MULTIMEDIA AS AN EMERGING CYBERTHREAT IN MODERN SOCIAL NETWORKS

Z. Minchev, V. Dimitrov, M. Tulechka, L. Boyanov

Institute of ICT/Institute of Mathematics & Informatics, BAS, University of National & World Economy
Sofia 1113, Acad G.Bonchev Str., Bl.25-A, Tel. +359 2 979 6631,
E-mails: zlatogor@acad.bg, vgd@acad.bg, milena_tulechka@abv.bg, lb@acad.bg

Abstract: The paper outlines the problem of multimedia contents influence to regular modern social networks users. An ad hoc methodological approach is utilized using preliminary questionnaires based surveys, experts' considerations, structural and system analysis. The obtained results are further validated via users' focus group biometric response monitoring. Our initial findings have demonstrated some promising results concerning quantitative measuring of human factor responses to modified and regular multimedia auditory stimulations that can be used for prevention of emerging cyber threats in the modern digital world.

Key words: Human factor, social networks, social engineering, security, entertainment, multimedia.

INTRODUCTION

Recently, modern social networks became quite popular, due to the fast development of ICTs though the communication process between people dates back to generic social organizations roots [1]. What is important to point out in today's Web 3 world, is the scale of influence, produced as a result of the blend of global Internet with mobile smart communications. This, can be considered and as a major instability source, from General System Theory perspective [2]. Today's social networks are mainly associated with Facebook, Twitter, YouTube, LinkedIn, Google+ and several others [3], generating a number of cyber threats [4], [5], [6].

According to these studies, modern social networks have a multiaspect security profile encompassing both technologies and users. Whilst the technological problems have a technical address, the human factor produces significant interest in the context of the upcoming digital world challenges for data control and privacy [6].

The "digital drugs" as a part of multimedia contents are special emerging threats for todays' cyber world. Appearing more as a mass media idea [7], these findings are also a subject of a number of scientific studies related to emotions and behaviour of Internet users [7], oriented towards binaural beats usage [8] or other external influences giving biometric response similar to real drugs.

As a complex and emerging threat, the "digital drugs" can be also addressed as social engineering instruments for users' control [7].

The aim of the present paper is to give a model-based exploration of "digital drugs" in the context of multimedia of modern social networks. Further on, some of the model findings are experimentally validated.

METHODOLOGICAL FRAMEWORK

The methodological approach that has been chosen for model creation uses the classical feedback human-in-the-loop control based on the utilization of the General Systems Theory [2]. The studied system is considered as an approximation of a complex dynamic system that consists of "Entities" and time-dependent weighted "Relations" sufficient enough for complicated problems interpretation [0]. The model practical implementation is based on experts' opinion usage for an initial Problem Space Definition, obtained from brainstorming and discussions combined with questionnaire based (q-based) surveys [5], [7]. The produced result is a System Model E-R Interpretation. As the created model is using experts' data, due to the fact of its innovative nature, the Resulting Entities Classification is further studied through real users' Biomonitoring Validation. The results from the biomonitoring are used for preliminary experts' believes validation. A generalized graphical interpretation of this framework is presented in Figure 1.

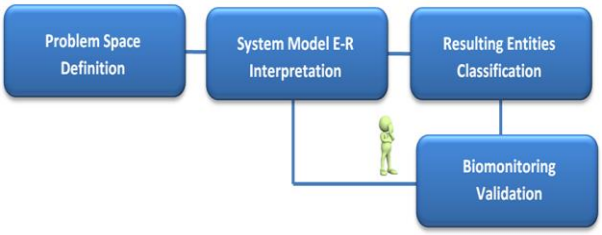

Figure 1. A generalized interpretation of the methodological framework for digital drugs exploration.

As shown in the figure, the generalized methodological framework is covering the already discussed four stages that will be considered in more details bellow, emphasising on the modern social networks communication environment case study.

PRACTICAL IMPLEMENTATION

The methodological framework for digital drugs exploration could be aggregated in the following three key general stages: *(i) Problem Space Definition, (ii) Model Interpretation, and (iii) Experimental Biomonitoring Validation.*

Problem Space Definition. This very first stage is related to key Entities and Relationships identification and was performed collecting users' focus group data from three q-based surveys. In general, it should be preceded with

preliminary detailed structural analysis. First we are referring to two supportive works: (i) a five years recent survey for cyber threats trends amongst 150 international ICT experts concerning Web technologies progress [9] in combination with (ii) SysSec consortium comprehensive Red Book forecasts [6]. Both are outlining the importance of social networks and Web 3 technologies.

