on the historical stages of knowledge. Thus, there is a valorization based on origin, reflections of the objective properties (naïve realism) and objectivity/ transcendentalism (objective idealism) (Popa, 1972). At present, the valorization through the smart technology is definitely based on subjectivity and flagrant manipulation. The perception is deeply affected, and the adaptation is false. To distinguish between good and bad becomes almost impossible rushing to value reversal. This aspect is found the most clearly in the perception of risk in general, and cataclysms in particular, which becomes non-existent. The sensorial sensitivity and subsequently the logical one become uninvolved or involved in a wrong direction (see the reversed tolerance behavior). A part of the international mass-media, advocate of the "traditional values" has already started encouraging the self-defense behavior using attention drawing articles such as: "*This is an apple. Some may try to tell you that it is a banana. They may repeat "banana, banana, banana" over and over again. They may write the word "BANANA" in capitals. You may even start believing that it is a banana. But it is not. This is an apple. Facts first.*" This is the text written over the simple and bright image of a red apple against white background presented in the CNN campaign of fight against mass manipulation and fake news in 2018[5]. If the

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[5] Agerpres (2018) https://www.agerpres.ro/cultura/sci&tech

obvious things can be so grossly manipulated so that perception should be deeply affected, all we can do is come to the conclusion that the non-formal education, especially the electronic, unprotected one is at war with the formal, traditional education. But what is to be done when the formal, traditional education is affected by the reversal of values caused by the decision factors educated non-formally at the "smart" type of life school? They will generate indirectly reversed values or lead society by perverted educational policies. Even worse, what is to be done when there are individuals affected by the "apple – banana" syndrome in the structures of defense during disasters or in the firefighter brigades, police, civil defense?

This type of syndrome could be characteristic ANAF (National Agency of Fiscal Administration) – www.anaf.ro, which encourage tax payers using letters paid by the same tax payers to use exclusively the "Private Virtual Space" (is there any term of privacy in the electronic environment? See Wikileaks which reminds that everything is public) and send sensible data such as the CNP (numeric personal code) electronically. This ideology is grounded by the "smart" societies whose aim is to reach a technological globalization such as the "smart city", "smart shops", "smart map", "smart caravan", etc. In fact, they only want direct, big profits based on routine, comfort and tolerance of a non-reactive population and *unable to defend themselves*. Another public institution, SRI (Romanian Department of Information) – www.sri.ro, whose goal is to protect citizens and society, in general, draw the attention of the modern technology users in its Guide to the population that "The firs rule of Internet navigation is *to stay as **anonymous** as possible*". This means one must not make personal information public (complete name, address, telephone number, CNP, passwords, family members' names, credit card numbers). The majority of credible people and companies will not ask you to send them this kind of data on the Internet." This is how SRI defines ANAF by analogy as a non-credible institution! If ANAF is only an economic institution which can affect the budget of a person or institution by the reversal of values, what is to be done when institutions such as

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Ministry of Education, Health, Defense, Civil protection are perverted through the intermediary of "smart city", "smart country" etc. projects?

To reach this objective we should follow how the evolved type of human behaviors studied up to now would react, to be able to understand the modern individual's adaptation at the electronic environment. To play with imagination, theoretically speaking, there might not be such thing as breast feeding anymore, but "modern" methods involving substitution chemical-biologic substances. Accordingly, the offspring would not benefit from the antibodies transfer from mother, the alimentation already filtered by mother and would not instinctively look for the breast, but an electronic device would announce the time of the meal providing the replacing substance. The human reproduction might happen in the laboratory by modern methods, the sexual intercourse being getting to be considered degrading. The defense could be the privilege of a third party.

4. THE EVOLUTIONIST PERSPECTIVE (?)

This chapter will bring arguments in favor of the hypothesis that the notion of tolerance, as spiritual individual's defense mechanism, has known conceptual changes in both its Christian and philosophical meaning in modern society as an attitude of non-defense against individual and eventually collective moral unstructuring.

It was not good, beautiful, easier life that was the foundation of human evolution, but effort, problems and trouble caused by the continuous adaptation to a hostile and full of hardship environment. Cataclysms, natural disasters, severe life conditions made it that Homo Sapiens Sapiens to be the only mammal that can survive anywhere on the Earth, even more, in the cosmos (extremely hostile to life). Thus, self-defense proves to be the adult's main behavior in front of the unknown, imminent attack and disasters. And still, humans and mammals have lost this instinctive defense behavior which can be found in fishes and birds. The aim of this chapter is to provide arguments supporting the hypothesis that tolerance – a spiritual behavior which combines most evolved behaviors - has started to lose its

basic meaning and purpose. First, tolerance is a Christian attitude, it is a learned behavior, a condition of evolution when the individual or society are strongly protected. The tolerance of diversity as an expression of the love of creation represents the evolutionary leap from animal to spiritual human. But the correct behavior also includes intolerance against all factors that could destroy creation or could estrange the individual from it. To be able to make a distinction between the two attitudes the individual need discernment. Unfortunately, we could say that discernment is destroyed by the smart technology. Therefore, when faced with the alteration or disappearance of the defense behavior, tolerance is out of place, its involution reaching the basic behavior.

