

**NATIONAL UNIVERSITY OF PUBLIC SERVICE  
FACULTY OF MILITARY SCIENCES AND OFFICER  
TRAINING  
DOCTORAL SCHOOL OF MILITARY ENGINEERING**

**Author Summary**

**Attila Schüller**

**Examining the Human Factor in the Fields of  
Information Security, Body Guarding and  
Property Protection and Evacuation**

**PhD Dissertation**

**Supervisor: Prof. Dr. Lajos Berek**

**BUDAPEST, 2015.**

## PROBLEM SUMMARY

There are countless human factors to consider, and as the rate of these factors differs in case of each person, significant differences in human behaviour can be observed even in similar situations. As a positive example, individuals with better organisational or communicational skills, higher intelligence level, practical experience in similar situations, better physical condition, etc. resolve the same problem more easily, more efficiently and with better quality compared to others with ordinary skills. However, some negative traits of the people on the other side of the scale can be considered as relevant risks.

Several scientists have researched the relations between security and society as well as security and human factors. The concept of sectors was developed in 1998 by members of the Copenhagen School, who defined the factors the society should focus on in order to ensure security. The following sectors were listed: military, political, societal, economic and environmental.<sup>1</sup> Ulrich Beck drew attention to the dangers of technical vulnerabilities by defining the term of risk society. Beck stated that the research related to risks does not take the contradiction between human factors (error, failure) and security into consideration.<sup>2</sup>

The field of security engineering deals with the establishment of security. The following subfields belong to the complex security engineering:

- law enforcement,
- body guarding and property protection,
- information security,
- occupational safety and fire protection,
- environmental protection.<sup>3</sup>

All these diverse subfields cannot be examined thoroughly in my dissertation, so in my research activities related to human factors I focused on some restricted areas of information security, body guarding and property protection and fire protection. Brief description of the typical problems related to human factor within the researched subfields:

---

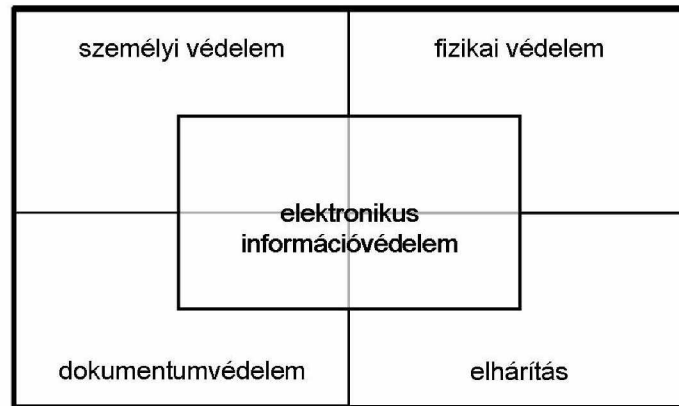
1 Barry Buzan, Ole Wæver, Jaap de Wilde: Security: A New Framework For Analysis. Lynne Rienner Publishers, Boulder, 1998.

2 Ulrich Beck: A kockázat-társadalom. Út egy másik modernitásba. Századvég, Budapest, 2003.

3 Pohl Árpád: A műveleti felkészítés rendszere a logisztikai tisztképzésben Hadtudományi szemle, 2015./1. p.: 151-166.

## Information Security

We are living in the age of informational society, when possessing and protecting information, i. e. information security, becomes more and more important. This is the purpose of complex information security, its elements and their relations displayed in Figure 1.



*Figure 1. A Complex Approach to Information Security<sup>4</sup>*

Although the human factor can be observed within all the fields shown in the figure, which determines the success or the failure of the specific field, there is even a direct relation between the protection and the human factor within the field of person protection. As the researched field is typically implemented in the area of information technology, the dissertation principally deals with the person protection within electronic information security, however, that has an effect on the whole information security as well.

The role of information security, in particular electronic information security or computer security becomes more and more significant in the age of informational society, so there is a continuous need for researching it. Several studies have researched the protection of critical infrastructure, however, they have not included the security aspects of the information technology systems in public education. This gap should still be researched and examined, because their defect may cause fatal problems in the area of education and civil services (issue of certificates, student and teacher identity cards), and unauthorized persons may access the personal and specific data stored in the affected systems as well.