The results from the third implemented (iii) survey came from 250 student participants in the framework of a smarthomes cyber threats identification research [5].

Our further results are covering data concerning: "Type of used smart devices"; "Most used social networks via smart devices"; "Activity for using smart devices"; "Type of information exchanged via smart devices".

A generalization of the obtained results from the third survey is presented in Figure 2.

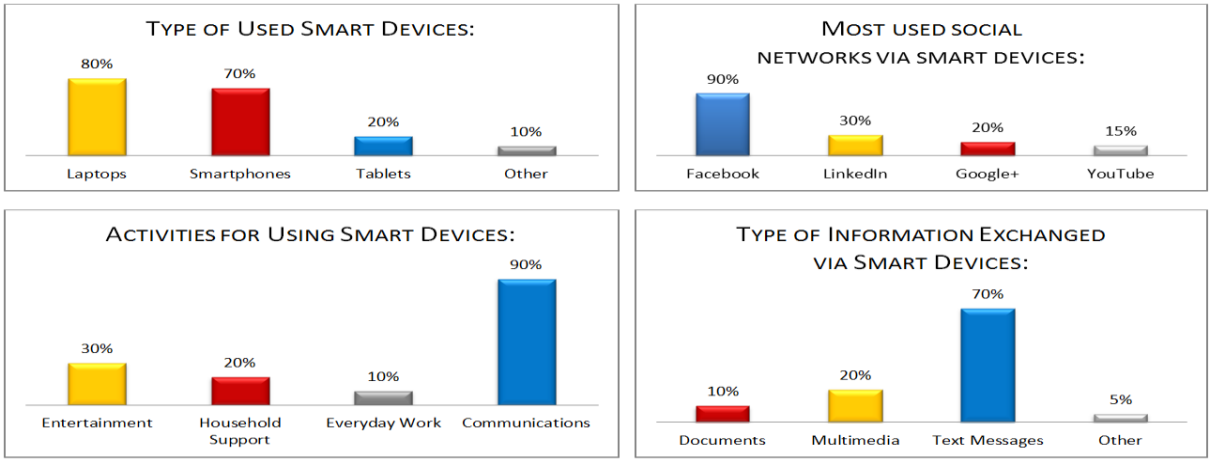

Figure 2. Q-based survey generalized results for social networks, users activities, exchanged information type concerning smart devices popularity amongst 250 participants.

Our target for this first stage was to define a set of entities forming the backbone of a "digital drugs" general system exploration model, taking into account the mobile Web 3, social networks priorities and the presented in Figure 2 results. These could be aggregated, with the assumption of more than 100 % answers' sums, amongst the following:

Currently the most used mobile smart devices are smartphones, laptops and tablets. This could be aggregated as "Smart devices" entity, including also ultrabooks and padphones. The listed social networks, using directly multimedia cover Facebook, YouTube and Google+ forming the "Social Networks" entity. Most often users' activities are related to: Communications and Entertainment exchanging basically: Text messages and Multimedia. They can be generalized around two more entities - "Multimedia Resources" (incorporating resources like: video clips, movie trailers, music files, advertisements and games) and "Entertainment" (addressing "Multimedia Resources" usage). Additionally, for model completeness we have added "Human Factor" (as a key driving factor) and external "Smart Environment" (as a surrounding environment of users' inhabiting, e.g.: cities, transportation, homes, etc., implementing a number of smart functionalities and services).

Model Interpretation. The model created as a result of the Problem Space Definition should cover the following requirements: defining and weighting entities with reasonable context in a suitable software environment and methodological base.

Following the social engineering and entertainment priorities from two other specialized studies [5], [7] we found these entities a reasonable context for studying "digital drugs" in multimedia contents. A suitable theory of use is the Generalized System Theory, incorporating the Entity-Relationship paradigm with the I-SCIP-SA software environment [10] (see Figure 3).

All entities in the model are represented with named round rectangles and their relations with weighted (noted with yellow colored labels) headed arrows.

The weighting scale gives the percentage measure, covering three levels: weak [0-30%], moderate [30-50%], and high [50-10%] for the interval [0, 1], [5].

Models can be either - static (marked with blue labels with zero value, over the relations' weights) or dynamic (marked with blue labels over the relations' weights, showing the number of simulation steps) in accordance with the implementation of experts' defined weights arrays or single value. In the present study we are using only the static one, being quite innovative with validation basically addressed towards the Human Factor response.

