



SCIENCE & SECURITY November 2016

CASRA NEWSLETTER – ISSUE 14

Whether you mourn summer or celebrate approaching winter at this time of the year, we are happy to supply you with an engaging midseason read: Our last Science & Security Issue of 2016.

In the section “Research Put Across,” we present a study which examines the effects of emotional exhaustion, job satisfaction and work-family conflict on airport security officers.

As for the “Security in Practice” section, we decided to address questions on e-learning and its role in keeping up-to-date with current, new and emerging threats.

We hope to have given you some insightful reading to go along with a cup of tea or coffee and wish you a fantastic holiday season!

Dr. Diana Hardmeier
Director

Prof. Dr. Adrian Schwaninger
Chairman

TOPICS IN THIS ISSUE:

RESEARCH PUT ACROSS

EMOTIONAL EXHAUSTION, JOB SATISFACTION AND WORK-FAMILY CONFLICT IN AIRPORT SECURITY OFFICERS

Situational factors such as task sequence, work environment and team interactions have proven to affect the performance of airport security officers. However, previous research has not focused on the relationship between specific work characteristics and other factors, such as emotional exhaustion. A recently published study has addressed this gap by examining the effects of work-family conflict as intervening variable in the job demands-resources model between workload, supervisor support, emotional exhaustion and job satisfaction in 1'127 airport security officers at a European airport.

SECURITY IN PRACTICE

CASRA E-LEARNING MODULES FOR KEEPING AIRPORT SECURITY OFFICERS UP-TO-DATE REGARDING CURRENT, NEW AND EMERGING THREATS

Computer-based training is a widely used effective and efficient tool to achieve and maintain high levels of detection of prohibited items in X-ray images by airport security officers. For certain current, new and emerging threats, screeners may also benefit from conceptual and contextual knowledge, e.g. on current trends to hide improvised explosive devices in passenger bags. E-learning modules that combine images, textual content and interposed questions can be a valuable addition to X-ray image interpretation training. In this article, we explain important scientific principles and show examples of how to use this training method.

EMOTIONAL EXHAUSTION, JOB SATISFACTION AND WORK–FAMILY CONFLICT IN AIRPORT SECURITY OFFICERS

Text: Marcia Mendes

Studies with airport security officers (screeners) have seen an emphasis on visual search in X-ray images, optimizing technology, and using security training programs to improve detection performance [1]. Situational factors such as task sequence, work environment and team interactions have proven to affect screener's performance as well [2]. However, previous research has not focused on the relationship between specific work characteristics and other factors, such as emotional exhaustion. A recently published study (Baeriswyl, Krause & Schwaninger, 2016) has addressed this gap by examining the effects of work-family conflict as intervening variable in the job demands-resources model between workload, supervisor support, emotional exhaustion and job satisfaction in 1'127 screeners at a European airport [3].

Screeners have to make highly relevant decisions in a challenging work environment where different factors come to play. Alongside situational fac-



tors, that influence work performance of cabin baggage screeners, health and well-being are of great relevance to job satisfaction of airport security staff. Previous research findings suggest that negative aspects of work (so-called stressors) affect performance negatively whereas positive aspects of work (so-called resources) have a positive impact on performance. These effects

on performance can occur both directly and indirectly [4]. The study presented in this Issue of "Research Put Across" examines resources, stressors and how they relate to each other through the job demands-resources model (JD-R).

EXPLORING RELATIONSHIPS BETWEEN WORK AND HEALTH WITH THE JD-R MODEL

The JD-R model is a well-tested and widely used theoretical framework for describing the relationships between work characteristics and well-being (Figure 1). The JD-R model assumes two processes: The health impairment process and the motivational process [5]. The presented study used demands (workload) and ill-health (emotional exhaustion) in the health process. Resources (supervisor support) and motivation (job satisfaction) in the motivational process. The JD-R model was extended by work-family conflict (WFC) as intervening variable. With this study, the researchers aim to shed light on the relations and interdependencies between these factors. That being said,

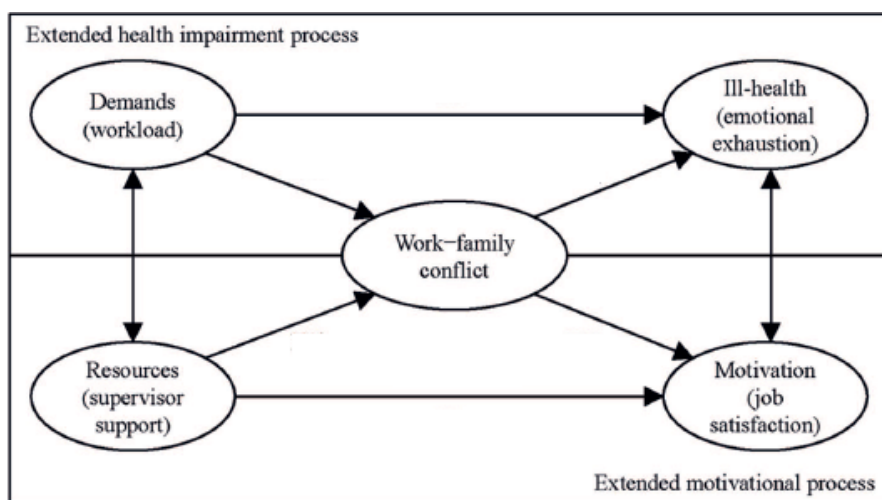


Figure 1: Extended version of the JD-R model

prior to examining the empirical results in-depth, relevant terms and definitions used in the model need to be explained in the subchapters ahead.

