Developing a framework of behaviours before suicides at railway locations

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Acknowledgements. Part of this study was carried out as part of the RESTRAIL project, receiving funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 285153.

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Abstract. Better knowledge of behaviours of people at railway property could help with identifying those at risk of suicide. Literature has been reviewed from a range of disciplines on what is known about studying behaviour in this type of public location. Secondary analysis has been carried out on descriptions of behaviour from structured exercises with experts and other pre-existing sources. A framework has been produced with five main classes (display of emotion, appearance, posture/movements, activities and interactions) and associated sub-classes. Commentary has been provided on factors that influence identification of suspicious behaviours, how to distinguish these from normal behaviours and the circumstances that inhibit timely reactions to the behaviour amidst the complexity of the operational railway. Opportunities to develop and use the framework are discussed, including using this to prompt collection of additional behavioural data from wider resources, enhancing staff training and developing requirements for effective use of surveillance technologies.

Practitioner summary. Many railway suicides could be prevented with better understanding of behaviours before events. Pre-existing data sources have been analysed, producing a framework highlighting five aspects of behaviour. This can prompt collection of better evidence on behaviours before suicide, with future applications in developing surveillance technologies, training staff and public awareness.

Keywords. Suicidal behaviour, railway, reporting, observation, surveillance technologies.

1. Introduction

Railway suicide is the largest contributor to loss of life on the railway, accounting for 88% of fatalities across Europe each year (approximately 3000 in number) (ERA, 2014). The circumstances surrounding these types of incidents are complex and there are no straightforward solutions to this as a problem for the rail industry or wider society. Preventative measures attempt to achieve their goals in different ways, such as limiting ideation of suicide on the railway, restricting means of access to the railway, reacting to intervene when people are identified as posing a risk of suicide, or efforts to minimise the impact of any collision (Burkhardt et al, 2014; Rådbo et al, 2008). One of these mechanisms of prevention (responding to a threat or incursion on the railway) relies on the ability to identify suspicious behaviours and react in a suitable way, in sufficient time to prevent an incident.

How people behave in the period leading up to suicide on the railway can be very variable. Within the psychological and biological literature there is on-going discussion about the definition and understanding of behaviour as a concept (Bergner, 2011, 2016; Levitis et al, 2009). At a practical level, life-saving interventions do occur on a regular basis on the railway, with police, station staff or members of the public making successful approaches to people who are displaying some kind of warning signal (Sutherland, 2015). Recent studies provide descriptive details on behaviours in this railway context (Mishara et al, 2016). A more complete understanding of the observable behaviours could strengthen training of staff and raise awareness of the public, as well as aiding the development of surveillance technologies.

The ergonomics discipline has made valuable contributions to improving safety and performance across many functions of the railway, such as traffic management and control (Balfe et al, 2012; Farrington-Darby et al, 2006; Golightly and Dadashi, 2017; Stanton and Baber, 2008), driving (Dunn and Williamson, 2012; Naweed et al, 2015), rail engineering (Wilson et al, 2009), risks at road / rail crossings (Read et al, 2016) and organisational strategy for rail organisations (Ryan and Wilson, 2009). There are currently no published studies in the mainstream ergonomics literature on suicide prevention, in spite of the discipline being well positioned to contribute to the understanding of people's behaviour and the design and implementation of technologies and associated processes for prevention.

The aim of this research is to produce a framework of behaviours of people involved in railway suicide, by investigating what can be collected from a variety of sources of evidence on these behaviours. This paper includes review of the current research in a number of disciplines with different perspectives on studying behaviour. This covers the current level of knowledge on behaviours in railway settings, how behaviour can be detected and studied in public locations, and potential relationships between observable behaviour and the expression of emotion. A number of recent studies of behaviours prior to suicide on the railway are then outlined. Results from these studies are integrated to produce a framework of different aspects of observable behaviour. Suggestions are made for how this can be used in future analyses and prevention activities, taking account of the wide ranging factors that can influence the study of behaviour of people on the operational railway. In the remainder of this paper the term

"pre-suicidal behaviour" is used when referring to the behaviours that have been observed prior to railway suicide. Silverman (2016) has provided detailed commentary on the confusion that surrounds definitions of terms such as suicide and the range of additional terms that can be relevant in the study of suicidal behaviour (e.g. suicidal ideation, attempted suicide, parasuicide, self-harm). The current study, in describing observable behaviours on the railway, is not intending to contribute to this debate on terminology.

2. Review of literature

2.1 Reported pre-suicidal behaviours in railway contexts

Various publications identify behaviours in the period leading up to suicide incidents in the railway environment (Guggenheim and Weisman, 1972; Gaylord and Lester, 1994; O'Donnell et al, 1996; Dinkel et al, 2011). Guggenheim and Weismann (1972) were the first to classify pre-suicidal behaviours, reporting on four common behaviours in underground suicides: jumping in front of a train; lying across the rails; touching an electrified line; and wandering on the track area before the arrival of the train. Dinkel et al (2011) used this classification to study over 4000 mainline incidents in Germany.

O'Donnell et al (1996), based on interviews with 20 rail suicide survivors, explained how almost all jumped in front of moving trains, with some choosing the first train they saw when entering the station. Others allowed several trains to pass by, or travelled around the rail system before getting off the train and accessing the track. One person removed her shoes before jumping, whilst the rest did not exhibit any different behaviours to others on the platform.

Lukaschek et al (2011) used a survey in Germany to explore expert knowledge in 202 police officers, identifying a list of pre-suicidal behaviours. These are shown in Figure 1, alongside examples from other published studies where common behaviours are reported. This figure includes findings from Mishara et al (2016), who reported on a two part study to identify behaviours from CCTV recordings of suicides in metro systems in Canada. In the first part, using trained observers and multiple camera views, several more easily observable behaviours (e.g. practicing jumping) and less tangible behaviours (e.g. psychomotor agitation) have been identified. The second part of the study used a larger group of

observers, with minimal training, to determine whether target pre-suicidal behaviours could be distinguished from recordings where no event occurred. Some of the more obvious behaviours were identified and the researchers have concluded that there is scope for developing this observational approach to identify those at risk, especially by considering some combinations of behaviour.

