

CREATING A PROFICIENCY SCALE FOR SCENE EXAMINATION IN SCOTLAND

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SCOTTISH POLICE
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Summary: This project builds on existing work and partnership with SPA Forensic Services completed under funded projects on Accelerating Professional Judgement and Decision Making (PJDM) Expertise in Scene Examination. The objective of the proposed project was to create a *Proficiency Scale* for Scene Examination in Scotland. Proficiency scaling is the attempt to forge a domain and organisation appropriate scale for distinguishing levels of proficiency (Hoffman et al., 2014). This approach has been widely used, for example in Navy and Air Force Weather Forecasting, with consequent significant contributions to performance and evaluation in the various domains/professions. Existing Applied Cognitive Task Analysis (ACTA) data was considered alongside additional data and information collected during this project to create a proficiency scale for Scene Examination in Scotland. This will increase our understanding of the different levels of reasoning and knowledge that underpin effective decision making in Scene Examination, and aid in the design of systems and structures to effectively evaluate and develop high proficiency.

INTRODUCTION

Aims & Objectives

The objective of the project was to create a *proficiency scale* for Scene Examination in Scotland. Proficiency scaling is the attempt to forge a domain and organisation appropriate scale for distinguishing levels of proficiency (Hoffman et al., 2014). This approach has been widely used, for example in Navy and Air Force Weather Forecasting, with consequent significant contributions to performance and evaluation in the various domains/professions.

Underpinning Research

Our research to date, on which this project builds, has offered insight into how Scene Examination practitioners think in action. As with many other parallel professions, service delivery is a series of judgements and decisions and Scene Examiners (SEs) are required to process vast amounts of information, to be able to think on micro and macro levels (often at the same time) and to rapidly formulate and enact coherent plans of action (Martindale & Collins, 2012).

We have already studied the development and application of PJDM expertise in several high performance domains (e.g., psychological support for elite athletes, Martindale & Collins, 2013; and coaching, Martindale &

Collins, 2015a) and these concepts are readily applicable to parallel domains of human performance which share the same challenges of high stakes environments (e.g., stressful field conditions, ill-defined and competing goals, conditions of uncertainty, and time pressured decision making) together with the complexity inherent in human interaction.

As SEs develop expertise, so their cognitive development, knowledge structures, and reasoning processes become more sophisticated and enhanced. Yet, these processes are by their very nature 'covert' - making them very difficult to 'see' and therefore to understand and train in developing practitioners. In fact, just the 'exposure' of an individual's reasoning style can serve to assist him or her in making further improvements. Accordingly, examination of these constructs can bring both immediate individual, and longer lasting structural benefit.

Our previous work exploring PJDM expertise has 'made thinking visible' by accessing and capturing the thought processes of experienced SEs (Martindale & Collins, 2015b). This work, using Applied Cognitive Task Analysis (ACTA), has identified the cognitive demands on professional judgement and decision making and the key cognitive elements required to perform proficiently. These findings have offered a unique window on the thought processes of SEs, and transformed covert thinking into detailed observable information about actions taken, situation assessment, and the use of critical cues.

Alignment with SPA Forensic Services Research Priorities

This existing ACTA data was considered alongside additional data and information collected in this new project to create a proficiency scale for Scene Examination in Scotland. Proficiency scales present an analysis of low, medium, and high levels of proficiency with regards to aspects such as reasoning style, knowledge, pattern recognition skill, mental modelling, affect and effort, goal orientation, and metacognition. This proficiency scale will increase our understanding of the different levels of reasoning, knowledge, and cognitive processes that underpin effective decision making in Scene Examination, and aid in the design of systems and structures to effectively evaluate and develop high proficiency.