The health impairment process

The key determinants of emotional exhaustion are workload and associated phenomena such as time or work pressure [6]. High job demands exhaust the screeners' mental and physical resources and can subsequently lead to ill-health [7]. All this, while the number of flying passengers is expected to rise to an additional four billion per year within the next 20 years according to current estimations [8]. This is of particular relevance to security screeners, as this occupational group will be greatly affected by the growth in passengers and luggage.

The motivational process

Motivation includes the physical, psychological, social, or organizational aspects of the job that are functional in achieving work goals, reduce job demands and/or stimulate personal growth, learning, and development [9]. Job resources are considered to be central determinants of positive motivational states such as high work engagement and organizational commitment [10]. Several studies have covered the relationship between job resources and job satisfaction against a JD-R background [11].

What do the terms emotional exhaustion and job satisfaction encompass?

Emotional exhaustion is characterized by feelings of mental fatigue or of being emotionally drained. It encompasses feelings of depersonalization and awareness of reduced personal accomplishment [12]. The results are increased prevalence of counterproductive work behavior, turnover intentions, and sickness absence as well as mental health problems [13]. Job satisfaction is

commonly defined as "pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences" [14]. Previous studies have discussed burnout and job satisfaction as major determinants of safety performance [15].

The role of supervisors

Having supervisor support available can have a positive impact on employee's job satisfaction [16]. The availability of supervisors is of particular importance to screeners due to the high standardization (detailed standard operating procedures with little opportunity to interact with colleagues) and tasks with negative connotations (searching passengers and their luggage). Passengers are often not pleased to have to pass through security and therefore screeners need high inter-personal skills, especially good communication skills. However, evidence on the indirect effect of supervisor support on job satisfaction seems to be inconsistent [17][18].

A closer look at family and work relationships

- › **Compatibility of family and work**
Family and work roles are crucial in predicting employees' health and well-being and may well influence the motivational process, because supervisors might, directly or indirectly (e.g. through scheduling), support a family-friendly organization of work [19]. Security screeners face the challenge of working in changing shifts, a working condition that has turned out to be relevant in terms of the compatibility of family and work [20].
- › **Family-work spillover and resulting work-family conflict**
According to the spillover model on relationship work and family roles [21], domains can influence each other. Effects from one domain to

the other can be either positive (enrichment) or negative (conflict). They can take either the direction work to family or family to work. The focus on negative spillover from work to family within the individual is called a work-family conflict (WFC). WFC acts as an intervening variable in the theoretical framework of the JD-R model making it a thematic priority for the researchers.

PARTICIPANTS AND PROCEDURE

The study used a cross-sectional analysis to survey the screeners employed at a European airport. The survey was conducted using a paper-and-pencil questionnaire. In the final sample of 1,127 screeners 44% were female and 55% male respondents. Additional demographic variables such as age, job tenure, marital status, and children of preschool/school were investigated. Also assessed were the conditions of employment. Participants were asked whether they worked full time or part time and about the type of shift work they usually performed.

MEASURES AND DATA ANALYSIS

The JD-R domains were rated on a Likert scale from 1 to 4 or 1 to 5. Workload was assessed by means of the statement „I have constant time pressure due to a heavy workload“. Emotional exhaustion was measured with the personal burnout scale (e.g. „How often are you emotionally exhausted?“) [22]. Furthermore, job satisfaction was examined using „I enjoy my work“. The scale on superior support measures the perceived availability of emotional and instrumental support from the supervisor (e.g. „To what extent is your supervisor willing to listen to your problems at work?“). Lastly, WFC was assessed, amongst others, with „The demands at my work interfere with my home life“.

followed by a 5-point-scale.

Reliability (Cronbach's Alpha), descriptive statistics, and correlations were examined using the data analysis software SPSS Version 22 (Table 2).

RESULTS OF STRUCTURAL EQUATION MODELING

In this study, results of structural equation modeling revealed that supervisor support as a major job resource predicted job satisfaction among screeners as well as indicating that higher levels of supervisor support were associated with lower levels of emotional exhaustion. As predicted, WFC proved to be a promising extension to the JD-R model that partially mediated the impact of supervisor support and workload on job satisfaction and emotional exhaustion. This is due to the workload being associated positively and supervisor support associated negatively with WFC, indicating that higher levels of workload were related indirectly via an increase in WFC to higher levels of emotional exhaustion (-0.11 , 95% bootstrap CI $(-0.15, -0.07)$, $p = 0.009$).