Tolerance is also defined as habit or the disposition of the organism to deal with certain environmental conditions (unfavorable, tough). Sociologically speaking, tolerance is a "non-combat" type behavior of adaptation when the individual has to face a negative, aggressive behavior (stress). Thus, as we have already stated above, tolerance should be an exception in the general human behavior. Education today, as it can be noticed by the values imposed by a certain well-defined society, teaches mostly tolerance and not the defense mechanisms as they were defined initially. When tolerance is imposed, and it is not an expression of the organic disposition, then the organism suffers and regresses. Values cannot be imposed on the individual, but they need to be taken upon the individual, and Homo Sapiens Sapiens who owns a defense mechanism (cultural, spiritual, educational, sanitary and, in the end, physical, rational) will get in conflict with the one coming to his rescue during disaster if this one has a wrong perception and reversed values. Some people's "tolerance" at floods, earthquakes, fire, social conflicts, etc., when others try to save them only represents the abandon of the defense behavior, if they ever had it. Changing the concept, as Wikipedia[6] does: "the respect for other's freedom" (including negative, aggressive, anti-traditional behavior), will only lead to the exception to become

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[6] We chose to mention Wikipedia because it is editable by all, so that it could be considered a carrier of modern points of view and perspectives.

rule. Moreover, in our language the term "lenient" is used as "forgiving" with the meaning of tolerant, but one can only forgive a mistake, not a wrong behavior. If we consider the terms "being wrong" (intentionally or not) and respect (for the other's freedom) equal, we could realize the greatest destruction of the evolutionary behavior. The evolution did not happen through mistakes, but through the crystallization of the axiological space that emerges from real social actions during difficult moments for the human being. If the individual had not valorized the loyalty to the collectivity, tradition and what is good for himself and then for the others, he would not have been constantly able to come back to his former state of "normality". Or, for the human being normality means morality. Unfortunately, morality has many needs, and failing to provide for them leads to immorality. In time, normality means culture, as the totality of thinking, attitude and action patterns. Culture consists of ideal components (beliefs, norms, values, models of action) and material components (tools, houses, clothes). It teaches how an individual should behave to the family and society members, for instance to the unknown persons. In a society where symbols, rites, language, traditions are predominant, people will be open, kinder to strangers, but also more "corruptible" and "tolerant" (Ianosi, 1977). In a society where norms, laws, and customs are predominant, people will be false, irrational, lazy, lacking culture, immoral, amoral at the best. Real culture allows people to adapt to the environment and survive in difficult situations, since, biologically speaking, the human being is weak. If we have weak or false culture, the individual's defense behavior will be diminished or lost.

If in politics, Nazism, communism, and the more recent neo-liberalism aim to the "new man", without religion and culture, international, in the technical domain, the smart policy has the same goal. The members of the Romanian Academy have recently reacted to the proposals of "smart", parental education: " The project of the Ministry of National Education of issuing a law for a system of parental education without any Romanian specific, with explicitly stated implications against the traditional family as nucleus of the social, cultural,

moral, Christian, millenary Romanians' life, supposes a unitary education of the children with no differences according to the sex, anthropologic and psychological, community environment (rural, urban, etc.), ethnic peculiarities. This project is an attempt resembling those from the states with totalitarian, internationalist or global regimes to obtain what has always been called "the new man", without family, nationality, country, identity."[7] The Romanian Academy considers that "in the year of the Romanians' Centenary of the Great Union, when the evaluation of the Romanians' exceptional successes is done, educated in the spirit of our traditions, giving up on these traditions would mean an act of national betrayal". This is how The Ministry of Education defines parental education: "Social inclusion by providing integrated social services (smart – n.a.) at the community level". This language is specific to the totalitarian societies as the Romanian Academy stated.

We consider the smart type educational process as an alternative at the teacher's choice, if they consider that the students are open to it (some students in the real-study classes). The "humanists" will ask for the traditional education which implies human interaction, valorized by feelings and self consciousness. The "Lottery" (XOY) behavior involving only three behavior patterns, a left one, a right one and a middle one only represents the present global economy mechanism where the infinity of the other adaptation behaviors developed by the individual are ignored (just like the researchers who were awarded the Nobel Prize and who standardized only three behavior patterns for the birds, animals and insects – bees). The XOY behavior can be found in politics, too where the human beings could not overpass the level of left, right and some middle political parties. Why does it happen? (Constantin, 2013). As a conclusion, the Romanian Academy is right when stating that "*giving up on these traditions means an action of national betrayal*", an action of humanity betrayal, we would say. People should not be tolerant to the electronic environment, but **they should have the ability of defending themselves against it, and mainly of selecting it**. *The electronic environment*

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[7] www. acad.ro/mediaAR/pag _media_pctVedere.htm (2018)

should only be an alternative to our daily lives, not an obligation. Why do the important hotel chains forbid the use of modern technology during the moment of tourists' relaxation? Why have programmers, such as Sean Parker, the Facebook founder or Steve Jobs, the Apple founder forbidden their family members use their own electronic programs? *We must not do what technology says, but technology must be able to adapt to our needs, requirements, to our use and easier life.* "Quod erat demonstrandum", programmers cannot foresee the majority of the human behaviors, so that the technology developed by them should adjust anywhere on Earth, but they only develop limited programs that force the users to learn what the programmers want them to. Since the present market economy relies on "educating" the consumer (the Pavlov effect), then the commercial boom of the "smart" technology is understandable.