What we did, how we will do it, and why it is important

An important benefit of proficiency scaling is to provide a clear and valid structure to the nature of expertise, which can act to drive the focus and activities of improvement. Proficiency categories are often based on traditional craft guild terminology (e.g., novice, initiate, apprentice, journeyman, expert, and master) and analysis of proficiency levels displays a more process focused approach in terms of knowledge, skills, and reasoning style, than performance outcome alone. As a further factor to enhance its strength and validity, a proficiency scale for a given domain should be based on more than method, and ideally on at least three methods (Hoffman & Lintern, 2006).

This project used three methods that contributed to the existing ACTA data for the creation of a proficiency scale for Scene Examination in Scotland.

- *In depth career interviews* with nine Scene Examiners (3 x high, 3 x medium, and 3 x low levels of proficiency) about education and training were carried out to yield ideas about breadth and depth of experience, and estimate the hours of experience required for each level of proficiency.
- *Professional standards / licensing* were considered to yield ideas about what it takes for individuals to reach the top of their field. This included an analysis of research into the key attributes of top-performing crime scene examiners (e.g., Kelty & Julian, 2012).
- *Measures of performance* at familiar tasks were also considered for convergence on scales determined by other methods.

A *social interaction analysis*, which can yield proficiency levels in a group of practitioners, was beyond the scope of this project. However, the methods identified above utilised alongside existing data collected from ACTA, was sufficient to create a proficiency scale for Scene Examination in Scotland.

Proficiency scaling can usefully start by distinguishing experts (high and very high proficiency) from novices (very low proficiency; Hoffman et al., 2014). Across the developmental continuum, there are qualitative shifts in the knowledge, skills, and reasoning of practitioners (i.e., the knowledge of novices is not an incomplete version

of the experts, but qualitatively entirely different; Lajoie, 2003). As proficiency develops, analytic, conscious, deliberate reasoning becomes more rapid and automatic. Although years of experience do not *guarantee* expertise, there is a link, in that the longer the career, the greater the *opportunity* to acquire a more diverse range of experiences. The actual level of development is highly dependent on individual characteristics; however, such as those measured by proficiency scaling. It was important to create a scale that is domain (Scene Examination) and organisationally (SPA Forensic Services) appropriate and that considers the full range of proficiency in Scene Examination in Scotland.

MAJOR FINDINGS TO DATE

In depth career interviews

In depth career interviews about education and training were carried out to yield ideas about breadth and depth of experience, and estimate the hours of experience required for each level of proficiency. The hour estimates, education and employment history were organised by proficiency group and are summarised in Tables 1 and 2.

Table 1. Hour Estimation Results

Proficiency Level	Age	Years in SE	Hrs as SE	Hrs training	Hrs other	Hrs in Education
High	M=40 SD=2.6 (37 – 42)	M=13.6 SD=1.6 (13 – 15)	M=24.9k SD=3.2k (21624 – 27920)	M=867 SD=764 (406 – 1750)	M=10.6k SD=4k (6024 – 13549)	M=4k SD=1.7k (2843 – 5890)
Medium	M=35 SD=0 (35)	M=11 SD=1 (10 – 13)	M=14.1k SD=2.2k (11657 – 15627)	M=518 SD=261 (320 – 815)	M=9.2k SD=7.3k (2479 – 17072)	M=7k SD=4.5k (2002 – 10690)
Low	M=27.6 SD=3 (25 – 31)	M=3 SD=1 (2 – 4)	M=4.4k SD=1k (3425 – 5565)	M=315 SD=140 (175 – 455)	M=10.4k SD=2.1k (8525 – 12845)	M=5.9k SD=1.2k (4800 – 7160)