[Figure 1 about here]

People's behavioural intentions and their planning of events in different railway locations have been described. For example, it has been suggested that people may seek out a prominent location of the station with high speeds and frequencies of trains, or open tracks with high line speeds (Clarke and Poyner, 1994; Lukaschek et al., 2011; Rådbo and Andersson, 2012) and fewer witnesses (Ladwig et al., 2009; Guggenheim & Weisman, 1972). Hiding, searching for seclusion (in vegetation, sheds, darkness) and choosing less busy locations to enable final preparation of the act without disturbance are common features of pre-collision behaviour (Rådbo et al, 2012). Rådbo et al (2005) pointed out how the majority of the victims in their study waited on or beside the tracks for some time before they were struck. However, not all suicides on the railway are likely to result from carefully planned activities. A significant proportion of suicides are thought to be impulsive or unplanned (Rimkeviciene et al 2015). Differences between the planned and impulsive origins of events could influence the behaviours that are visible at railway locations.

Various types of pre-suicidal behaviours on the railway are reported in the literature. There is considerable overlap across the studies, but also unique findings. Some of the descriptions are lacking clarity (e.g. about what it means to be erratic, unusual, aimless, depressed). Reports can also be anecdotal in nature. Some might be situation specific (e.g. looking down tunnels in metros) or culture specific (e.g. the type of clothing worn). Many of these will occur quite close to the time of the event and their main value could be in differentiating between accidental and deliberate events (Driever et al, 2002), rather than enabling earlier interventions. Currently, there is not a clear articulation of the types or different elements of behaviour, or how easy these are to observe.

2.2 Surveillance of behaviours in rail security contexts

Many publications report on surveillance systems (e.g. camera and visual analysis systems) in transport or other public locations (e.g. Arroyo et al, 2015; Candamo et al, 2010; Delgado et al 2014; Denman et al, 2015; Paul et al, 2013). Popoola and Wang (2012) classify three research directions: detection and tracking, human motion analysis and activity analysis. Technological challenges can impact on the success of detection and tracking of people in busy environments (Candamo et al, 2010). These include identifying people in varying lighting conditions (indoor and outdoor), against a range of visual backgrounds (e.g. movement of people and trains within visual images) and maintaining focus on a target person as they move through cluttered environments with various possibilities for occlusion. Novel applications of human motion analysis have been reviewed (Lim et al, 2015), including motion detection (Candamo et al, 2010) and identification of common events. Examples of studies of common movements or actions include walking, running, waving, jumping (Vats and Chan, 2016) and recognition of the quality of movements, such as human gait characterisation (Paul et al, 2013) or angry postures in crowds (Gilbert et al, 2011). Activity analysis has been described as the area with the greatest potential for research development (Popoola and Wang, 2012). This commonly studies how people are interacting with the local environment (e.g. Candamo et al 2010 elaborate on how interactions between the person and facility can be indicative of trespassing) and the importance of the study of behaviour in context. This can be effective in identifying abnormal (Candamo et al, 2010; Paul et al, 2013), anomalous (Suriani et al, 2013), suspicious (Arroyo et al, 2015) or deviant behaviours (Burghouts et al, 2011) in comparison with what is normal at a railway station.

Several categories of anomalies have been described (Candamo et al, 2010; Popoola and Wang, 2012), such as detection of lack of movement (of people or abandoned objects), displaying unusual speed, forbidden, unusual or wrong direction movements. Different applications of technology can be used to support identification of these anomalies. These include securing the perimeter location to detect track incursions or access to high risk or secluded areas, and detecting loitering and abandoned objects through change detection analytics (Denman et al, 2015).

Candamo et al (2010) refers to detection of multiple person interactions, which can be indicative of disturbances in crowds. This is typically in fighting or attacks, but could be anomalies in the collective behaviour of crowds if a suicidal person is in a place of risk and draws the attention of others (Gallup et al, 2012). Anomalies can be identified by determining the densities of crowds and unexpected patterns in crowds (e.g. analysis of nearest neighbours or clustering algorithms, Kok et al, 2016).

Suriani et al (2013) investigated advancements needed for the detection and response to sudden events. Vats and Chan (2016) used computer vision and fuzzy set theory to detect human activity as early as possible, with the intention to identify this as soon as it began and before the activity finished.

There are developing technological capabilities to detect actions, anomalous behaviours, movements into forbidden areas, or movements around stations, when people are alone or in groups. Consideration needs to be given to how this can be done early enough in a sequence of behaviour to enable an intervention. There are still practical challenges in deploying these effectively in real life environments.

2.3 Expression of emotion

The expression of emotion was explained at length by Darwin (1998). Several recent publications consider visible display of positive or negative emotion through facial expression and body posture and movements. Aviezer et al (2012) used a study in a sporting context to demonstrate that body posture may be a better discriminator of emotion than facial expressions during peak displays of emotion. Martinez et al (2016) used actors to produce static and dynamic representations of the six basic emotions (anger, disgust, fear, happiness, sadness, surprise) and tested how well these could be recognised through facial, body or combined facial and body expressions. They concluded that there are important differences in how emotions can be detected at a distance or in close contact with people. Expression through body postures showed the greatest potential at distance and for longer and shorter times of exposures to cues. Considering these expressions of emotion in context can be important for minimising errors in identification (de Gelder and Hortensius, 2014). As examples, bodily expression can provide important context for interpreting facial expression and the reactions of others to an emerging event can influence the understanding of emotional expression.

Recent studies have attempted to link descriptions of static postures and functional movements to expressions of affect, such as anxiety, despair and sadness. Kleinsmith and Bianchi-Berthouze (2013) summarise details of the discriminating features that have been identified within the literature for 34 affective states. Figure 2 shows some of the features that have been identified for a selection of affective states.