When faced to the natural disasters, and even worse, to human-induced ones, the modern individual, who is extremely tolerant, is self-condemned to exitus. In order to be able to fight for the other's rights, one must be able to fight for their own rights. In order to be able to protect the other, one must be able to protect themselves (Ianosi, 1998). The reversal of values used by the smart technology at large scale today has had as results spectacular involutions in the evolved human behavior. The individual's freedom of living, expressing themselves as they wish, even negatively and offensive about the values built by Homo Sapiens Sapiens based on the evolutionary historic axiological relations, annihilating the beauty, civic-social, and affective human behavior represents, in fact, the loss of the self-defense behavior. What is more, the value reversal through the commercial, smart-type behavior, "Rom-English" (language mixture), presenting notions with different meanings, duplicity, in general, on behalf of general and individual liberties, together with questioning some international norms such as the Man's Rights, certain Conventions regarding the environment or the elimination of mass destruction weapons to the direct and short term benefit of certain closed societies miming democracy (open society) will lead, at least, at important breaks in the human behavior.

Humanity has developed specific behaviors trying to become better. Technology, starting with the sickle (on our territory – Romania - a sickle dated from approximately 6300 years ago has just been discovered[8]), up to the today's sowing machines – has contributed massively to the development of the knowledge and research behavior for an easier life, the food behavior being the essential one. On the other hand, technology has contributed to the rational development of the defense behavior with direct effects on the art of beauty and civic-social behaviors. But what could be done when technology is not used to the society's advantage as it has been meant to, but to the advantage of closed societies, the defense behavior being replaced with the warlike and tolerance behaviors? Can the individual fight against the environment? How much can the individual tolerate the real or virtual environments? Professor Jean-Francois Toussaint declared from the University Descartes, Paris, France[9] : "The decline of the human abilities that can be seen today is a sign that the environmental changes, including the climate, are contributing to the increasing of the number of constraints that we have to take into account at present. Observing the decline tendencies can offer an early hint that something has changed, and not for the good. The people's height decreased during the last decade in some African states; this fact suggests that some societies are no longer capable of offering enough nutrients for each of their babies and maintain their younger inhabitants' health". Will Homo Sapiens Asistatus (modern man assisted by technology) lose the acquired skills, and become a Homo Sapiens Troglodytus? The famous professor went on: "While trying to overcome the environmental restraints, people might need more and more energy and investments to restore the balance between the pressures set on the ecosystems. But, if this is accomplished, we will assist at an increment of the average values of height, life expectancy and the majority of human bio-markers."[10] So, technology can be blessing and curse at the same time. Nowadays, most people are

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[8] See the "Museum of Dacian Civilisation", B-dul 1 Decembrie Nr. 39, DEVA, Hunedoara, www.mcdr.ro
[9] Agerpres, https://www.agerpres.ro/cultura/sci&tech (2017)
[10] www.medscape.com/voirarticle (2018)

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constantly connected to the "smart" technology by the electronic devices.

5. DISEASES CAUSED BY SMART TECHNOLOGY

In this chapter we will try to highlight the main behavioral alterations as result of the psychological changes induced by the overuse of smart technology as mentioned in chapter 4. The scientific research in the domain is only at its beginning, although C. G. Jung was able to draw attention on the start of behavioral changes in the 50s (Jung, 2015): "(…) we have fallen into an abyss of progress which pushes us violently towards future, pulling us even harder from our roots. (…) it is exactly the loss of this bond with our past, the lack of roots that cause such a discomfort in civilization, and such hurry, that we live more in the future and in a virtual promise of a golden era, than in the present up to which our evolutionary fundament hasn't even arrived. (…) the hope of more freedom is annihilated by an increased slavery toward the state, not to mention the awful dangers we are exposed to by the most brilliant progresses of science. The less we understand what our ancestors looked for, the less we understand ourselves and bring our total contribution to the amplification of the individual's lack of instincts and roots, so that, becoming a mere particle in the crowd, he only follows the spirit of gravity."

Nomophobia (no-mobile-phobia) is a disorder caused by technology, but also by its absence, represented by the fear of being left without a mobile phone. *Gadgets (electronic toys)* have become a continuation of their bodies for certain people, and their loss can cause *panic attacks, difficult breath, and trembling, sweating, acceleration of the heart beats, chest pains or nausea*. The fear of not having the mobile phone is caused by addiction. When a person is physically or mentally addicted to something, they cannot find a way of escape. People are social animals which need constant company, communication and contact with the others. Subsequently, this phobia is not totally unnatural, considering that the mobile is handy, quickly available and used by persons of all ages. The most vulnerable and attached to the

mobile phone are the children, teenagers and the elders who, preoccupied with it, get almost completely disconnected from the exterior world. They can be seen bending over the mobile while walking in the street, during breaks at school, sometimes even during classes or courses, at home, at the table, and when going out with friends. But there are more dangers. Except for the nomophobia, using the mobile without limits causes *memory weakness*, and the *inability of developing memories*. Anatomists draw attention on the fact that the spine is bending more and more to the front as people use tablets and mobiles.

The long-lasting incorrect posture causes the disease called Telepressure[11] (Fig. 1).

But what are smart technology and/ or artificial intelligence, basically speaking?