The model experts' analysis is shown in Figure 4 in a three dimensional Sensitivity Diagram (SD). SD is presenting *Influence* (dimension x), *Dependence*, (dimension y) and sensitivity (dimension z) values. Four sectors encompassing the entities classification are utilized: green (buffering, left-down zone), red (active, right-down zone), blue (passive, left-up zone) and yellow (critical, right-up zone). All entities (visualized in SD with indexed balls) from the model with negative z value are passive for their sector, whilst those with positive z values – active.

SD from Figure 4 gives a profitable classification for further analysis, outlining the "Human Factor" (indexed ball "2") as a critical entity together with "Smart Devices" (indexed ball "4") and "Social Networks" (indexed ball "5"). The "Entertainment Activities" (indexed ball "3") are noted as active entity and "Multimedia Resources" (indexed ball "1") as passive one. "Smart Environment" (indexed ball "6") is a buffering entity, assuming neutral influence in the current model.

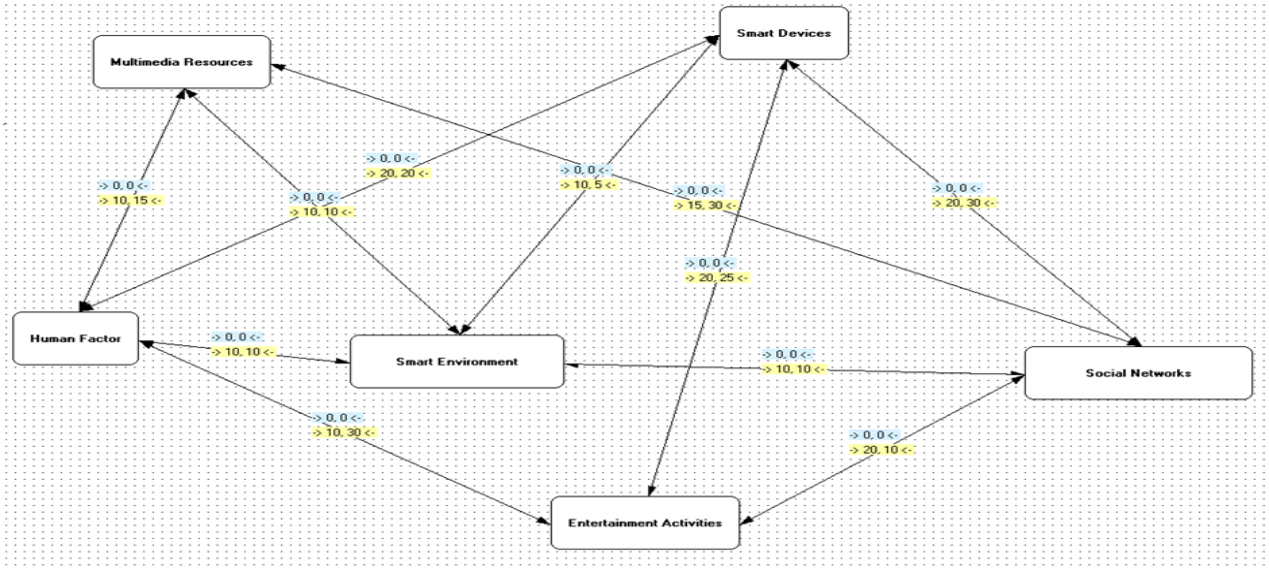

Figure 3. Graphical interpretation of a general system model for "digital drugs" exploration in multimedia contents via I-SCIP-SA.