[Figure 2 about here]

These discriminating features place an emphasis on the postures (e.g. position of various body parts, twist of the body or symmetry in the posture) and description or characteristics of movements (e.g. stepping motions, amount or speed of movement, rate of change of the movement, force, fluency, fluidity, tension or control of the movement, Dael et al, 2013; Garber-Barron, 2012) or the lack of movement (such as freezing in terror, Karg et al, 2013). To date, outputs from this type of study of bodily expression have been applied in the development of video games or robotics (e.g. Dael et al, 2013), but may have potential for wider application.

2.4 Detecting and responding to behaviour and expression of emotion

Hawton and van Heeringen (2009) report how it is possible to identify high risk groups and produce strategies for the general reduction of risk of suicide in populations. In contrast, the prediction of risk in individuals is difficult, with a need to consider issues such as the imminence of risk (perhaps displayed by hopelessness), the intention to die, the extent and likely success of planning of the means of suicide, the availability of the means of suicide and the presence of other contributing factors that could heighten risk (such as alcohol). Assessing factors such as intention to die has been considered by Beck (1974). This type of assessment can be problematic (Freedenthal, 2007; Kamerow, 2012), due to the questionable reliability of what people might say about their intentions. There are thought to be limitations in the ability of experts to predict suicide in individuals, with high numbers of false positives, even when using the best known predictor variables. This could raise questions about placing too much responsibility on community based people or rail staff to identify and respond to indications of risk (Goldney, 1992).

Identifying someone close to the point of carrying out a suicide attempt at a railway station is likely to be different to predicting suicidal intention in clinical settings. When observing behaviours at railway property there is clear access to a means of suicide and interactions with the person are close in time to a potential event. Reisch (2012) has commented on aspects of behaviour that might be associated with different phases of suicide (presuicidal phase, mental pain phase, first suicide action phase, final ambivalence phase, final phase of action, waking up). Examples included observable indicators such as lack of eye contact in the first suicide action phase or "standing with crossed arms leaning forward and .. extremely tense, the gaze directed downward" whilst on a bridge or at a train station in the final ambivalence phase of suicide. Reisch suggests that this knowledge implies that people (e.g. police officers, taxi drivers, train drivers) can be trained to identify and react to some of these behaviours. In order to determine the future direction in supporting the identification of pre-suicidal behaviour at railway locations it is necessary to clarify precisely what can be observed and how this is reported.

2.5 Concluding comments from the review of literature

The review of literature has covered content from a broad range of disciplines. There are various reported behaviours, though there is not much description or a clear structure for the different aspects of behavioural content. More could be done to clarify what people report naturally and in what level of detail, providing a more coherent structure to understand the range of behavioural content that is relevant in this context. It is also important to consider how this knowledge could be used in future prevention work, such as training or development of technological support tools.

3. Method

3.1 Overview of the approach to collection and analysis of data on behaviours

The collection and analysis of the data has been inspired by the pragmatic approach of Miles et al (2014, pp6-10), as well as elements of content analysis (see Graneheim and Lundman, 2004 for a review) to assemble, condense, compare, classify and interpret descriptive data from various sources of behavioural accounts.

The first source was the narrative accounts that are already documented in records and databases. The second type of data was new information that was collected in structured workshops with staff to understand more about their expert knowledge and experience of public behaviour in these contexts. Outlines of methods and conclusions from preliminary analysis of data from several of these sources have been presented in Ryan (2013) and Ryan (2017). The current study collates and produces detailed findings from reanalysis and synthesis of content. In order to explain the provenance of the data, details of the sources and methods of extracting and analysing the data within the current study are presented below. All parts of the work involving collection of data from participants received permission from the Faculty of Engineering Ethics committee at the University.

3.2 Identification and review of existing sources of data on behaviours

3.2.1 Narrative data on reports of behaviour of people before incidents, as recorded in an industry database.

The SMIS (Safety Management Information System - http://www.rssb.co.uk/risk-analysis-and-safety-reporting/reporting-systems/smis) database is compiled and updated by rail organisations and transport police and contains a broad range of information on incidents. The analysis draws on data from 257 incidents that have occurred over a 20 year period at 51 stations on three separate rail routes close to London (Ryan, 2017). The data set contains details of the types of behaviours that occur at a range of stations (large and small mainline stations). A narrative data field contains brief descriptions from witnesses.

3.2.2 *Examples of testimony in case studies that are collected by the Samaritans.*

The Samaritans (a UK registered charity and suicide support organisation) collect written descriptions of how people have intervened to prevent incidents. These testimonies are recorded in free text accounts (approximately half to one page in length) containing descriptions of behaviour that has been observed. Nineteen, anonymised testimonies were provided by the Samaritans for the study.

3.2 3 Descriptions of behaviour from CCTV footage

Analysis of behaviours on CCTV footage can meet with some resistance from within the industry, either because of issues of data protection, ethical concerns or sensitivities in releasing this type of data. In

Great Britain, the coroner liaison officer for the British Transport Police (BTP) observes and provides written descriptions of CCTV footage (where it is available) for all suicide cases that are considered at a coroner's inquest. Eleven, anonymised examples of the descriptions from CCTV recordings of incidents were provided for analysis.

3.3 Structured workshop exercises to collect new data

3.*3.1 Overview of the structure and content of the workshops*

Two workshops were conducted with 12 expert staff from the BTP (senior officers and frontline staff with experience of patrolling stations and making interventions to prevent incidents, n=8), Network Rail (one member of the suicide prevention team and one first responder to incidents, n=2) and the Samaritans (responsible for training industry staff in how to identify people at risk and how to respond to incidents, n=2). The workshops were designed to collect information from people who had specific experience of dealing with railway suicide and trespass and enable the exchange of ideas about the behaviours of people in the period prior to an incident.

3.3.2 Content of the exercises from the workshop and.

The workshops contained five exercises, as outlined in Figure 3.

[Figure 3 about here]

3.4 Analysis and synthesis of the data

The analysis was conducted in a series of steps. Relevant descriptions of behaviours from different sources (Sections 3.2, 3.3) were extracted and recorded in separate summary tables, providing a corpus of data for further analysis. For example, for the data from SMIS (Section 3.2.1, also in Ryan, 2017), this analysis included grouping of similar behaviours and identifying relevant differences in behaviours (e.g. jumping into the path of the train, as distinct from jumping onto the track to await the arrival of the train). These groupings reflected distinctions within earlier studies (e.g. jumping, lying, wandering), but also recorded additional descriptive content about the event. A similar process of collation, clustering

and summary of behavioural content was carried out for the written testimonies and the CCTV descriptions.