If we consider the terms separately, smart technology represents the multifunctional technology which can accomplish more tasks in a single device. Artificial intelligence was introduced by John McCarthy in 1995 and it is supposed to "aim the study and design of intelligent agents, systems that perceive the environment and maximize the chances of success through behavior". But the intelligent agents are calculation machines, in fact, modern man's tools. If we take into account the implications of the word "intelligence" – the ability of understanding the essential easily and correctly, solving new situations or problems on the basis of previously acquired experience (cultural, spiritual and real perception mechanisms), then the introduction of certain sophisticated computer programs as artificial "intelligence", in the absence of their developing of cultural, spiritual and real perception mechanisms specific to the human being, only represent an elimination/ attenuation factor of the defense behavior. The desire of creating a powerful artificial "intelligence", based on self-consciousness is predestined to failure; almost all intelligence simulations rely on rules and common algorithms, the progress has been done only in the field of the basic one (e.g. oral and verbal recognition, automatic translation from one language to another and chess). If we take into account that **artificial "intelligence" cannot go**

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[11] Public image – www.ncbi.nlm.nih.gov/pubmed (2018).

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beyond the animal intelligence (*another field of artificial "intelligence" studies animals, especially insects, which are easier to imitate by robots, but* *satisfactory computational pattern to simulate animal intelligence could not be created*).

Fig. 1. Telepressure. Kenneth Hansraj, Head of the Surgery clinic at the New York Spine Surgery and Rehabilitation Medicine, states: "At 15 degrees inclination to the screen, there are 12 kilograms of pressure on the spine, at 30 degrees 18 kilograms, at 45 degrees 22 kilograms and at 60 degrees no less than 27 kilograms"

Another argument in favor of our theory that advanced technology needs advanced self defense mechanisms is brought by general Nicolae Ciuca, Head of the Major State for Defense (SMA), whose declaration was presented by Agerpres: "Endowing the army with modern fight equipments must be done at the same time with the training of the staff who is to use them. (…) Educational plans and school curricula must be adapted as well as possible to the major technological changes and to cover all innovations in the military field.(…) We need all is called **perfect communion inside this technique – man binomial**, so that, in the end, we could say we have accomplished a capability". To sum up, we do not throw away the traditional education, but it has to include and adapt the major technological changes!

"The majority of smart category devices offer comfort, not security", declared Mircea Grigoras, deputy general manager of the National Center for Response to Cybernetic Security Incidents (CERT-RO), during the conference "Cyber threats & Cyber security Day" (CERT-RO, 2017). "Today we have the possibility to connect almost any type of household devices to the internet, including coffee machines, air-conditioners, surveillance cameras and systems, alarms, doors. There are doors using a 'Bluetooth' connection to open in front of the owner when he approaches and has the mobile in his pocket. These are highly demanded products. Their majority aim to the user's comfort. Having comfort is extraordinary, but, at the same time, one must be very aware that when posting information on the internet, one enlarges the attack area", the above-mentioned manager said. We wonder rhetorically: WHO is attacking WHO? If we mention attack, do we also mention defense behavior? Moreover, in the USA there are concerns for the protection of those who should learn from their parents about the defense behavior. Civic American societies state that "smart" watches, instead of protecting the children, could make them vulnerable to piracy or computer criminality. "Seemingly supportive for parents who want to protect their children, in reality these smart watches endanger the little ones", Josh Golin stated in an official announcement, from the association "Childhood without publicity"[12]. Programmers and content creators who contributed to the success of campaigns such as Google, Twitter or Facebook, and Justin Rosenstein (co-founder and head of production of software company Asana) deny their own creations and send their children to elite schools where they are forbidden to use mobiles, tablets, even laptops. At present, there are voices which started to be heard warning that not only does it cause addiction, but this mobile device technology also brings its contribution to the severe

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[12] Agerpres, author: Simona Tatu (2018) https://www.agerpres.ro/ cultura/sci&tech.

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limitation of people's abilities to stay focused on their activities and even to the IQ decrease[13]. The mere presence of "smart phones" affects the cognitive capacity, even if the device is turned off. "Everybody is distracted (by these devices) all the time", Rosenstein added[14].

A reversed behavior pattern was sanctioned by the Manager of the Cannes film festival , too, in 2018, using the logo: "We want to bring decency back". He called the selfies "grotesque and ridiculous" photos, threatening the film lovers present at the festival with the exclusion[15]. If today the environment turns against us because of our negative actions on it (massive industrialization and exploitation) and even we turn against ourselves using smart technology (the loss of the defense, art of beauty, human affection, etc. behaviors), then the modern individual's adaptation becomes critical, if not impossible. Sean Parker, founder president of "Facebook" reminds that the network was created to waste the users' attention and time as much as possible, and, in our country Mr. Gabriel Botnariu, member of the Health Department in the Romanian Parliament has declared recently that urgent measures need to be taken to invest in the children's and youth's mental health and welfare to eliminate the social maladjustment caused by the "social media" which is a social scourge. If not, then we will have the correct dimension of the disaster upon the individual today (the massive mental health affliction)[16]. An initial symptom is recognized by doctors under the name of "body dystrophy disorder", which means an obsession related to a perceived body flaw. If, for instance, make up was created to cover face flaws, nowadays the tendency is reversed by the irrational use of the "smart" technology. "Applications such as Snapchat, Instagram or Facetune highlight a new reality of today's beauty". An article published online by the American Medical Association mentions: "All these applications allow the instant alteration of the individual's aspect according to completely unrealistic standards"[17]. Thus, the society gets an unhealthy idea about what people should look like or how they should behave. The result is that people start forming an altered self-image while their need of getting a rhinoplasty or facial lifting cannot be objectively supported. Most of the times a psychologist is the one that can bring the situation to normal. The lack of professional support for such individuals leads to self destruction. Self distrust and continuous dissatisfaction are basic signs of behavior deficiencies.

