The “Scenario Invention Task” (SIT): an innovative method for harnessing natural human creativity

Anjum Naweed

Appleton Institute for Behavioural Science, Central Queensland University, Adelaide, South Australia, AUSTRALIA

1. Introduction

Many industries the world over are undergoing a trend of very high job growth. In the case of Australasia, exponential increases in the demand for train drivers have been predicted (Infrastructure Partnerships Australia & PriceWaterHouseCoopers 2009). As the demand for services continues to increase, there is a need both to retain the expertise, but also continue filling the positions being made vacant through resignation and retirement. A key barrier in the way of being able to supply drivers is the current workforce profile. Between 2004 and 2008, the average age of the Australian train driver grew from 38 to 43 years of age (Mahendran 2007; Transport and Logistics Industry Skills Council 2012), and in 2008, the median age of the workforce was higher than in many other industries (Department for Education Employment and Workplace Relations 2009). This pattern shows no sign of subsiding but the issue is complicated by the skill underpinning train driving (Naweed et al. 2013).

Train driving involves operating long and heavy trains in an environment where signals are hidden from view and the driver is engaged in a tug-of-war with huge dynamic forces (Branton 1979; Hamilton & Clarke 2005). The rail industry has traditionally trained the skills required to overcome this through a blend of on-the-job practical work and off-the-job theory. Route knowledge is a constituent of this that can take years to acquire, mainly through repeated cab rides. This is however, a very time consuming process. Capturing how routes are understood and encoded is essential before it is lost altogether. It is important to first build a cohesive picture of what actually constitutes train-driving expertise and route knowledge, both from the operational and internal cognitive perspectives before the way this expertise is delivered is optimised.

Train driving also involves considerable risk. A signal passed at danger (SPAD) is a rail industry term for a train that has gone past a stop signal and encroached into a section of unauthorised track. Sustaining attention for long periods increases the drivers' vulnerability to various task-related disturbances and risks, which impact the way route knowledge is internally mediated SPAD errors are frequently attributed to preoccupation on competing tasks, inattention, and distraction (Edkins & Pollock 1997). Capturing how train drivers have encoded the route, tasks, and coordinated it against their responses to safety scenarios is critical for understanding the demands of the environment and building resilience. This abstract outlines a “Scenario Invention Task,” (SIT) a generative and innovative method designed to harness natural creativity to understand how they make sense of complex information and coordinate expert behaviour.

2. Practical innovation

Eliciting knowledge from experts in complex systems can be problematic. Much of it this knowledge is tacit and resistant to conscious introspection (Cullen & Bryman 1988). As a case in point, train-driving knowledge is notoriously hard to elicit. Beyond the obvious difficulties, Branton (1979) describes the underlying skills in train driving as 'enactive,' implying that knowledge accumulated through routine behaviour may be especially difficult to extract. Whilst interviews and observational methods have been used when eliciting train-driving expertise, few approaches have incorporated generative visualisation techniques used in participative design (Hughes & Parkes 2003; Sperschneider & Bagger 2003). The SIT is a novel methodology that is able to stimulate the retrieval of expert knowledge in the rail and other domains.

3. How to do it

Generative visualisation tasks aim to externalise the mental representation or knowledge of some part of the environment. These sorts of data have been shown to provide significant correlation with spatial knowledge (Aginsky 1997). Theoretically, the underpinning of these methods for knowledge elicitation is stemmed in the multiplicity of dimensions. Thus, daily experience is visual and sensory but may not always be explained with words or be reduced to language (Eisner, 2008, as quoted by Bagnoli, 2009). Including the non-linguistic
dimensions in research methodology may allow access to innate experience and represent different levels of that experience (Bagnoli 2009). The use of visual and creative methods can facilitate investigating layers of experience that are not so easily put into words (Gauntlett 2007). SIT uses principles of rich picture situation summaries (Checkland 1980; Monk & Howard 1998), but in practice, the SIT requires a rapport-building platform before it can be applied. Thus far, all the research using this method has been conducted in Focus Groups and part of the Critical Decision Method.

The SIT is initiated partway through a Focus Group or interview with a request for participant(s) to invent a challenging scenario (or stretch of railway) using felt-pens and paper. The task is unconstrained and participants use their own formalisms, interpretations, and drawing conventions. Once invented, each participant is asked to imagine or simulate driving over their route and describe the strategies they would apply to achieve this unscathed and without incident. This involves listing strategies, pinpointing where key decisions would be made, and highlighting pressure points. Time is allocated to draw and think up driving strategies, and each participant is asked to provide a ‘walk through’ of their drawings and encouraged to provide their commentary on others’ drawings.

Figure 1. Sample data collected using the SIT during a SPAD study (note these are to illustrate the diversity of data that came out of the task).

Figure 2. Sample data collected using the SIT during a Route Knowledge study (note this is to illustrate the diversity of data that came out of the task and are unmodified for legibility.)
Figures 1 and 2 illustrate two examples of data that were collected as part of the SIT. The pictures convey the individualistic and nuanced approaches participants used to construct their interpretations, formalisms and drawing conventions. The SIT was considered to address project aims, enrich the data pool, and offer an important therapy to participants who found it difficult to articulate their views. A number of participants in different focus groups exclaimed that they “did not realise [they] knew so much.”

Having elicited expert knowledge using the SIT, consideration must be given to what the process to analyse it looks like. This depends on the research question, but the most prevalent way of analysing these data is to transcribe the accompanying commentary and draw themes and conceptual groupings from phrases, comments and features in the transcriptions, which would ground the findings (Huberman & Miles 1994), and to use the drawings to support them. Depending on preference, users are advised to used a structured approach such as Grounded Theory (Glaser & Strauss 1967), and a combination of inductive and deductive coding techniques. Thus the categories and themes are not predefined but emerge entirely as a function of (inductively) analysing the orthographic transcripts, and subsequently, reveal a series of codes that can be applied to the drawings. The data can then be analysed (deductively) for their content using a predefined process devised to meet the aims of the study. These findings were then used to visualise different route features and characteristics in a spreadsheet and the same sort of process could be applied to the verbal data from the cab rides.

4. Where It Has Been Used

The SIT has been used to inform and develop the way route knowledge is delivered and acquired in training. However, consideration must be given to the applicability of the reported approach to eliciting other types of expertise. In the rail domain, the approach is suited to operational tasks and capturing expertise of related or co-dependent tasks, such as that performed by the Controllers/Signallers. However, the expertise in the work activities performed by other forms of frontline tasks, such as train dispatchers (i.e. platform staff) and train guards, may also respond well. Looking beyond the task itself, the toolkit has specific utility for eliciting expertise in different contexts. The SIT was used to collect expertise of train driving associated with SPAD occurrences (e.g. Naweed 2013). In this context, the task focused on challenging scenarios to develop an understanding of the behaviours, risk perception and locus of control in the expertise associated with those situations (suitably modified and adjusted for ethical considerations). Another study used the SIT to examine the workload and error tolerances of train drivers in ‘driver only’ and dual-driving modes. In short, there is a great deal of versatility in the toolkit and it appears to responds very well to different operational environments and/or different contexts where articulation of expertise is a barrier to eliciting knowledge.

5. References


Naweed, A. (2013). Psychological factors for driver distraction and inattention in the Australian and New Zealand rail industry. Accident Analysis & Prevention, 60(0), 193-204.