Findings from the workshop exercises were collected using a combination of individual written accounts, lists prepared by the experts, or contemporaneous notes that were taken to record the group discussion (Ryan, 2013). The text records for each exercise were read and coded to identify behavioural-related phrases. These phrases were reviewed and clustered into distinct groups of behaviour.

The outputs from the analyses of the sources were collated in three detailed tables (shown later in section 4), reflecting what is known about behaviours in different periods of time before an event (immediately, a moderate time, or a longer time before). These tables enable traceability of the content to the original source of the information.

A second phase of analysis of this corpus of data was carried out, using coding and memos to interpret the content. Features of the behavioural data were identified, producing a set of five behaviour types (see later in Table 4). These were explained, summarising the evidence on the behaviours that they represented. Commentary was also provided on the potential to identify (either by observation by a person or using technology) and respond to these different features of behaviours. This commentary was provided using expert knowledge of human factors, the rail suicide problem at rail property, the wide ranging factors that influence safety and performance on the operational railway, and outputs from review of literature on related research areas.

4. Results

Tables 1 to 3 present comprehensive accounts of the range of behaviours that have been identified using the different study methods, over three time periods. There is not a firm distinction between these periods (typically weeks or hours before an incident for longer term; minutes to seconds for medium term and seconds for short term), with some potential for overlap in the behaviours. However, the findings are presented in this way for ease of viewing the details of behaviours that may have differing opportunities for safety interventions. Each of the seventy rows in the tables relates to a different example of reported behaviour. These tables show where a behaviour has been identified by one or

more methods, including variations in the way in which the behaviours have been described in the different sources. The tables therefore provide lists of the observable behaviours and commentary on the practicalities of observing and reacting to these.

[Tables 1-3 about here]

4.1 Findings from the historical data sources

The narrative data on behaviours from the SMIS database related primarily to the short term (e.g. people ran suddenly from a platform, Table 3) and medium term behaviours (e.g. people tried to conceal themselves behind buildings and bridges, Table 2). There was one example of long term behaviour (Table 1), where someone was noticed at a station earlier in the day. These accounts also contained details of access points (e.g. from station platforms, with small numbers from crossings, bridges or climbing fences) and train types (e.g. high speed and lower speed trains were involved). There are explanations of how people accessed the railway, often crossing the tracks in search of trains. These accounts indicate different time intervals between being noticed and being struck by the train. It is possible to see the potential influence of the station configuration on the types of behaviour. Some details are available on postures and gestures prior to impact with the train.

The descriptions of CCTV images contained information in 19 of the behaviour categories, even though this analysis was based on a small sample of observations. The descriptions cover aspects of observable behaviour across the three time periods. For example, the accounts described longer term reconnaissance visits for planning of events. Medium term behaviours included explanations of how people moved around stations or the tracks, went to isolated locations and the types of strategies they used in searching for trains or looking at the information board for train times. Short term descriptions included examples such as rapid movements to the platform edge for some, and a slow, deliberate walk to the edge for others. In one instance, an account (not shown in Tables 1-3) referred to the visible evidence of other passengers who were “peering” at the incident site, even though the incident itself was not visible on the CCTV footage. The accounts also contained explanations of things that are “not”

observed, such as “not pacing”, “not rocking” or “does not appear in distress”. Details could also be inferred from what was available (e.g. the time period in which people were at a station - between 8 and 30 minutes, the numbers of trains that people allowed to pass by).

The written testimonies from people who have carried out interventions contained details in 13 of the behaviour categories. These testimonies included accounts of behaviours that could be observable much further back in time (e.g. by family members) through to more immediate behaviours before an event (e.g. details of the locations at which events occur). These accounts demonstrated the range of people who can observe and potentially initiate interventions in response to suspicious behaviours, as well as explaining different types of interventions that are possible.

4.2 Findings from the workshop exercises

The workshop exercises were designed to prompt for behavioural content from a number of perspectives. Tables 1-3 show the following have been identified from the different exercises:

- A wide range of behaviours has been reported, such as unusual or erratic behaviours, having a particular focus on trains or the infrastructure, and some unexpected behaviours (e.g. being inconspicuous or well-dressed) (exercise 1)
- Behaviours were identified across the three time categories
- Behaviours can be difficult to distinguish from typical behaviours at stations (e.g. waiting or letting trains go by) (exercise 2)
- There is evidence on how people recognise when things are not right (e.g. including references to “gut feeling”, and how something is out of context for the location (e.g. someone being somewhere they should not be) (exercise 3). People may also be identifiable at home as being at a higher risk, displaying behaviour which is out of character, changes in appearance or how they interact with friends.
- Choices are evident in how people access the track (e.g. at fast lines with non-stopping trains) (exercise 4)
- There are examples of concealment (e.g. moving from behind bridges and being in poorly lit locations) (exercise 4)

- Suggestions have been made for how to intervene (e.g. moving closer to someone) (exercise 1), and the need for people to have the courage to do something (e.g. asking if someone is okay) (exercise 5)
- It was suggested that there should be better coordination between organisations and improvements in the use of existing knowledge and data (e.g. CCTV) (exercise 5).

Several behaviours were identified in two, three or even four of the different workshop exercises, as well as being identified from the other types of historical data that have been used in this study (e.g. repeated visits to the station, waiting on platforms, something being "not right", looking disconnected / lack of eye-contact). Many of the behaviours were identified in only one of the exercises, demonstrating the value of using a wide range of methods in this study.

4.3. Identifying different types of behaviour

Each of the examples of behaviour from Tables 1-3 have been classified into five categories, as shown in Table 4. These are decomposed to display sub-classes within the behaviour types. Table 4 includes commentary on the potential to observe and react to these behaviour types.