The control variables job tenure, working full/part time, and type of shift work were integrated one at a time into the final Model M1. In line with the bivariate correlations reported in Table 2, job tenure had significant effects on the study variables: Workload and emotional exhaustion increased with increasing job tenure. Supervisor support, WFC and job satisfaction decreased. Additionally, working part time was related to lower levels of WFC and job satisfaction but higher levels of emotional exhaustion compared to working full time. Finally, working in fixed shifts or day duty significantly reduced WFC, but interestingly, slightly increased emotional exhaustion compared to working in changing shifts.

	MD	SD
1. Workload	3.30	0.81
2. Supervisor support	3.53	0.88
3. Work-family conflict (WFC)	3.75	0.99
4. Emotional exhaustion	3.40	0.80
5. Job satisfaction	2.47	0.93
6. Gender [1]	1.56	0.50
7. Age [2]	2.78	0.98
8. Job tenure [3]	2.79	1.09
9. Marital status [4]	1.27	0.45
10. Children of pre-school age [5]	1.85	0.36
11. Children of school age [6]	1.72	0.45
12. Working full/part time [7]	1.20	0.40
13. Shift [8]	1.44	0.50

Table 2: Descriptive statistics and correlations

[1] 1 = female; 2 male. [2] 1 = ≤ 29 years; 2 = 30-39 years; 3 = 40-49 years; 4 = ≥ 50 years. [3] 1 = ≤ 2 years; 2 = 3-6 years; 3 = 7-11 years; 4 = ≤ 12 years. [4] 1 = in partnership; 2 = not in partnership. [5] 1 = yes; 2 = no. [6] 1 = yes; 2 = no. [7] 1 = full time; 2 = part time. [8] 1 = changing shifts; 2 = fixed shifts or day duty.

The results of the study show, that resources available at work energize the motivational process. This contributes towards better adjustment which leads to reduced WFC. Reduced WFC makes it possible to direct personal resources toward attaining work goals and consequently promotes job satisfaction.

IMPLICATIONS FOR THE DESIGN OF BENEFICIAL WORKING CONDITIONS

The results of the current study provide starting points on how to promote job satisfaction, enhance working conditions which in turn could benefit performance. Given the latest findings on WFC, it will be essential for aviation security organizations to take this variable into account in future workplace health promotion in order to decrease the risk of emotional exhaustion among screeners, and, as a consequence,

to decrease the risk of further serious health problems and adverse organizational and societal outcomes. In this context, supervisors may also consider to support a family-friendly organization of work, either directly through approving family-friendly initiatives [23] or indirectly through scheduling family-friendly shifts [24].

CONCLUSION

Emotional exhaustion, job satisfaction and WFC of airport security screeners are important factors that deserve more attention. By taking into account WFC in future health promotion, airport operators can decrease the risk of emotional exhaustion among their security officers and enhance their job satisfaction. Optimizing workload and making sure that there is good supervisor support are good starting points to reduce emotional exhaustion and increase job satisfac-

tion both directly and through the effect of WFC.