<sup>4</sup> Muha Lajos: A komplex információbiztonság szerepe. In: Kovács László (editor): Számítógép-hálózati hadviselés: veszélyek és a védelem lehetséges megoldásai Magyarországon. Study. ZMNE, Budapest, 2010. p. 222.

## Body Guarding and Property Protection

The profession of body guarding and property protection has undergone a major transformation during the past decades. After the change of regime in Hungary, the public safety became worse, which increased the need for the protection of person and property.<sup>5</sup> A growing number of public events are organised, and due to the financial and economic changes, the number of individuals involved in cash transportation and value protection has multiplied. Beside the growing quantity of activities, the transformation of the market and the demands caused significant changes in human factors as well, namely, the requirements against security guards. HR (human resource) professionals and psychologists have created a fairly rich literature about manpower recruitment process, however, there is no specific source material available about the competency requirements of security guards. According to the practice, the security guard trainings can be accomplished with minimal physical and mental conditions. The act CXX. of 2012 and the relevant statute 68/2012.(XII. 14.) determine mandatory training and exam for the security guards, however, competency checks are not mentioned in them. The factor of armed security guards make the situation even more distressing. As Pál Bilkei Gorzó declared earlier, he analyses yearly around four or five hundred security guards and according to him, 10-12 percent of them are unsuitable for wearing guns.<sup>6</sup> Enterprises also superficially examine the competency of the employees at the most. As a result, the employees are not capable to perform their duties in high quality, or in even worse cases, they represent potential risks for the workplace. In order to develop the aptitude test for security guards, I analysed such a complex area, where human politics, psychology and sociology are all present beside security engineering, so this subfield has the most in common with the human factor.

## Fire Protection

In the field of fire protection the outstanding problem related to human factor is the process of evacuation. During the past years, several examples could have been observed, when building evacuation was a necessary step in case of fire or other dangers, however, during the escape of the crowds, the lack of preparedness and the perplexity resulted in panic, which

---

5 No author (3K Consens Iroda): Személy- és vagyonőr  
[http://www.epalya.hu/media/mappa\\_kieg/Szemely\\_es\\_vagyonor.pdf](http://www.epalya.hu/media/mappa_kieg/Szemely_es_vagyonor.pdf)  
 Downloaded at: 06. 14. 2015

6 Lencsés Károly: A biztonsági őrök tizede alkamatlan a fegyverviselésre  
[http://nol.hu/belfold/20091128-ne\\_jusson\\_senki\\_fegyverhez\\_pszichologiai\\_vizsgalat\\_nelkul-447331](http://nol.hu/belfold/20091128-ne_jusson_senki_fegyverhez_pszichologiai_vizsgalat_nelkul-447331)  
 Downloaded at: 06. 20. 2015

ended in fatal accidents. Even in case of objects with an effort to establish maximum security, where operators fully comply with the legislation in force, there are pre-defined escape routes independent from the location and direction of the fire and the location of the individuals present. According to patents, presented detailly in my dissertation, there is a possibility to trace alternate routes, however, this is not an optimal solution either. Confirmed by references and also my own research in the relevant chapter, in most cases of emergency, escaping individuals follow each other or intend to reach the gate where they entered the building, instead of relying on the signs indicating the pre-defined escape routes. As a result, there is a justification of developing a system which supports evacuation with considering the location of the danger, the distribution of the crowd as well as the routes to the emergency exits, and generates a unique escape plan, with special, definite light and sound navigation for the escapers.

## **POINTS OF INTEREST**

During my research I am looking for solutions which reduce the negative effects and risks caused by human factors. My intention is to support the stability and safety of security systems.

Objectives:

- revealing the human factors obstructing the establishment of information security in spite of the increasingly strict regulations, looking for solutions to prevent them,
- finding a solution to hire the most competent security guards to perform their duties,
- reducing human errors during evacuation.

## **RESEARCH HYPOTHESES**

To develop the topic of the research, I have set up the following hypotheses:

1. I can prove that one of the main reasons for the guidelines in the area of information security is that the users are not aware of the necessity to protect information, especially personal and sensitive data. Additionally, analysing the development and operation of the information technology systems especially in the area of public

education, specific examples show that human factor should be considered as potential risk from the side of all involved parties.