[Table 4 about here]

5. Discussion

5.1. Breadth of coverage of pre-suicidal behaviours and ability to discriminate risk of incident from the observable behaviours

This is the first piece of work that has gathered together such a broad range of descriptive evidence about the behaviours of people before rail suicide events. This study does not aim to present a clear characterisation of which behaviours can predict suicide at railway stations. The results are from analysis of what people have found relevant to report and these are valuable because they expand existing knowledge of different aspects of behaviour that are notable in the period leading up to an event. Further studies are needed to determine which of these could be predictive of a suicide event.

The preliminary framework characterises different aspects of behaviours in the period leading up to incidents, with extensive content from a number of different sources (Table 4, supported by Tables 1 to 3). Firstly, the framework identifies some of the nonspecific visual indications of *emotional response*, reporting about visible signs of despair, vulnerability, agitation and being anxious (see also Mishara et al, 2016). These signs are likely to be recognisable to observers (Martinez et al, 2016), but observable features were not articulated in greater detail. This raises an interesting point about how people identify and report (Ericsson and Simon, 1993) on suspicious circumstances. deGelder and Hortensius (2014) explain how people interpret and respond to visual cues of emotion within a specific context, but find it more difficult to describe visible features or provide labels for an emotion that is being expressed. It is therefore not surprising that people do not naturally describe the visible cues that contribute to their interpretation. People can be vulnerable to reporting things that they can not know (Nisbett and Wilson, 1977), especially if inappropriate prompts or questions are used (Ericsson and Simon, 1993; Ryan et al, 2010). It will be important in future studies to investigate how people identify and respond to pre-suicidal behaviours, giving consideration to what they are comfortable with reporting.

The second aspect of behaviour in the framework related to *appearance*, such as visual indications of alcohol problems or mental health issues (Lukaschek et al, 2011; Mishara et al, 2011). Of particular interest is the importance of considering appearance in context and a range of examples have been collected. The diagnostic value of multiple indications has also been recognised (Table 2, 4).

A variety of *postures, gestures and movements* have been classified (Table 2, 3, 4). Some of the content is consistent with known pre-suicidal behaviours, such as the immediate behaviours of lying, jumping and wandering to access the track (Guggenheim and Weisman, 1972; Dinkel et al, 2011). Additional descriptive content is provided on activities such as crossing tracks and movements around stations (Mishara et al, 2016) in search of trains. A relatively small proportion of these relate to the types of postures and movements that have been reported by Kleinsmith and Bianchi-Berthouze (2013) as discriminating features of affective states. It is difficult, currently, to identify specific affective states with confidence as there are similarities in the discriminating features (Figure 2). The current analysis has been valuable in considering what can be observed, what draws people's attention in terms of bodily

expression and how this could be used to indicate underlying emotions. For example, the sudden and slow deliberate movements to the platform edge, sitting with the head down, and open arms in front of the train might give some insights into anticipated affective states of being anxious, defeat, despair, fear and terror (Figure 2). Stepping back temporarily, could indicate some hesitancy, similar to the ambivalence that has been described by Reisch (2012). States of joy or serenity might be evident in the high quality of motion (Dael et al, 2013; Kleinsmith and Bianchi-Berthouse, 2013), seen in dancing across the platform, arising as a result of making a decision. This sense of relief in observable behaviours was something which has also been expressed by participants in workshops. It is possible that the limited accounts of these discriminating features could result from a lack of awareness or limitations in the ability of observers to identify and describe relevant aspects of these visual cues. Greater staff knowledge of some of these discriminating features might prompt closer inspection of body postures, gestures and movements in the real life context of the railway environment, either in real time observations at railway stations or in analysis of CCTV data.

Several sub-classes of *events, activities or actions* have been identified (Table 1-4), including commonly reported waiting and searching behaviours (Mishara et al, 2016; looking for the train) and how people interact with possessions (Gaylord and Lester, 1994; Lukaschek et al, 2011; Mishara et al, 2016). In order to identify these from amongst other similar behaviours at stations it will again be necessary to discriminate whether these are out of character for the location. There are occasional reports of hiding (Rådbo et al, 2012), such as beneath bridges and reports of people appearing from behind buildings on stations, indicating a desire for seclusion or the intention of the person to conceal themselves. There are also less frequent reports of unusual events (e.g. contact with the train from the platform).

The final class in the framework relates to various examples of *interactions* with people or the local environment. Similar brief examples (e.g. erratic communication and avoiding eye contact, Gaylord and Lester, 1994, Lukaschek et al. 2011) have been introduced in earlier work of Lukaschek et al (2011). These interactions can be instigated by the suicidal person or someone at the railway station. People may display their emotional state or intentions more clearly through these types of interactions (Vrij et

al, 2010) and there are potential opportunities to exploit this within, or on approach to, the station. This could include encouraging more interaction, slowing down movements of individuals or crowds to enable interaction, encouraging interaction at the entrance to stations (customer service staff, staff in retail outlets, or with technology such as ticket machines) or before the arrival at the station (with family, taxi drivers, bus drivers). However, there may be difficulties achieving this with likely changes in the industry (e.g. reduction of station staffing, potential removal of ticket barriers and interaction with ticket staff and machines with the introduction of on-train ticketing).

The available evidence so far suggests that there are likely to be some common, visible features in pre-suicidal behaviours, across different time periods. Some of these behaviours that can arouse suspicion are similar to what would be considered as normal behaviours at stations (e.g. waiting for periods of time). O'Donnell et al (1996) reported how behaviours of most of the people in their study had not differed from other passengers. The reports of the longer term behaviours, observable in the home or community, had not been expected at the outset of this study. There are signs (at least in hindsight) that might be indicative of risk, including preparation activities prior to the event, reconnaissance activities, alcohol addiction, or not engaging with sources of support. The current study has expanded knowledge of what has been identified as deviations from "normal behaviours" prior to an incident, especially those that are out of character for the location or the person involved.

5.2 Provenance of the information from different sources

The content on what people have observed and how they described what they thought was important has been collected using different forms of prompting in research exercises or scrutiny of industry records.