REFERENCES

- [1] [von Bastian, C., Schwaninger, A., and Michel, S. \(2008\)](#). Do multi-view X-ray systems improve X-ray image interpretation in airport security screening? *Z. Arbeitswissens.* 3, 166–173.
- [Koller, S., Drury, C., and Schwaninger, A. \(2009\)](#). Change of search time and nonsearch time in X-ray baggage screening due to training. *Ergonomics* 52, 644–656. doi: 10.1080/00140130802526935
- [Halbherr, T., Schwaninger, A., Budgell, G., and Wales, A. \(2013\)](#). Airport security screener competency: a cross-sectional and longitudinal analysis. *Int. J. Aviat. Psychol.* 23, 113–129. doi: 10.1080/10508414.2011.582455
- [Mendes, M., Schwaninger, A., and Michel, S. \(2013\)](#). Can laptops be left inside passenger bags if motion imaging is used in X-ray security screening? *Front. Hum. Neurosci.* 7:654. doi: 10.3389/fnhum.2013.00654
- Wolfe, J. M., Brunelli, D. N., Rubinstein, J., and Horowitz, T. S. (2013). Prevalence effects in newly trained airport checkpoint screeners: trained observers miss rare targets, too. *J. Vis.* 13:33. doi: 10.1167/13.3.33
- Biggs, A. T., and Mitroff, S. R. (2014). Improving the efficacy of security screening tasks: a review of visual search challenges and ways to mitigate their adverse effects. *Appl. Cogn. Psychol.* 29, 142–148. doi: 10.1002/acp.3083
- Mitroff, S. R., Biggs, A. T., and Cain, M. S. (2015). Multiple-target visual search errors: overview and implications for airport security. *Policy Insights Behav. Brain Sci.* 2, 121–128. doi: 10.1177/2372732215601111
- [2] Science & Security – CASRA Newsletter (2008). [Issue 8](#)
- [3] Baeriswyl, S., Krause A., & Schwaninger, A. (2016). Emotional exhaustion and job satisfaction in airport security officers - Work-family conflict mediator in the job demands-resources model. *Frontiers in Psychology*, 7, 1-13. doi:10.3389/fpsyg.2016.00663 [PDF]
- [4] Binnewies, C., & Sonnentag, S. (2006). Arbeitsbedingungen, Gesundheit und Arbeitsleistung (working conditions, health and performance). Retrieved from <http://nbn-resolving.de/urn:nbn:de:bsz:352-opus-57901> [28.01.2014].
- [5] Bakker, A. B., and Demerouti, E. (2007). The job demands-resources model: State of the art. *J. Manag. Psychol.* 22, 309–328. doi: 10.1108/02683940710733115
- [6] Lee, R. T., and Ashforth, B. E. (1996). A meta-analytic examination of the correlates of the three dimensions of job burnout. *J. Appl. Psychol.* 81, 123–133. doi: 10.1037/0021-9010.81.2.123
- Alarcon, G. M. (2011). A meta-analysis of burnout with job demands, resources, and attitudes. *J. Vocat. Behav.* 79, 549–562. doi: 10.1016/j.jvb.2011.03.007
- Bowling, N. A., Alarcon, G. M., Bragg, C. B., and Hartman, M. J. (2015). A metaanalytic examination of the potential correlates and consequences of workload. *Work Stress* 29, 95–113. doi: 10.1080/02678373.2015.1033037
- [7] Bakker, A. B., and Demerouti, E. (2007). The job demands-resources model: State of the art. *J. Manag. Psychol.* 22, 312. doi: 10.1108/02683940710733115
- [8] Benda, P. (2015). Commentary: harnessing advanced technology and process innovations to enhance aviation security. *J. Air Transp. Manag.* 48, 23–25. doi: 10.1016/j.jairtraman.2015.06.008
- [9] Bakker, A. B., and Demerouti, E. (2007). The job demands-resources model: State of the art. *J. Manag. Psychol.* 22, 312. doi: 10.1108/02683940710733115
- [10] Schaufeli, W. B., Bakker, A. B., and Van Rhenen, W. (2009). How changes in job demands and resources predict burnout, work engagement and sickness absenteeism. *J. Organ. Behav.* 30, 893–917. doi: 10.1002/job.595
- [11] Lewig, K. A., and Dollard, M. F. (2003). Emotional dissonance, emotional exhaustion and job satisfaction in call centre workers. *Eur. J. Work Organ. Psychol.* 12, 366–392. doi: 10.1080/13594320344000200
- Angulo, B. U., and Osca, A. (2012). Role stressors, task-oriented norm and job satisfaction: a longitudinal study. *J. Work Organ. Psychol.* 28, 171–181.
- Biggs, A., Brough, P., and Barbour, J. P. (2014). Enhancing work-related attitudes and work engagement: a quasi-experimental study of the impact of an organizational intervention. *Int. J. Stress Manag.* 21, 43–68. doi: 10.1037/a0034508
- [12] Maslach, C. (1982). Burnout: The Cost of Caring. *Englewood Cliffs, NJ*: Prentice-Hall.
- Cordes, C. L., and Dougherty, T. W. (1993). A review and integration of research on job burnout. *Acad. Manage. Rev.* 18, 621–656. doi: 10.5465/amr.1993.9402210153
- Lee, R. T., and Ashforth, B. E. (1993).

A further examination of managerial burnout: toward an integrated model of burnout. *J. Organ. Behav.* 14, 3–20. doi: 10.1002/job.4030140103

Cropanzano, R., Rupp, D. E., and Byrne, Z. S. (2003). The relationship of emotional exhaustion to work attitudes, job performance, and organizational citizenship behaviors. *J. Appl. Psychol.* 88, 160–169. doi: 10.1037/0021-9010.88.1.160

[13] Cordes, C. L., and Dougherty, T. W. (1993). A review and integration of research on job burnout. *Acad. Manage. Rev.* 18, 621–656. doi: 10.5465/amr.1993.9402210153

Lee, R. T., and Ashforth, B. E. (1996). A meta-analytic examination of the correlates of the three dimensions of job burnout. *J. Appl. Psychol.* 81, 123–133. doi: 10.1037/0021-9010.81.2.123

Borritz, M., Rugulies, R., Bjorner, J. B., Villadsen, E., Mikkelsen, O. A., and Kristensen, T. S. (2006). Burnout among employees in human service work: design and baseline findings of the PUMA study. *Scand. J. Public Health* 34, 49–58. doi: 10.1080/14034940510032275

Bolton, L. M. R., Harvey, R. D., Grawitch, M. J., and Barber, L. K. (2012). Counterproductive work behaviours in response to emotional exhaustion: a moderated mediational approach. *Stress Health* 28, 222–233. doi: 10.1002/smi.1425

[14] Locke, E. A. (1976). “The nature and causes of job satisfaction,” in *Handbook of Industrial and Organizational Psychology*, ed. M. D. Dunnette (Chicago, StateIL:Rand McNally), 1297–1349.