*Hrs – Estimated hours; SE – Scene Examiner

Table 2. Education and Work Experiences

Proficiency level	Education	Other jobs
High	BSc /LLB (Hons) n = 3 English Law, Forensic & Analytical Chemistry, Biology of plants and animals MSc n= 0	Local Council (Working with public in relation to council tax and benefit enquiries); Crew Member, Administration assistant, Floor Manager, Research Assistant, Receptionist, Telephone Banking Operator; Customer Services (Bank), Mark Enhancement Officer
Medium	BSc (Hons) n = 3 Anatomy, Physiology, Physics MSc n= 3 Forensic Science (n=2), Forensic Engineering & Science (n=1)	Customer Service (Various p-t positions), Temp in Research & Development team; Administrator at Sexual Health Clinic, Administrator at Occupational Health & Firearms Licensing Departments; Various p-t positions (Math's tutor, customer service, call handler at complaints department, including suicide calls)
Low	BSc (Hons) n = 3 Forensic Biology, Forensic Science, Marine Biology MSc n= 1 Biological Photography & Imaging	Administrative Role in the Department of Justice; Kennel Assistant, Waitress, Census Enumerator, Dog walker, Administrator for Scene Examination Unit; Forensic Support Assistant

The relevant experiences that SEs found useful for their professional development fell into six clusters: (1) it helped them make and verify their career choice, (2) allowed them to gain hands on experience and deeper understanding of scene examination, (3) contributed to their understanding of how other related departments and systems work, (4) built their resilience by developing confidence and coping skills, (5) provided opportunities to develop communication skills, and (6) developed their cognitive skills (e.g., analytical skills, reflective learning, and professional judgement and decision making).

Professional standards/ licensing

Professional standards/ licensing were considered to yield ideas about what it takes for individuals to reach the top of their field. This included a review of SPA Scene Examination documentation relating to training, competence, development, and performance monitoring. Role profiles for Scene Examiner Level 1, Level 2, and Supervisor were considered, alongside guidelines for training and competence in Scene Examination. Staff training and competence portfolios were considered for Initial demonstration of competence, Maintenance of competence, and Attainment of initial competence. An informal interview was also conducted with the Lead Scene Examiner and Quality Lead for Scene Examination regarding the Knowledge, Skills, and Attitudes required for top performing Scene Examiners in Scotland.

An analysis of research into the key attributes of top-performing scene examiners was undertaken. Researchers in Australia (e.g., Kelty & Julian, 2011; 2012) have investigated the skills and qualities identifiable for high performance in major crime scene examination. The summary of skills found to be critical for effective performance in crime scene examination included: cognitive abilities (e.g., objective and considered decision making), knowledge base (e.g., sound knowledge of scientific principles), experience (e.g., crime scene to court, and highly charged situations), work orientation (e.g., genuine interest in/ dedication to the job, and self-motivated learning), communication skills (e.g., good negotiation and assertive interpersonal skills), professional demeanour (e.g., modest, respected, and self-confident), and approach to life (e.g., consistent, grounded, and self-resilient; Kelty & Julian, 2012).

Measures of performance

Measures of performance at familiar tasks were considered for convergence on scales determined by other methods. This currently takes the form of 'Performance Monitoring' which includes technical and procedural checks of case records and on-site activity, dip sampling, evidence management system dip sampling, direct observation at scene, management of non-conforming work, and SPA/Police Scotland behavioural competency descriptors. The latter document in particular offered useful distinctions between essential, supervisory, and managerial levels of behavioural competency, including development, competent, and exceeding indicators which have directly informed the creation of the proficiency scale.

Applied Cognitive Task Analysis (ACTA)

The Applied Cognitive Task Analysis protocol has now been carried out with three scene examination supervisors per region (East, West & North) representing over 50% of the supervisors in Scotland, and three scene examiners (one per region). ACTA is an effective knowledge elicitation tool, incorporating three methods, which generates vast amounts of valuable information about the cognitive processes underpinning expert performance. Previous findings have indicated potentially important regional differences in the effectiveness of the approach to the examination of a scene. This ACTA data was also used in the creation of the proficiency scale, in particular by considering responses from scene examiners across differing levels of proficiency.