The structured workshop exercises draw upon many years of experience of the participants from their roles in the transport police, rail operations and training and support work for the Samaritans and therefore has some similarities with the survey of experts from Lukaschek et al (2011). The outputs contain useful descriptive detail, covering wide ranging behavioural classes from the framework. There is a risk that this type of report could collect anecdotes and memorable events or circumstances, rather than the more mundane and first hand experiences of those involved. The participants were confident

that there are patterns of behaviour that can be used to identify those at risk of suicide. However, experts may not be aware of potential shortcomings in their judgement (e.g. bias from recent or more commonly reported visual cues, Tversky and Kahneman, 1973).

There is much, pre-existing information that is available to the industry, with the potential to use this to understand more about behaviours in the period prior to incidents. Previous analyses of similar organisational data has presented brief accounts of behaviours that are reported in police records (Lukaschek et al, 2011) and summary statistics of different types of immediate behaviours (Dinkel et al, 2011). The emphasis in the current study has been on demonstrating the value of in-depth examination of the content of the different records.

The different data sources cover a number of timeframes and offer different perspectives of incidents. For example, the 257 incidents in the industry database commonly contain reports of short term behaviours, observed by train drivers immediately before an impact. The narrative descriptions of behaviours from this source cover all suicides at the selected stations over a twenty year period and therefore give a good indication about the relative frequencies of different types of events, such as the more common modes of access to the track and some of the more unusual suicide events (Ryan, 2017).

The observations of CCTV by the police staff member contain descriptive details from a longer time period of up to 30 minutes prior to the incident. These are a smaller sample than those analysed recently by Mishara et al (2016). The emphasis in the current study has been on understanding the breadth of descriptive content that can be recovered from this sample. The quality of the evidence from CCTV recordings relies upon the location and coverage of cameras at stations. These are usually positioned with personal security rather than with suicide in mind and are not capable of observing all parts of the station and track. There were several incidents where people moved into areas that were not covered by cameras, either deliberately or without knowledge of the location of cameras. These accounts also rely on what the observer thinks is relevant to record. In this study, the reports give insight to the knowledge and expectations of the observer, presumably based on experience from previous events. The analysis adds descriptive characteristics to the existing knowledge of modes of

access to the track and demonstrates the potential for more in depth, structured analysis of CCTV evidence in future work.

The testimonies from the Samaritans were collected from people who have been involved in interventions. These cover diverse time periods and include details of how they became aware that a person was at risk. Like the other sources of pre-existing data, these were not created with the specific intention of collecting detailed accounts of behaviours, but nevertheless contain information that can be used for this purpose. However, these "unsuccessful" attempts (where interventions have occurred) may be different in nature to the events in which someone is not able to intervene to prevent an incident.

There are some general limitations in the study. Parts of the analyses are based on small samples of data. This work is still at an exploratory phase, demonstrating the potential for looking in greater detail at pre-suicidal behaviour and the resulting framework. The analysis of the qualitative data has been carried out by a single analyst and there has been no wider consultation on the process or outputs from the analysis (e.g. using Case Analysis, see Miles et al, 2014). Therefore, no claims are made about reliability of the classification. Efforts have been made to show extensive outputs from the data, to demonstrate the transparency of the process of qualitative analysis. Other researchers and practitioners are encouraged to use the current framework in studies with a greater range of behavioural variables and operating contexts.

5.3 Future use of the framework

The framework has immediate value in inspiring the collation of more information on behaviour types, giving observers greater sensitivity to additional visible cues or indicators. For example, future studies could collect more detailed accounts of posture, gestures and movements that may be indicative of affective states. This needs to consider observable features that are described naturally, as a reductionist approach may not be consistent with how people observe and identify emotion in some real life contexts (deGelder and Hortensius, 2014).

Further analyses of this kind can be carried out using a wider range of experts, across different contexts and cultures, with additional source documents and databases. These could include detailed reports from Coroners and in-depth analysis of CCTV recordings over a greater range of incidents or field

based observations. This would compile additional descriptive details and help to verify and develop the main classes and sub-classes of the framework. It may be necessary to resolve some existing difficulties with access to some data sources (Ryan, 2017), to achieve this and learn more from past incidents (Ryan, 2015).

It is known that people can and do react to make interventions in railway and other contexts (Sutherland, 2015). This could be deliberative decision making, where judgements are likely to be reasoned and thought through carefully. Alternatively, this could be intuitive decision-making or the "gut feeling" (Ryan and Stedmon, 2012; Gigerenzer, 2007) that was mentioned by the experts at the workshops (Table 2, 4), being aware that something was not right in a particular context (e.g. people being in the wrong place). In this case people may respond to a small set of visible and other cues (Klein, 1999), potentially subconsciously (Vallacher and Wegner, 1987).

There is still a lot to do in terms of understanding how people can discriminate potentially suspicious behaviours from normal behaviours and react in time to one or more cues to prevent an event. There may be a need for the right viewing skills (Schmidt, 1982) and expertise (e.g. Farrington-Darby and Wilson, 2006) in these observations, such as the experienced police officers who have encountered a number of similar situations, built knowledge through experience or training and know what to look for. Some aspects of behaviours may not be privileged knowledge and staff and members of the general public may be able to respond to relevant emotional cues (de Gelder and Hortensius, 2014).

As a longer term goal, a validated framework with greater clarity on the behaviours that are predictors of rail suicide, could be used for additional staff training and to provide materials for public awareness. An existing prevention strategy is built around training front-line staff in identifying some of the known indicators and giving them strategies for how they should approach people (Cross et al, 2010; Isaac et al, 2009; RSSB, 2013). It will be important to consider what level of detail is needed for the most effective training (e.g. simple cues or more detailed knowledge). More explicit and informative guidance on what can be observed may help in reviewing existing training programmes.