[15] Siu, O., Phillips, D. R., and Leung, T. (2004). Safety climate and safety performance among construction workers

in Hong Kong. The role of psychological strains as mediators. *Accident Anal. Prev.* 36, 359–366. doi: 10.1016/s0001-4575(03)00016-2

Nahrgang, J. D., Morgeson, F. P., and Hofmann, D. A. (2011). Safety at work: a meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *J. Appl. Psychol.* 96, 71–94. doi: 10.1037/a0021484

[16] Lewig, K. A., and Dollard, M. F. (2003). Emotional dissonance, emotional exhaustion and job satisfaction in call centre workers. *Eur. J. Work Organ. Psychol.* 12, 366–392. doi: 10.1080/13594320344000200

Cortese, C. G., Colombo, L., and Ghislieri, C. (2010). Determinants of nurses’ job satisfaction: the role of work–family conflict, job demand, emotional charge and social support. *J. Nurs. Manag.* 18, 35–43. doi: 10.1111/j.1365-2834.2009.01064.x

Biggs, A., Brough, P., and Barbour, J. P. (2014). Enhancing work-related attitudes and work engagement: a quasi-experimental study of the impact of an organizational intervention. *Int. J. Stress Manag.* 21, 43–68. doi: 10.1037/a0034508

[17] Frye, N. K., and Breugh, J. A. (2004). Family-friendly policies, supervisor support, work-family conflict, family-work conflict, and satisfaction: a test of a conceptual model. *J. Bus. Psychol.* 19, 197–220. doi: 10.1007/s10869-004-0548-4

Thompson, B. M., Brough, P. A., and Schmidt, H. (2006). Supervisor and subordinate work–family values: does similarity make a difference? *Int. J. Stress Manag.* 13, 45–63. doi: 10.1037/1072-5245.13.1.45

Karatepe, O. M., and Kilic, H. (2007). Relationships of supervisor support and conflicts in the work–family interface with the selected job outcomes of frontline employees. *Tourism Manage.* 28, 238–252. doi: 10.1016/j.tourman.2005.12.019

Yildirim, D., and Aykan, Z. (2008). Nurses’ work demands and work–family conflict: a questionnaire survey. *Int. J. Nurs. Stud.* 45, 1366–1378. doi: 10.1016/j.ijnurstu.2007.10.010

Cortese, C. G., Colombo, L., and Ghislieri, C. (2010). Determinants of nurses’ job satisfaction: the role of work–family conflict, job demand, emotional charge and social support. *J. Nurs. Manag.* 18, 35–43. doi: 10.1111/j.1365-2834.2009.01064.x

Lu, L., Chang, T., Kao, S., and Cooper, C. L. (2015). Testing an integrated model of the work–family interface in Chinese employees: a longitudinal study. *Asian J. Soc. Psychol.* 18, 12–21. doi: 10.1111/ajsp.12081

[18] Ito, J. K., and Brotheridge, C. M. (2012). Work-family and interpersonal conflict as levers in the resource/demand-outcome relationship. *Career Dev. Int.* 17, 393–413. doi: 10.1080/10615801003728273

Odle-Dusseau, H. N., Britt, T. W., and Greene-Shortridge, T. M. (2012). Organizational work–family resources as predictors of job performance and attitudes: the process of work–family conflict and enrichment. *J. Occup. Health Psychol.* 17, 28–40. doi: 10.1037/a0026428

[19] Frye, N. K., and Breugh, J. A. (2004). Family-friendly policies, supervisor support, work-family conflict, family-work conflict, and satisfaction: a test of a conceptual model. *J. Bus. Psychol.* 19, 197–220. doi: 10.1007/s10869-004-

0548-4

[20] Beutell, N. J. (2010). Work schedule, work schedule control and satisfaction in relation to work-family conflict, work-family synergy, and domain satisfaction. *Career Dev. Int.* 15, 501–518. doi: 10.1108/13620431011075358

[21] Voydanoff, P. (2002). Linkages between the work-family interface and work, family, and individual outcomes. An integrative model. *J. Fam. Issues* 23, 138–164. doi: 10.1177/0192513x02023001007

[22] Nübling, M., Stössel, U., Hasselhorn, H. M., Michaelis, M., and Hofmann, F. (2006). Measuring psychological stress and strain at work: evaluation of the COPSOQ questionnaire in Germany. *GMS Psycho Soc. Med.* 3, 1–14.

[23] Frye, N. K., and Breugh, J. A. (2004). Family-friendly policies, supervisor support, work-family conflict, family-work conflict, and satisfaction: a test of a conceptual model. *J. Bus. Psychol.* 19, 197–220. doi: 10.1007/s10869-004-0548-4

Yildirim, D., and Aykan, Z. (2008). Nurses' work demands and work-family conflict: a questionnaire survey. *Int. J. Nurs. Stud.* 45, 1366–1378. doi: 10.1016/j.ijnurstu.2007.10.010

Lu, L., Chang, T., Kao, S., and Cooper, C. L. (2015). Testing an integrated model of the work-family interface in Chinese employees: a longitudinal study. *Asian J. Soc. Psychol.* 18, 12–21. doi: 10.1111/ajsp.12081

[24] Beutell, N. J. (2010). Work schedule, work schedule control and satisfaction in relation to work-family conflict, work-family synergy, and domain satisfaction. *Career Dev. Int.* 15, 501–518. doi: 10.1108/13620431011075358