2. a) I can design a professional system measuring human factors, which makes possible to properly examine the competency of security guards.
- b) Adaptive tests are often being criticized for significantly harder or even easier completion. According to my hypothesis, I can prove that adaptive tests end with similarly accurate results as the traditional paper and pencil tests.
3. During evacuation, we can observe several human factors with a negative effect on the speed of the escape from the building. According to my hypothesis, I can design a technical solution with more efficient indicators, supporting the capacity of making decisions in case of emergency, which results in a more effective evacuation compared to the current methods.

## RESEARCH METHODS

By reason of the complexity of the topic I used a wide range of research methods. I explored, reviewed and critically analysed the available Hungarian and foreign references before systematizing them. Additionally, in the area of information security:

- quantitative research was my primary research method in the area of information security,
- I applied empirical method as well in order to analyse information security related customs, and I compared the results with the statistical data of my quantitative research,
- as qualitative research I made several unique interviews, focusing on peculiarities which could not have been explored and analysed through the quantitative method,
- I elaborated study cases in case of systems where information security is not established.

In the area of the professional system applied for supporting the competency testing of security guides:

- I examined the process of ability testing for assessing employees working in such positions,

- with the help of simulation, I explored the differences between the assessment methods and the typical measurement biases and I determined which of the tested models can be applied effectively,
- I used synthesization to define the basic principles of the system.

In the area of fire protection:

- I applied primary research to analyse the behaviour of people during fire alarms,
- I examined the currently available technical solutions with the help of comparative literature analysis,
- I performed analysis and abstraction to develop the basic principles of the light string signal system and the segmentation methods,
- I built up the system as a whole with the help of synthesization.

## **BRIEF SUMMARY OF THE RESEARCH IN THE THREE FIELDS**

### **Chapter 1**

In the course of my survey carried out, the users could answer questions about the justification of information security regulations, then with the help of an experiment, I demonstrated that their responses reflected a much more positive attitude than their irresponsible behaviour in deed. I elaborated study cases examining the incidents within the field of information security in Hungarian public education.

### **Chapter 2**

With the help of a self-made simulator, I compared several test methods for assessing competency, as a result, I could conclude that the multistage models are similarly accurate as the traditional tests, I analysed the measurement biases of further tests as well. I determined the the basic principles of the professional system supporting the competency test for security guards.

### **Chapter 3**

I analysed the human errors committed in the course of fire alarms. I examined the current technical and principal solutions, which may help the escape process. I elaborated the

principle and the build of an intelligent evacuating system, determined the requirements of the signal system of light strings, and defined the basic algorithm controlling evacuation.

## **CONCLUSION SUMMARY**

I proved the negative effect of human factor on all the three sub-fields. In the field of information security the user habit – mainly the ignorance of the guidelines – is the most critical problem in my opinion, in the topic of body guarding and property protection, the suitability of the security personnel is not checked properly and professionally and in the field of fire protection, during evacuation, reducing perplexity and panic is crucial.

Information security needs a change in paradigm. It is clearly proven that it is impossible to create a secure system with guidelines only, because of the influence of the human factor, which mainly consist from user negligence. Additionally, the current methodology even allows intentional damage causing. There is a need for the application of technical developments which are able to provide protection against these problems. My suggestion is to limit the users on authentication level: with technical equipment, methods we need to deny the rights of the users to give permissions for other individuals. I presented some easy to apply techniques to manage this.

The small security businesses are mostly ignoring the need of competency checks performed by professionals on their candidates, the main approach is just a Curriculum Vitae check and a face to face interview. This fact leads to the case that the person who is intended to provide protection will mean a potential security risk. Professional methods can be successfully applied in various science areas. Considering the results of human politics, psychology and sociology it is possible to build such a professional system, which can assess especially the competency of the security guards. The data could be collected into a database and comparing the results of the regularly repeated assessment would be beneficial for a deeper analysis of the field. I defined the basic principles of the system, I examined the test methods for evaluation and determined which one is the most appropriate to apply.

In the field of fire protection, during an evacuation the problem is that people are ignoring the emergency exit signs. With the current technology it is possible to build a system which would consider the location of the danger and the crowd to generate the evacuation lines real time, on demand and make the escape routes clearly visible for those who are escaping. I examined the method of light signs, I defined requirements regarding their usage and the



segmentation of the building. I suggested an algorithm for the route planning and created the block diagram of the system.