The framework can be used when considering requirements for visual surveillance technologies, potentially aiding faster and more effective interventions. Camera systems may contribute in station areas, if some of the weaknesses can be overcome. This can include operating within different lighting conditions and shadows under station canopies (Spirito et al, 2005), complexity in the environment and occlusion that can limit the ability to identify and track the movements of a person (Arroyo et al, 2015). The video analytics technology is more developed in relation to detection of a selection of relevant behaviours (Candamo et al, 2010; Popoola and Wang, 2012), many of which have been identified in the current analysis. These include loitering (e.g. pacing, sitting for prolonged periods), detection of trespassing (moving into areas where people should not be) and detection of abandoned objects. The technology is less mature for detection of postures or gestures (e.g. rocking), though there is some recent work that demonstrates the potential to detect a variety of movements or actions (Vats and Chan, 2016) and display of extreme emotions through body (head and body) postures and movements (Martinez et al, 2016; Aviezer et al, 2012). Little has been mentioned in the outputs from the study about facial expressions (Ekman and Friesen, 1971; Martinez et al, 2016), though these might be used implicitly by people in their identification of states of despair, anxiousness or sadness (Figure 1, Table 2, 4). Whilst potential benefits from use of technology could be achieved, these might be available at high cost (initial capital costs, staffing, maintenance and software upgrading). A careful balance is needed between sensitivity for detection of risky behaviours and minimisation of false alarms (Green and Swets, 1966), as well as ethical consideration in the use of this technology (Adams and Ferryman, 2015). Suitable processes are needed to consider how operators will interact with the technological support systems. This can include how people can intervene when needed to make judgements on complexity within visual images from real world applications, and the difficulties in ensuring a suitable response when a relevant threat is identified within a busy station environment.

6. Conclusion

It is possible to intervene to prevent some rail suicide incidents. Existing publications list examples of pre-suicidal behaviours on the railway, but these often lack detail or a structured account of the different types of behaviours that can be useful indicators of risk. More extensive studies of behaviour could offer

insight to opportunities for earlier interventions to prevent incidents. This analysis has produced a framework that describes a broad range of behavioural classes and sub-classes that can be observed at railway locations. There is novelty within this framework, which characterises a diverse set of critical features of pre-suicidal behaviour in this context, including display of emotion, appearance, gestures, activities and interactions. The framework collates behavioural data over a varying timeframe, represents data from the perspectives of people in a number of different roles and covers a range of rail and non-rail locations. The analysis goes further than any previous studies in compiling data on behaviours prior to rail suicide events, also considering the quality and coverage of the data. However, there is still an incomplete understanding of people's behaviours and the potential to identify those at risk.

The framework can be used in various ways. Firstly, this can be used to inspire the collection of more detailed behavioural data and associated analyses, validating the structure and adding content to the framework. Classes from the framework can be used subsequently to refine requirements for surveillance technologies and to develop and apply better training of staff and provide appropriate information for public interventions.

[7809 words]

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Table 1 Summary of longer term behaviours from reports and observations

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	**Commentary and *Behaviour type classification***
Seen at the station earlier in the day (Nar) Repeated visits to stations (CCTV) Repeated visits to stations (Sam)	Reconnaissance, research to check out the station. (Ex. 1) Revisiting a station (Ex.2) Repeated visits for planning (Ex.5)	*Appearance* – Identifiable after an event on CCTV when looking specifically for an individual. Behaviours would need to draw attention prior to an event, or the person may need to be known to station staff as posing a risk of incident or identifiable via face recognition technologies.
	Sorting out finances (closing accounts, withdrawing money, preparing a will) (Ex.2)	*Activity* – potentially out of character for the person, or several such activities at one time.
	Behaviour change, out of character behaviour (recognisable to family) e.g. buying new clothes) (Ex.2)	*Appearance* – potentially out of character for the person, or several such activities at one time.
	Being calm – realisation that things will end soon (Ex.2)	*Emotional response* – potentially evident as a change in behaviour, such as from a more distressed condition. However, this might be interpreted as an improvement in the mood / health / condition of the person, rather than a cause for concern.
	Continuing with the ordinary (buying clothes for children, preparing lunch) (Ex.2)	*Activity* – likely to be very difficult to identify as the person, from the outside, appears to be carrying out activities as usual.
Physical illness, depression, previous mental illness (Sam)	Evidence of mental health issues (Ex. 3)	*Appearance* – non-specific indicators, which may have some visual component, but may be based on assumptions and probably difficult to characterise with any certainty and without confusion with other conditions or behaviours
Previous suicide in the family (Sam)	Other suicides in the family. (Ex. 2)	*Influencing factors* – People close to someone involved in a previous event may be at an increased risk of suicide by similar means. Close family members may need to be aware of the increased risk, but presumably those most likely to observe indications of risk may also be at risk themselves. Agencies in contact with the family may be able to identify early indications of risk.
	Anniversaries. (Ex. 2)	*Influencing factors* – Similar to the above, but with increase of risk at different periods of time, perhaps many months or years later.
	Disassociation, isolation. (Ex. 2)	*Appearance* - Perhaps evident through a change in behaviour, such as no longer taking part in family activities or engaging with a circle of friends.
	Previous suicide attempts (Ex. 2) People known previously to police or station staff (Ex. 3)	*Influencing factors* – Some people may be identifiable as requiring a higher degree of surveillance than others in society, posing a specific risk to themselves and the railway. They may be identifiable at a railway location where there is a regular presence of station and police staff.
Relationship problems (Sam)		*Influencing factors* – An increase in risk at specific periods of time.
	Lack of self care (poor appearance, poorly kept home) (Ex. 2)	*Appearance* – potentially evident as a change in behaviour or condition of the person or their home.