CASRA E-LEARNING MODULES FOR KEEPING AIRPORT SECURITY OFFICERS UP-TO-DATE REGARDING CURRENT, NEW AND EMERGING THREATS

Text: Milena Kuhn

Computer-based training (CBT) is a widely used effective and efficient tool to achieve and maintain high levels of detection of prohibited items in X-ray images by airport security officers (screeners) [1]. For certain current, new and emerging threats screeners may also benefit from conceptual and contextual knowledge, e.g. on current trends to hide improvised explosive devices (IEDs) in passenger bags. E-learning modules that combine images, textual content and interposed questions can be a valuable addition to X-ray image interpretation training. In this article, we explain important scientific principles and show examples of how to use this training method.

CBT can be very effective to increase X-ray screener's visual inspection performance, which contains a search and decision component [2]. To be effective, CBT should be individually adaptive, have large image libraries of high quality depicting prohibited items from different viewpoints and based on systematic threat assessment (for more information see Science & Security – CASRA Newsletter, [Issue 2](#)). An example for such a CBT is X-Ray Tutor (XRT), which features a prohibited items library containing at least 250 objects, each of them depicted from dozens of viewpoints. This library and the selections for different XRT modules (cabin baggage, hold baggage, cargo, mail, etc.) are periodically updated based on CASRA's systematic threat assessment (STA, for more information on this topic see Science & Security – CASRA Newsletter, [Issue 9](#)).

For some prohibited items it can be useful to provide additional conceptual and contextual knowledge using e-



learning modules. For example, screeners should know that IEDs can also be built without a metallic detonator as it has been discussed in some propaganda magazines and other channels promoting terrorist acts in the last two years. Another example is hiding IEDs in toys. This threat is known since decades but only recently, old and new ways of building and concealing such IEDs are discussed on certain terrorist networks and forums. Therefore, it is important to update screeners on different ways of using toys to hide IEDs by explaining mechanisms and functioning (conceptual knowledge) as well as by providing information on different implementation scenarios identified by STA (contextual knowledge).

E-learning is an ideal tool to impart such conceptual and contextual knowledge and raise awareness of threats. Combining e-learning with XRT3, as this can be done in the CASRA Learning System (CLS, see infobox "CLS"), part of CASRA Solution, is valuable for improving and keeping awareness and

performance of screeners up-to-date.

When working with research partners, airport operators, security screening providers and end users, we sometimes receive questions on e-learning.

INFOBOX: CLS

The CASRA Learning System (CLS) is an online platform that allows for the creation of organization-specific learning content and tests for security officers to supplement their X-ray image interpretation training as part of the CASRA Solution. Practice approved e-learning, either default CASRA content or own content, can be integrated. Administrators of the platform can also create new content, deliver online exams and keep track of grades. E-learning content may also be outsourced on a safe server platform, eliminating the need for an elaborate on-site installation whilst allowing the use of the platform by several sites at once.

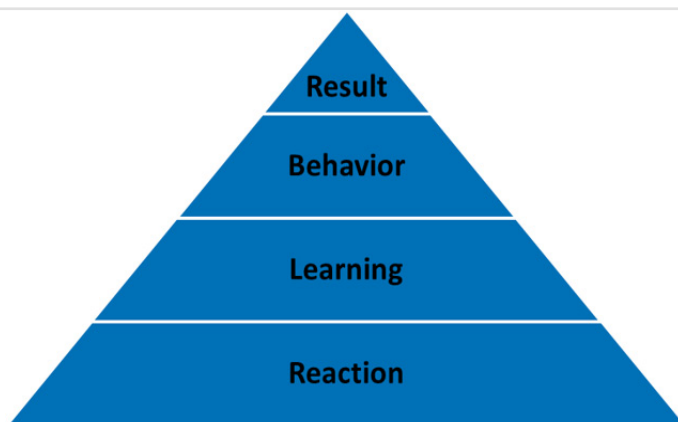


Figure 1: Four levels of evaluation: Kirkpatrick (1998)

They touch on the selection process of images used in the modules and the significance of STA, the scientific basis behind e-learning and, lastly, the user-friendliness of the training. On these grounds, we selected a number of typical questions that are answered below. The next paragraph centers on the question of X-ray image source material and how it relates to effective and efficient threat detection.

IF YOU ARE A SECURITY EXPERT, YOU MIGHT ASK YOURSELF: "HOW DO I ENSURE THAT MY ORGANIZATION IS AWARE OF CURRENT, NEW AND EMERGING THREATS AT ALL TIMES?"

CASRA is carrying out STA in collaboration with national and international organizations and experts on an ongoing basis. This involves a standardized process starting with the scanning of different public and non-public sources, followed by an assessment of threat scenarios (see Science & Security – CASRA Newsletter, [Issue 9](#)). Countermeasures involve updating image libraries of CBT and threat image projection (TIP). In addition, to increase awareness and competence to detect certain threats, e-learning modules are created. This is important for the detection of prohibited items that benefit from

conceptual and contextual knowledge as explained above. Moreover, your security officers' work motivation and confidence increases because they are being continuously updated on current, new and emerging threats and feel adept at detecting them.