Another phenomenon is to be noticed at the young intellectuals who adopt a specific outfit: earplugs, rucksack and ragged clothes. They generally work for multinational companies or, more tragically, in the academic education field, promoting "sharing" without judgment (proof of the lack/ decrease of the defense behavior). The lack of attention, selfishness and carelessness are chronic behaviors caused by the absence or loss of the abstinence behavior, the action of "sharing" representing the exact opposite.

"The world's and people's digitalization do not clean the social reality of its inequalities, or of its other issues. In this tendency it is easy to see the loss of intelligibility and the reign of binary ambiguity. The bigger the data volume, the greater the possibility of being algorithmically correlated. The human being will not dream and hope anymore. The "group shaped" individual does not have the possibility of own and private development. (…) Making a decision is not equal to obeying the result of a virtual calculation. The human subject disappears behind data about him. "The speed of information is more important than knowledge, logos – than words and ideas, corpse images – than the ones with people alive. What can be done?", CMR President, dr. Gheorghe Borcean stated in March, 2018[18].

We should take into account that modern smart technology can be used correctly and safely only after the age of 12 – 14, when the young are able to acquire moral and civic-social defense values. On the other hand, it is known that "the activity of the

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[13] Test Sprint Mind (2018).
[14] Agerpres, https://www.agerpres.ro/cultura/sci&tech (2017).
[15] Agerpres, cultura (2018).
[16] www.raportuldegarda.ro (2018).

[17] www.ama-assn.org (2018).
[18] www.cmr.ro (2018).

human brain starts slowing down and the cerebral decline installs after the age of 24"[19]. The effects of addiction and severe limiting of the staying focused on developed activities ability (the Sprint Mind test), the IQ decrease and the blood pressure value increase (stress) with direct results on the cardio-vascular system. In addition, a specific protein (beta-amiloide) accumulates in the brain causing vascular dementia, because of the chronic reduction of the blood circulation at brain level. These facts make us wonder what type of evolutionary leap could experience Homo Sapiens Sapiens between 14 and 24 years old.

This disaster was "disseminated culturally" by the French writer Phil Marso who published in 1999 his humoristic novel "Tueur de portable sans mobile apparent" (The killer of mobiles without visible reason), the first thriller whose main character is the mobile phone. On the 6th of February 2001, willing to expand the debate started in his novel, he came with the proposal of having at least one day when people should give up on using the mobiles, or at least reduce the number of conversations and SMSs. These are the International Days without Mobile (February 6th – 8th) established in 2004 to draw the users' attention on the impact of modern technology on environment and daily life.

6. CONCLUSIONS

Is smart technology a real support in the individual's life nowadays? Does it take the individual to the next level of the human physical and mental abilities? As we have stated in the article smart technology and artificial intelligence have both advantages and drawbacks. They are just like any creation: both good and bad. And yet, reaching certain physiological and anatomic limits as great researchers suspect nowadays can be blamed on "certain persons' desire" of taking advantage and controlling society. In fact, the rational, creative individual will find protection mechanisms when faced with the actual disaster

which is unperceivable by the majority. "Mens sana in corpore sano!" if the mind is not healthy, can we speak about a ready to fight, healthy body? Giving up on fight in favor of tolerance as general not exceptional behavior will make the difference between extinction and survival.

We must also consider the psychological spiritual approach that relies on the expansion of the human consciousness. Along with the technological evolution that aims at transforming the individual into a robot, having a deep impact on his brain, there must also happen a spiritual evolution that would strongly react to this overwhelming technological wave. The deeper aspect of the matter depends upon the inner freedom of the individual who has the choice of becoming either controller or controlled. This can only be achieved through education and self knowledge so that we can develop inner spiritual organs to help us face the dramatic and traumatic intrusion of smart technology in our lives.

Nevertheless, the young generation's lack of desire for the species continuation, the emancipation of the reversed behaviors, the spread of (new) diseases, and the lack of the self-nourishment and defense behaviors, creativity, ration and authentic values, in general, will lead to the natural selection in **the most important artificial disaster ever to be created by man**.

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[19] See the study conducted at the Simon Fraser University in Canada (2017), https://www.sfu.ca/internationalstudies/undergraduate/2017.html

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Erasmus+ in Cologne. Life in Cologne

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Abstract. "Life in Cologne" is the third and last article of the series "Erasmus+ in Cologne" and is intended mainly for students and researchers of the Faculty of Geography of the University of Bucharest, who want to take part in an Erasmus+ scholarship. It covers advice and relevant information concerning the city of Cologne, the student life there and the nearby destinations that can be visited.

Keywords: *Erasmus+, Cologne, International Student, Tourist Attraction, Student Life*

1. THE CITY

When you think about Cologne, you instantly have in mind the image of **Cologne Cathedral** (*Kölner Dom*), the symbol of the city (Figure 1), a masterpiece of medieval Gothic architecture and the second most visited tourist attraction in Germany, after the **Brandenburg Gate** (*Brandeburger Tor*). The cathedral was built between 1248 and 1473 and it is one of the highest domes in the world, with a height of 157.31 m (koeln.de, 2018). The church is in a continuous process of restoration, many of the old architectural structures being replaced. For a view over the city, the Hohenzollern Bridge and the Rhine, you can climb up its 533 steps.