Protocols for Creating a Proficiency Scale for Scene Examination in Scotland

A document outlining the protocols for creating a proficiency scale for scene examination in Scotland was adapted from the Protocols for Cognitive Task Analysis (Hoffman et al., 2008) with permission from Robert R. Hoffman. This included basic proficiency categories, cognitive styles analysis, and some cognitive styles designations. These proficiency scale templates were then refined using the data and processes outlined above to be tailored to the domain of Scene Examination, and in particular to the SPA FS organisation. The proficiency scale includes indicators of reasoning style, knowledge, pattern recognition skill, causal reasoning and mental modelling, affect and effort, goal orientation, and metacognition for high, medium, and low levels of proficiency.

Knowledge exchange/co-productive activity between the research community and SPA Forensic Services

The proficiency scale was co-produced with SPA Forensic Services. In depth career interviews were conducted with staff across a range of experience levels (e.g., low, mid, and high), and consideration of professional standards and measures of performance were carried out in consultation with SPA Forensic Services training and development staff. Accordingly, this project represents an exchange of knowledge between SPA Forensic Services (knowledge, skills & reasoning of staff) and the research communities of University of Edinburgh and University of Central Lancashire (creation of a proficiency scale).

FUTURE WORK

Future work in this area will necessarily start with testing, adjusting, and validating the proficiency scale for scene examination in Scotland. The categorisations are not intended to be inclusive or exhaustive (e.g., Hoffman et al., 2008) and not all scene examiners will fit neatly into one or other of the categories.

In addition, there are a number of benefits to the organisation which result from these clear process markers, especially with regards to understanding how proficiency and expertise in scene examination develops. For example, to achieve high proficiency there is a need for: (1) critical skills for accomplishing the task; (2) a constant 'stretching' of the skill, through increasing challenges (difficult and rare cases); (3) high levels of intrinsic motivation to work hard on hard problems; (4) practice that provides rich, meaningful feedback; and (5) practice based on mentoring or expert instructional guidance (Hoffman et al., 2014). These conditions can all contribute to a 'professional process' focus. The intrinsic motivation mentioned is thus 'operationalised' when committed and/or ambitious professionals have a more objective process marker on which to focus their efforts. Thus, the proficiency scale for scene examination in Scotland begins to encapsulate effective and accepted process markers.

Therefore, in future work, SPA Forensic Services should consider how to integrate these features and conditions, which are necessary for training high proficiency and adaptive expertise, into the Scene Examination environment. There is scope to promote a work-place community of practice for the maintenance of organisation knowledge (e.g., Lintern et al., 2002). This would in turn provide the continuous training, deliberate practice, and associated feedback necessary to achieve higher levels of proficiency. In addition to the evolution of natural work place processes, current CPD systems and structures could be developed to incorporate more structured knowledge and practice audits, differing types of practice (e.g., scenario-based training with varied content & complexity), reflective training (e.g., understanding concepts/terms used to describe thinking & reasoning), team training (e.g., using simulations), feedback (e.g., de-briefing) and mentoring (e.g., dynamic assessment).

This work is reflective of the increasing levels of interest in human factors implications for forensic science in recent years (e.g., Edmond et al., 2016). This partnership between the academic and service delivery communities represents a unique opportunity to develop the conditions necessary for enhancing scene examination performance, and therefore enhancing delivery to criminal justice partners.

Outputs and Impact of the Project

The output from this project is the creation of a proficiency scale for Scene Examination in Scotland. This scale can inform the SPA Forensic Services *Training Needs Analysis*, help to guide the nature and content of professional development and training, and further the development of a *Career Grade Framework*. The scale would usefully contribute to the understanding of how to develop Scene Examination staff for high proficiency. The impact is likely to be on training and development policy and practice, and evidence of this impact may include citations in SPA Forensic Services documents, incorporation in training or CPD material, independent documentary evidence (e.g., email testimonies), and process evaluation on uptake of the scale.

SOURCES OF FURTHER INFORMATION

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