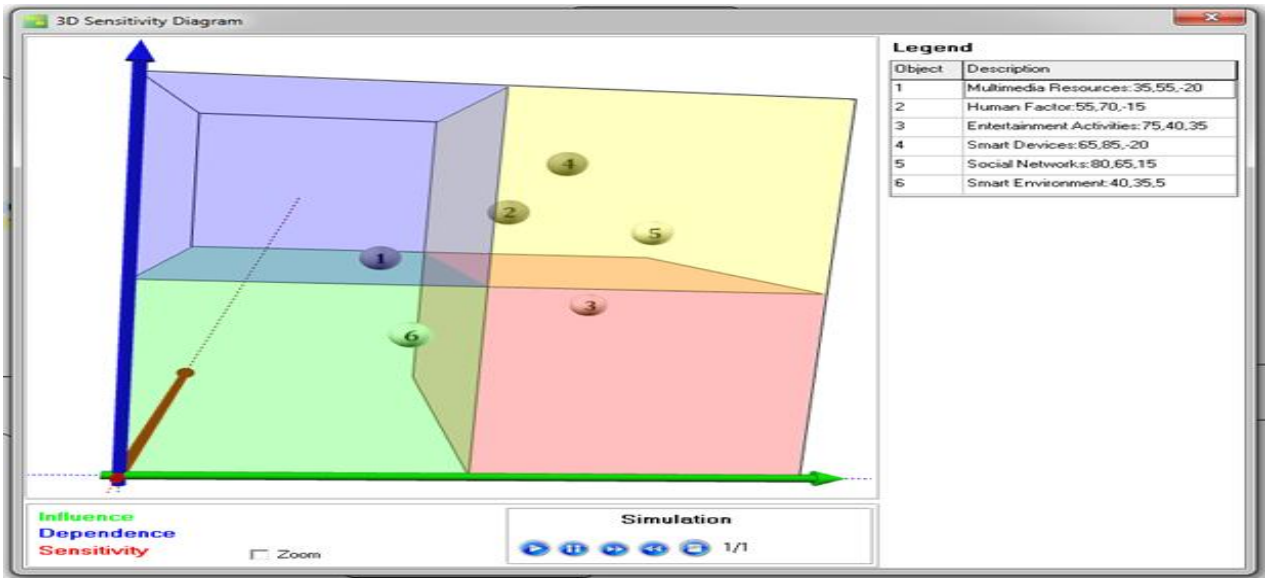

Figure 4. Sensitivity Diagram of generalized system model.

The "Human Factor" is a critical passive entity and should be further studied in the Biomonitoring Validation stage, aiming to obtain a more comprehensive evidence for this experts' believes and analyses results in regard to entertainment in social networks.

Experimental Biomonitoring Validation. This stage was organized with the help of a flexible, specialized two electrode Mind-Reflection© Galvanic Skin Response (GSR) equipment for VERIM© Lab Light, EU (connected via the USB 3.0 port of Asus Zenbook UX31E to the standard official producer software environment of the device), providing monitoring of the dominated hand middle and ring finger resistance dynamics of a volunteers group with preliminary ethyl alcohol cleaned contact places.

A total number of 15 healthy volunteering participants (averaged age 30 years - 10 men and 5 women) took part in the validating process.

The experiment concerned a listening process in a comfortable sitting position with resting hands at a font desk next to the sitting chair. Two popular 3 min melodies (selected after [11]) classified in advanced with a q-based evaluation and related to fear (Fear Melody, Ghost in the Machine song from Dark Water album of Angelo Badalamenti) and joy (Joy Melody, Gioachino Rossini's overture of William Tell opera) were used. Both melodies were played twice with 1 min pause between the series – without additional auditory stimulation, and with binaural brain booster performance series rising at Left 14-10 Hz, Right 19-10 Hz. The auditory stimulation was organized via David Delight Plus Relaxation audio stimulator of Mind Alive Inc. using less than 1/4 volume power covered by the base music melody.

The musical stimuli were used from on-line YouTube web page, both with and without brain booster stimulation. The stimulation mixture is presented via a Hi-Fi audio headset with 35 dB sound energy stimulation level. The playing device was mobile SONY Xperia© S tablet SGPT 1311. Onset synchronization was organized in accordance with both used smart devices IP internet access, using common wireless D-Link DIR 600 router.

Due to the rather specific nature of the resulting records, a further processing in Matlab R2011b environment for

measuring Higuchi Fractal Dimension (HFD) similar to [12] was performed.

The generalized results for Huguchi Fractal Dimension averaged relative differences are given below.

Emotional Feeling	Avg. HFD1	Avg. HFD2
Fear Melody	1.335	1.563
Joy Melody	1.375	1.452

Table 1. Generalized results for Huguchi Fractal dimension.

The results from Table 1 show noticeable differences between both series calculated averaged fractal dimension with (Avg. HFD2) and without (Avg. HFD1) additional auditory boosting. We must note that during our experiments there were participants demonstrating opposite results, i.e. diminishing of HFD, probably due to different psychological predisposition. This basically, depends on the external "Smart Environment", which is not presently considered in detail, as the present one is focused mainly to multimedia threats.

The results confirm the importance of "Human Factor" entity together with "Multimedia Resources" passive role, i.e. hidden cyber threats source existence [7].

CONCLUSIONS AND FUTURE WORK

The obtained initial modelling and validation experimental results are giving us the possibility to make an assumption that a quantitative measurement of external multimedia auditory influence to nowadays social networks users is possible to be made up to a certain level. This, in combination with problem modelling is of vital importance for the creation of protection software service in nowadays digital world. It is important to note the necessity of implementing the proposed method in a more comprehensive multimedia sense, incorporating visual information and integrating mobile platforms. These will provide a capability for complete real-time users' behaviour and emotions biometric data monitoring and more reliable and detailed cyber threats identification.

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