Figure 1 *View over the Cathedral and the Old Town*

Probably the most beautiful part of the city is the **Old Town** (*Altstadt*), located on the left bank of the Rhine. The biggest part of the Old Town was destroyed during the Second World War, but was restored in the following years. Many of the buildings preserve the initial architecture and colors. This part of the city is very popular among tourists, as they can choose between museums, pubs or breweries.

If you are a citizen of Cologne and are registered with the city hall, you have the possibility to visit all museums for free once per month. That day is called *Cologne Day* and it is the first Thursday of the month, except on public holidays. All you have to do is to present your city registration documents at the entrance. You should start with the *Cologne City Museum*, where you can discover the history and the evolution of the city, including how the citizens lived here in the past, especially during the Second World War (Figure 2). During this time, almost the whole city was destroyed, excluding the Cologne Cathedral, which miraculously survived, despite of all aerial bombs dropped here during the war.

You can continue your visit at the **NS-Documentation Center** (*The NS-Dokumentazionszentrum),* a place which reveals another period that has left its mark on the city, when the National Socialist German Workers' Party

ruled in Germany. Here were the headquarters of the Secret State Police for the District of Cologne and a place where many persecutions and executions were made. Currently, the place is also used for the permanent exhibition *Cologne during the period of National Socialism.*

Figure 2 Cologne City Museum

If you love art, you should not miss **Wallraf-Richartz-Museum & Fondation Corboud**, a place where you can admire *the widest collection of impressionist and neo-impressionist art in Germany* and works of art signed by artists such as Manet, Monet, Renoir, Pissarro, van Gogh, Cézanne, Gauguin, Rubens, Rembrandt, Murillo, Boucher, and also works of the German Romantics and French Realism (Wallraf-Richartz-Museum & Fondation Corboud, 2018).

If you prefer the modern art instead, then **Ludwig Museum** is definitely an option to consider. Here can be found representations of *the most important modern trend from the beginning of the twentieth century to the present* and one of the largest Picasso collections in Europe (Museum Ludwig, 2018).

Cologne is also known among the chocolate lovers for **The Chocolate Museum**, located in the **Rheinau Harbour** and offering, besides delicious experiences and information about the history and the culture of chocolate, a beautiful panorama over the city with views over the Old Town and the Cathedral. Although, the best panorama over the city can be experienced from **Köln Triangle Panorama**, one of the highest buildings in the city and the best spot for watching the sunset and the

Cologne Cathedral. From here you can admire the city through a 360º panorama.

Not only places and museums are a reason for visiting the city of Cologne, but also the events organized here. Of course there are concerts, festivals or theatre plays, but the highlight of all events is *Kölner Lichter*, Germany's biggest fireworks spectacle (Figure 3). This event brings joy and wonder in Cologne since 2001 (Culture trip, 2018), being an event of tradition. Its date is set for six years ahead and it is a much awaited event. The fireworks illuminate Cologne's skyline in a show synchronized with music, especially traditional German songs which are sung by everyone present, creating a wonderful atmosphere. The admission is free and people admire this show standing on the banks of the Rhine. You can also buy a ticket for one of the fifty boats that float on the river that night, searching for the best place to admire the fireworks (Cologne Tourism, 2018).

Figure 3 Kölner Lichter 2017

Reggae or hip-hop fans will find **Summerjam festival** the perfect reason to come to Cologne. This festival is organized annually in the north of the city, at the *Fühlinger See* (Cologne Tourism, 2018). The gaming community has also an event organized yearly for them, **The Gamescom Festival**, with more than 300 000 visitors from 90 countries per year. Street food festivals like **Eat Play Love** and the ones that take place in May in Ehrenfeld are also popular, especially among students. Other festivals and celebrations that deserve attention are: **Passagen** (trends and ideas in design), **lit.Cologne** (literature festival), **Art Cologne** (contemporary art), **Short Film Festival Cologne**, **C/O Pop** (electronic and pop music festival), **Photokina**

(imaging and photography) or **Kölner Oktoberfest** (Culture trip, 2017).

A visit to Cologne must include also a **boat trip on the Rhine** and companies like *KölnDüsseldorfer*, *KölnTourist* and *Colonia* offer the possibility to take panorama boat trips from Cologne to Rodenkirchen, Porz or Mülheim (Cologne.de, 2018).

Cologne is home to many **vintage flea markets**, whereas North Rhine-Westphalia is a perfect place for the urban industry culture. The streets of Cologne host 12 vintage flea markets. Most of them comprise a mix of new and old things with reasonable prices. The *Antique Market at the Rheinenergie Stadium* is one of the oldest flea market in the state and only old products are sold here. If you are looking for household accessories, old books, vinyl records, accessories or even clothes, you should visit the *Stadtflohmarkt at the Uni-Center*, which takes place every Saturday all over the year.

All of us might have heard of **Eau de Cologne**, but few might know that it is originary from Cologne (*Kölnisch Wasser*) and was invented 1709 by Johann Maria Farina. This is the second symbol of the city of Cologne after the Cathedral and the most famous Eau de Cologne is **4711 Cologne** (Figure 4).

Figure 4 The house of 4711 Eau de Cologne

The Cologne Carnival (*Kölner Karneval*) takes place yearly and is the biggest event in Cologne. Traditionally, the carnival season is declared open at 11:11 on the eleventh of November. Officially it starts a few weeks before Easter, when parties take place on the streets and in pubs, where closing times are suspended during the festival. When talking about local music, the most known band from Cologne is **Kasalla** that sings about the city in an original way – **kölsch rock**. Not least, the local football team, **FC Köln**, is very appreciated by the fans, having a billy goat as a mascot. The team plays its home games on the RheinEnergieStadion.