Based on my research we can conclude that the human factor is causing a negative effect on all of the examined aspects of security and we can find solutions to mitigate and reduce these effects. The complexity of the researched field results in a variety of human influence detected, the diversity of individuals force us to consider various types of risk even within the same aspect. Considering all of the above, I conclude that a common solution is not suggestible. However, the human influence is a must to consider as a complex and various possible factor, while boundary and failure of machines is predictable, the human nature and logic is not so simple and obvious.

In some cases, we can observe similar human factors even from different aspects of security. For example, in the field of information security I presented that the low risk awareness on user as well as on developer side can destroy the security. This statement is applicable for body guarding and property protection as well, when the security businesses state that they are not vulnerable even if they employ less professional but cheaper personnel. Finally, during fire alarms the same is proven when the individuals ignore the importance of evacuation practice as they do not acknowledge the likelihood of fire at their location.

During my research I noticed that during the evaluation of a human factor it is very likely that at least one other dangerous human factor is accompanying it, with a strong interaction between the factors. Let us see a few examples! By information security, the users are not following the guidelines, however, even if they would, the developer mistakes may still cause vulnerabilities. The security guards need to focus on self-development and becoming competent, but this habit is not sufficient in case the businesses are looking for cheaper but less competent employees. Most people escape by following their instincts during a fire, but in many buildings, even if they follow the escape routes they will not succeed as the signs are missing because of human error. Therefore, my conclusion is that the human factor needs to be examined from many aspects to successfully reduce its negative effects.

Based on the above, I defined the *principle of correlation between human factors*:

*Examination of one particular human factor (from here on main factor) will likely reveal at least one other dangerous human factor (from here on side factor) and is in deep correlation with the main factor. The development of the main factor is only possible if we examine it together with the side factors and we ensure that those support*

*the development of the main factor. To this end, it might be necessary to develop the side factors as well.*

## NEW SCIENTIFIC RESULTS

1. Analysing the habits of the computer users and their personal data handling, **I made suggestions for making the permission management more secure within the information technology**, additionally, **I elaborated case studies** by analysing the security anomalies occurred during the development and support of the IT infrastructure of the public education, **which are considerable in order to increase the reliability, data integrity of these systems.**
2. I simulated the test methods used to evaluate the competency of security guards by a self coded program, based on this I determined the precision level of the particular measurement models and I the typical biases caused by them. With this process I proved, that the multi-stage adaptive testing provides acceptable accuracy. I developed the functions of the professional system supporting competency testing, and made proposals for its usage (complex evaluation of an individual, comparing capabilities of individuals, support of contractors in various ways, tracking self-development, establishing future researches). In a few words, **I laid the foundations of the professional competency checking system of the security guards, with a special focus on the measuring method.**
3. By analysing video recordings, I justified that during a fire alarm the technical solutions are failing due the human errors of the escaping individuals. Based on this, I set the requirements of a visual coordinating system of light strings, defining the physical requirements in depth (e. g. resistance, translucency), accurate placement of lights, working method and synchronism. I developed a building segmentation method, coded the base algorithm for the escape route planning of the control system. I defined the block diagram of the complete system. As a result, **I created the base of a building evacuation system which – partly by reducing the possibility of human errors – makes the evacuation procedure more efficient.**
4. After the complex examination of all the three sub-fields I proved that the observation of the human factor is not sufficient on the level of individuals or tasks. **I defined the**

**principle of correlation between human factors, which makes the development planning of the human factor more efficient.**

## **RECOMMENDATIONS**

1. Based on my suggestions the user permission handling can be properly regulated, additionally, the issues of the public education IT systems can be corrected.
2. I recommend the usage of the principles and methods defined for the competency checks of security guards and the smart building evacuation systems during building the systems and apply them in practice.
3. I recommend to review and extend the usage of the evacuation algorithm currently applicable during fire alarms in order to serve at bigger places like during the evacuation of a metropolis.
4. I recommend to use my dissertation as a suggested education material in the military engineering education.

## **EFFECTIVENESS OF THE SCIENTIFIC RESEARCH**

My research results are feasible, they support the reduction of the negative human factors in all the three researched sub-fields and as a result, the increase of security.