Having read about the sourcing of e-learning image material, you might wonder at this point: What is the most suitable and efficient method of convey-

ing said knowledge to security officers? The next section addresses scientific aspects of e-learning.

IF YOU ARE A RESEARCHER, YOU'RE LIKELY TO ASK: "WHICH LEARNING THEORIES HAVE BEEN USED DEVELOPING CASRA'S E-LEARNING MODULES?"

Our e-learning modules are based on the ADDIE model, which stands for: Analysis, Design, Development, Implementation and Evaluation [3]. It is a widely acknowledged and used Instructional Systems Design (ISD) framework of processes for training developers and serves as a descriptive guideline for building effective training and performance support tools in the five phases mentioned above. The last phase, Evaluation, is based on the four levels of evaluation by Kirkpatrick (Figure 1).

Within ADDIE, particular attention is given to the phase of Development, as this phase is being shaped by the

Initial situation

On the market there are many products which are specifically designed for disguising knives in daily objects.

An example for such a product is an iPhone cover, in which a lockable blade over 6cm and further tools are integrated.

TASKONE G3 IPHONE 5/5S CASE

\$99.95

Protection with function. TaskOne G3 is the ultimate protective case for your smartphone. Built-in Stainless steel tools and super rugged aluminum and polycarbonate protect your device from serious impact and give you everything you need at a moment's notice, when all you have is your phone.

Stainless Steel Tools included in the TaskOne G3:

- 2.5" Knife with serrated
- 1.8" sawblade
- Flaw with wire cutters and 3.5mm hex screw drivers
- 5" ruler (1/8" graduations)
- 4 Allen wrenches (1/16", 2.5, 3, 4, 5, 6mm)
- Dual spider wrenches
- Wire stripper
- Small and large ballhead screwdrivers
- Phillips screwdriver
- Rotational reconfiguring saw blade mount
- Dual handcar and portrait kickstands
- Roller opener

SELECT A COLOR: BLACK

iPhone cover Taskone with integrated knife

E-Learning modules for current risks
Hidden knives

Figure 2: Example of a learning unit in an e-learning module introducing a case.

Is this a realistic scenario?

It can be assumed that there will be smuggling attempts with 3D guns in order to reveal possible flaws in current security controls. Particularly for journalists it could be exciting to conduct such attempts and to report on them.

The production of a functioning gun is possible with 3D printer, however it requires substantial technical knowledge.



E-learning modules for current risks
Novel 3D printable guns

Figure 3: Example of a learning unit in an e-learning module evaluating the feasibility of a threat.

How high is the damage potential?

The use of irritant sprays can produce several symptoms ...

› Respiratory tracts

- Uncontrolled coughing fits (irritation of the airways)
- Shortness of breath
- Speech difficulties
- Cramps in the upper part of the body



E-learning modules for current risks
Irritant sprays disguised in everyday objects

Figure 4: Example of a learning unit in an e-learning module assessing damage potential.

educational approach of ECLASS, comprising of the steps of **E**xplain, **C**larify, **L**ook, **A**ct, **S**elf-Evaluate and **S**ummary [4].

E = Explain

The introductory segment should be used to motivate the student by explaining the lesson's purpose and connected benefits.

C = Clarify

This is the main part where theory and the learning content in general are being presented.

L = Look

During this step, one or several examples are being presented to illustrate what previously was discussed in theory.

A = Act

The e-learning user is being encouraged to act and work with the learning content for example by solving problems, write summaries, give presentations, engage in group discussions, etc.

S = Self-Evaluate

In the self-evaluate part, trainees solve test questions autonomously to

verify whether they have reached the lesson's learning objectives or not.

S = Summary / Submit

This is the final element of an assignment or the educational unit. The summary provides a "take home message" by condensing the learning content into a couple short sentences at the end.

Following the ADDIE model, how does the theory translate into practice? After all, an e-learning module will only lead to satisfactory results if the training interface is user-friendly and the instructions in the modules easy to follow. Taking into account usability and user experience of screeners is therefore of crucial importance. The section ahead examines e-learning from a user's point of view.

AS A SECURITY SCREENER, YOU MAY BE CURIOUS: "WHAT DOES AN E-LEARNING INTERFACE LOOK LIKE?"

E-learning modules should be developed with the end user group's specific needs in mind. Clear interfaces, simple instructions and explanatory introduction completed by exit slides

can contribute towards a positive user experience. The goal is a motivating and effective training session that follows the educational approach of the ADDIE model. Hence, each training module contains a number of slides, sequenced according to ECLASS units.

Initially, each threat scenario is introduced. An example of such an introduction can be viewed above (Figures 2). This slide belongs to a module on current threats using hidden knives.

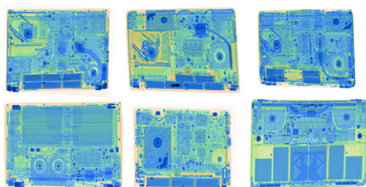
The next learning unit contains an evaluation of feasibility. This section answers the question of how realistic the introduced threat scenario might be (Figure 3).