2. STUDENT LIFE

Maybe the best known place among students is **Zülpicher Street** (*Zülpicher Straße*), a street that lies between *Zülpicher Place* and *Gleueler Street*, very close to the University of Cologne and to the **Student Canteen Zülpicher Street** (*Mensa Zülpicher Straße*). The segment between the *Zülpicher Platz* and the *Universitätsstraße* is the crowded one. Day and night students come here to socialize, to relax and to have a good time. There are a lot of restaurants, pubs and clubs in this area, so no matter how you would like to spend your time here, you will not get bored. *Theatercafe Filmdose* (Zülpicher Str. 39) offers a very delicious and authentic **tarte flambée**, while the best **shawarma** is found at *Habibi* (Zülpicher Str. 28), a very popular place. Very close to the Zülpicher Street, at **Hellers brewery** (*Hellers Brauhaus*) you can drink Hellers Kölsch (Figure 5) on draught (Roonstraße 33).

Kölsch is a beer type originally from Cologne and since 1997 it has a protected geographical indication within the European Union (Besch and Profeta, 2002). This beer recipe is very unusual, because it is warm fermented, but kept conditioned at low temperatures like a lager beer (Daniels, 1996). That is why for maximum flavor each glass of Kölsch has to be drunk straight off. The most known Kölsch breweries are *Heinrich Reissdorf*, *Gaffel Becker & Co* and *Cölner Hofbräu Früh,* and the beer produced by them is sold in almost all stores in Cologne.

Figure 5 *Hellers Kölsch beer on draught*

During summer, adults and students gather on both **banks of the Rhine** and gaze at the city, at the river and at the ships passing by. It is in their culture to drink, especially **Kölsch** beer, have a snack and listen to music. The right bank of the Rhine is the best spot to look at the opposite side of the city, where the Cathedral lies. If you come here during sunset, you will not regret it.

As a student at TH Cologne you are allowed to eat at the **student canteen** (*Mensa*). There are seven student canteens spread around the city (all part of the KSTW – Cologne Student Network):

1. Mensa Zülpicher Straße
2. Mensa Robert Koch Straße
3. Mensa Musikhochschule
4. Mensa Deutz
5. Mensa Südstadt
6. Mensa Sportpark Müngersdorf
7. Mensa Gummersbach
8. Mensa Kunsthochschule Medien

All students in Cologne get discount on the menus, but guests can also eat here. The closest student canteen to Campus Deutz is *Mensa Deutz*, located near the main entrance. It is opened from Monday to Friday for around three hours between 11:30 and 14:30. Periodically, there are also events called *Streetfood@Werk*, when a special menu with street food is also available.

Each canteen comprises also a **Cafeteria** with longer opening hours, where you can buy sandwiches, drinks and snacks. Student canteens have at least 4 different menus daily: 2 meat-based menus (*Menü I*, *Menü II*), 1 vegetarian menu (*Menü Vegetarisch*), 1 special offer menu (*Aktionstheke*). The prices for students differ from 2.05€ to 3.55€, while the price range for guests is almost double. The biggest student canteen in Cologne is *Mensa Zülpicher Straße*, located on the *Zülpicher Street*. This canteen is made up of three smaller canteens, one of them being opened also during weekends and on evenings.

3. NEARBY DESTINATIONS

If you want to discover the surroundings, you can choose to travel by train, as **Cologne Main Station** is an important local, national and international hub with many connections and one of the busiest stations in Germany. The most important railway company in Germany is Deutsche Bahn AG and you have multiple choices to buy your tickets: online (*www.bahn.de*), from the vending machines and even through the mobile application *DB Navigator*. An advantage of being a student in Cologne is the fact that you have the **NRW-Semesterticket** for the whole semester. This ticket allows you to travel through the whole federal state North Rhine-Westphalia for free by all means of transport (except for the IC and ICE trains).

The closest big city to Cologne is **Bonn**, the former capital of West Germany and the place where Ludwig van Beethoven was born. Maybe the best time to visit this city is in April when the **Cherry Blossom Avenue** is full of freshly bloomed cherry trees (Figure 6). After visiting the **Beethoven House**, make sure to see also the Electoral Palace and the *Hofgarten*, the **Bonn Minster** and the place where the brand Haribo was invented (Haribo = **Ha**ns **Ri**egel **Bo**nn).

On your way back to Cologne, a worth-visiting place is **Brühl** with its **Augustusburg** (Figure 7) and **Falkenlust Palaces** of Baroque and Rococo architecture, both UNESCO cultural World Heritage sites.

Figure 6 *Cherry Blossom Avenue*

Figure 7 *Augustusburg Palace in Brühl*

Not far away from Cologne lies **Aachen**, the westernmost city in Germany, known for the **Aachen Cathedral** (*Aachener Dom*), the church of coronation for German kings and queens for almost 600 years (Figure 8). The **Aachen City Hall** (*Aachen Rathaus*), the **Marketplace** (*Markt*) and the *Katschhof* are as well worth visiting.

Figure 8 *Aachen Cathedral*

Three Country Border (*Dreiländereck*) is a place very close to Aachen, where you can be in three countries at the same time: Germany, Belgium and the Netherlands (Figure 9).

Figure 9 *Three Country Border*

If you want to discover the natural landscape of the region, the best choice is the **Eifel National Park** (*Nationalpark Eifel*), located south of Aachen. You can discover it on your own or on a guided tour with a ranger, on foot, on your bike, on a boat or on horseback. If you are here, do not miss **Monschau**, known for its idyllic atmosphere and beautiful German houses (Figure 10).

Figure 10 *Monschau*

Other destinations in the area are **Düsssseldorf**, with its futuristic architecture and the 240 meter high **Rhine Tower** (*Rheinturm*), **Kettwig** (a small, but charming city located on the Ruhr) or **Münster** (the place where the Treaty of Westphalia was signed).

Another accesible and affordable way of transportation throughout Germany and outside the country is the **FlixBus network** (*www.flixbus.de*). This network has hundreds of hubs around Europe and in Cologne the station is located at the Cologne-Bonn Airport. This is a good starting point for

daytrips or city breaks to cities like Amsterdam, Brussels or Hamburg. All FlixBuses are equipped with Free WiFi. For the best prices it is advisable to book your trip a few weeks before.
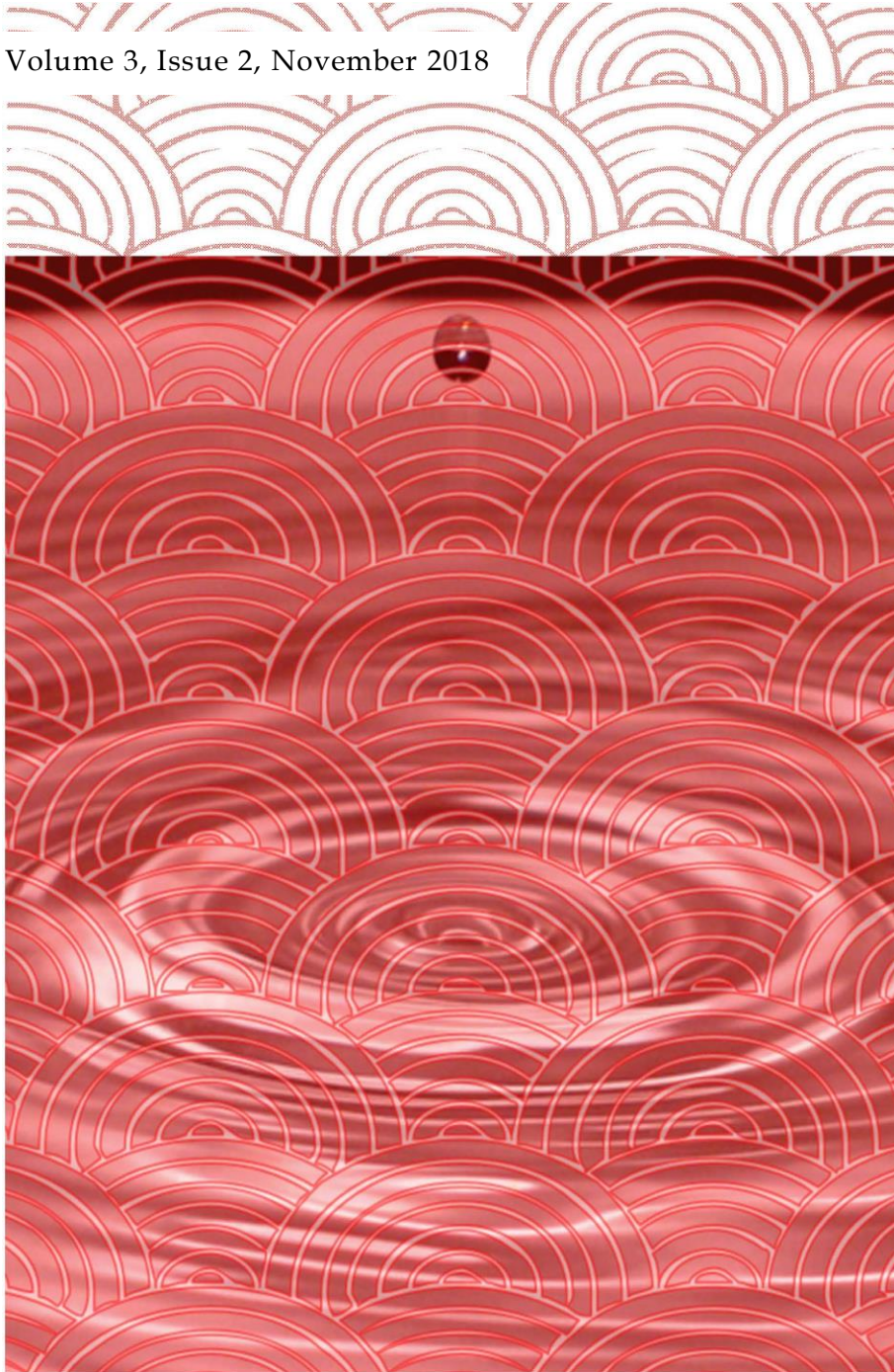
4. CONCLUSION

No matter how long you will study in Cologne, make sure to get the most out of it, because it is a city with an unique culture. Have fun studying what you like. Travel and experience as much as you can. If you really want to enjoy Cologne as an Erasmus+ student, we recommend you to read also the first two articles of the series: "Prologue" and "TH Cologne".

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