Following on to that, an assessment of damage potential is given. In case of irritant sprays disguised in an everyday objects, this would include information on the damage potential for humans, as can be seen on Figure 4.

The final building block of the training consists of slides that touch on the significance of threats in relation to daily work by including practice relevant questions. At this point, the security officers

Significance for everyday work

When looking at the x-ray images of six different laptops, there are no larger dark areas in any of them (image below).



Therefore not only single components of an IED, but also dark alarms in electronic devices should evoke clear suspicions. In such cases, particularly the use of additional control methods for the detection of explosives (Explosive Trace Detection, Explosive Detection Dogs, Explosive Detection Systems) in line with the prevailing working guidelines can contribute to clarification.

E-learning modules for current risks
IEDs in electronic devices

Example 2



- ☒ Normal belt
- ☐ Manipulated belt

Your answer is correct!
Click [here](#) to continue.

Show solution

E-learning modules on current risks
IED belt

Figures 5 and 6: Example of a learning unit on the significance of threats in relation to everyday work and a slide showing a test question in the e-learning module on the current risk of "IED belt".

might be prompted to answer a few test questions to ensure that the e-learning content has been correctly understood (Figures 5 and 6). The training concludes with a well-structured transition from theory to application of the learned content in every-day professional life, followed by an exit slide.

Achieving satisfactory results may not only depend on the end user's experience with the training. Inputs by supervisors of security staff are equally relevant and should be taken into consideration when developing e-learning units. A concern that may arise in this capacity could be the following:

AS A SUPERVISOR OF SECURITY STAFF PERHAPS YOU WONDER: "CAN I BE CONFIDENT THAT MY OFFICERS ARE LEARNING WELL AND UP-TO-DATE, EVEN THOUGH THEY ARE NOT RECEIVING FACE-TO-FACE TRAINING?"

Choosing an educational approach based on scientific principles will support the supervisor in achieving on-set quality standards for their organization. The ultimate aim should always be a targeted, purposeful training that enriches the knowledge of his/her security staff. Up-

to-date information on threats, based on STAs, keep the security screeners informed about possible threats. For this, several e-learning modules have been developed, covering current, new and emerging threats such as

- › IED in toys
- › IED belts
- › IEDs in electronic devices
- › Hidden knives
- › Novel 3D printable guns
- › Modified e-cigarettes
- › Irritant sprays disguised in everyday objects
- › Non-metallic IEDs and more.

Another advantage of e-learning is its flexibility. The individual progress of a user is not dependent upon an instructor or other trainees (as it would more likely be the case in a class sitting). If further questions regarding the content of the e-learning modules persist, pairing e-learning sessions with periodical classroom sessions (so-called blended learning), in which the learning content is discussed both in groups and with the instructor, might be recommended.

Aside from benefits in relation to learning efficiency, e-learning modules offer the possibility to train a number of

security officers as soon as possible across the organization in standardized way. They also make it possible to train responses to situations that would be dangerous and/or expensive in reality. Lastly, an easy system set-up that requires minimal administrative effort contributes to the cost-efficient running of a staff unit.

CONCLUSION

We have covered e-learning from different perspectives, learning that the modules should ideally contain a selection of current, new and emerging threats based on STA which ensures a high degree of topicality as well as a purposeful training. Using the method of e-learning also helps to raise awareness of current, new and emerging threats and contribute towards the improvement of the detection performance of security officers. Finally, a user-friendly interface and minor administrative overheads make e-learning a motivating, effective as well as time- and cost-efficient solution for airports and other institutions.

REFERENCES

[1] [Halbherr, T., Schwaninger, A., Budgell, G.R., & Wales, A. \(2013\).](#) Airport security screener competency: a cross-sectional and longitudinal analysis. *International Journal of Aviation Psychology*, 23(2), 113-129. doi:10.1080/10508414.2011.582455

[2] [Koller, S.M., Drury, C.G., & Schwaninger, A. \(2009\).](#) Change of search time and non-search time in X-ray baggage screening due to training. *Ergonomics*, 52(6), 644-656. doi:10.1080/00140130802526935

[3] Bejol, P., Schwaninger, A. (2014). E-Learning and Blended Learning: Pädagogisches Konzept und dessen wissenschaftliche Grundlagen (pedagogical concept and the scientific foundation thereof). Version 1.0.

[4] [Gerson, S.M. \(2000\).](#) E-CLASS: creating a guide to online course development for distance learning faculty. *Online Journal of Distance Learning Administration* [Online].

Science & Security – CASRA Newsletter

ISSN [1664-5715](#)

Published three times a year

Editors:

Dr. Diana Hardmeier

Prof. Dr. Adrian Schwaninger

Editorial Managers:

Alex Kunz

Daniela Kirin

Sarina Baumgartner

CASRA

Thurgauerstrasse 39

8050 Zurich, Switzerland

Phone +41 (0)43 336 01 01

Fax +41 (0)43 336 01 00

E-mail info@casra.ch

Web www.casra.ch