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	**Commentary and *Behaviour type classification***
	Not taking medication (Ex. 2)	*Action / inaction* – potentially evident through identifiable changes in behaviour
	Weight loss, not eating (Ex. 2)	*Appearance* – potentially evident as change in appearance or condition of the person
	Over-filling life, no time with friends and family (Ex. 2)	*Activity, Influencing factor* - Potentially evident as a change in behaviour of the person and changes in social interactions. This might be a cause or symptom of underlying problems.
	Focus on the past (Ex. 2)	*Interactions* - Change in behaviour of the person and communications with others
Drugs and alcohol problems (Sam)	Drug and alcohol problems (Ex. 2) Evidence of addictions (Ex. 3) Drink / drugs (Ex. 5)	*Appearance, Influencing factor* - May be a longstanding problem or change in behaviour or condition of the person or their home. Potentially other visual indications to family and friends.
	History of railway work (Ex. 1)	*Influencing factor* - Familiarity with the railway and therefore knowledge of the potential to use the railway as a means of suicide. This might influence choice of a particular railway location. There may be a change with the way in which someone interacts with the railway.
	Reported missing (Ex. 1) Going missing (Ex. 2)	*Event, Activity* - An extreme example of a change in behaviour. This might relate to a prolonged period of contemplation of future actions or could be descriptive of the period of time prior to discovery of a suicide event and therefore of minimal value in prevention.
	Threats of suicide (Ex. 1) Threats of suicide, comments to family members, suspicious questions (Ex. 3)	*Event, Action* - Overt references to suicide (whether knowingly or not), which could be interpreted by family, friends or others as a real threat or a cry for help. Depending upon the detail within the threat, this might give some indication of the extent of contemplation about such an event on the railway.

Table 2 Summary of medium term behaviours from reports and observations

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	***Behaviour type classification* and Commentary**
Buying tickets (CCTV)	Normal behaviour, unsuspecting, not drawing any attention (e.g. buying a ticket) (Ex. 2)	*Activity* - Enables access to the platform without raising suspicion and could be indicative of careful planning or spontaneous / impulsive actions when on the platform. There may be opportunities for identification of risk of incident through interaction with a ticket clerk, though many tickets will be purchased via machines or on-line.
Movement around the station / platforms (CCTV)	Frequent appearances in places that would not be expected (Ex. 1)	*Movement*- Movements around a station can be normal behaviour, particularly when there are changes in platforms or people are using cafes, shops or toilet facilities. Frequent appearance in unusual locations (e.g. ends of platforms or secluded areas) could raise suspicion, if the movements of people are identifiable amongst a crowd, potentially supported by surveillance technology.
Walked / ran along the platform (Nar)	Wandering and looking for something, pacing - walking backwards and forwards (Ex. 1) Pacing – walking up and down the platform (Ex. 2)	*Movement* - This type of behaviour would need to be distinguished from behaviours associated with looking for the right platform, a friend, a timetable or station facilities. These movements may indicate a state of agitation, and to identify those at risk of suicide it would be important to distinguish associated behaviours from those linked to agitation from a delayed train. It may be possible to identify wrong direction movements and movements that are not typical of the speed of other movements at stations.
Walking along / across the tracks (CCTV)		*Movement* - A strong indication of risk to the individual, either in relation to suicide or accidental trespass related incidents. This may be a deliberate movement towards a predetermined location of path of a train (e.g. fast lines) or wandering until a train is encountered. Whilst this is identifiable (assuming people are in the vicinity or relevant surveillance technology is able to pick up the movement to identify the incursion), the time available to intervene could be short, depending upon circumstances such as train frequency.
Waiting on disused platforms (CCTV) Being in the wrong place (e.g. lineside, platform ends, near fast lines, railway bridges) (Sam)	Being in an unusual location (certain parts of a station, walking towards the platform end) (Ex. 1) Unusual location for people. In a high-risk area or hotspot (Ex. 3)	*Activity* - A strong indicator of risk of incident (assuming people are in the vicinity or relevant surveillance technology is able to pick up the movement or loitering / waiting in an area). This might suggest an element of planning to identify a preferred location (near fast lines or as a train enters a station at a higher speed), or to ensure seclusion for contemplation or completing a suicide attempt.
	Deviant behaviours on bridges (jumping off, hiding behind or underneath) (Ex. 4)	*Appearance, activity* - A strong indicator of risk of incident (assuming people are in the vicinity or relevant surveillance technology is able to pick up the movement or loitering / waiting in an area). These may be in less populated areas and the behaviour by definition is intended to ensure seclusion. This may only be evident very close to the time of the incident, therefore opportunities to intervene would have to be directed at identifying people in transit to (or on immediate arrival at) this type of location.
	Inconspicuous, not noticed by others (Ex. 1)	*Appearance* - Avoiding raising suspicion, whether deliberate or just the nature of the person's behaviour in

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	***Behaviour type classification* and Commentary**
		this type of event. Poses large problems for identification of people at risk under these circumstances and efforts to intervene.
	Conspicuous, drawing attention, appeared out of place (Ex. 1)	*Appearance* - Non-specific in nature, but something that is not normal behaviour in the context in question. There is potential for intervention (assuming people are in the vicinity or relevant surveillance technology is able to pick up the movement or loitering / waiting in an area).
Movements up and down stairwells / waiting near stairwells (CCTV)		*Movement* - A movement in a particular location of a station. This may be indicative of a state of agitation, searching for trains, moving to other platforms or awaiting the arrival of a train. The structures near to the stairwells may provide some seclusion during final contemplation of a suicide attempt and a place to hide prior to the final action of accessing the track. Some high risk locations could be monitored with surveillance technology.
Walking to platform ends (CCTV)		*Movement* - This is a movement to a particular place of known risk of incidents. The movement may be distinguishable as it is different to other movements (e.g. wrong direction movements) at the station.
Waited on the platform (Nar) Waiting on platforms for some time / letting several trains go by (CCTV) Letting several trains go by (Sam) Sat on a bench (Nar) Sat on the platform (Nar) Sitting on a bench / getting up and sitting back down (CCTV)	Letting several trains go by (Ex. 1) Loitering, particularly where they should not be (e.g. end of a platform) (Ex. 2) Loitering (Ex. 3) Waiting / time on the platform (Ex. 5) Sitting on a bench for some time (possibly with the head down) (Ex. 1)	*Activity, Posture* - This has been identified from many sources. It is a behaviour that needs to be differentiated from the behaviours of other people waiting for trains on platforms (someone who may be waiting some time for a specific train, thereby letting several trains go by). Waiting lengthy periods (e.g. longer than a repeating cycle of trains), may be an indicator, providing that someone is able to distinguish that the person has been there a long time or surveillance technology can identify extended presence in a location. This may need to be considered in conjunction with other characteristics of behaviour whilst waiting for trains, and may include some visual indication of agitation or feeling extremely low.
Rocking (CCTV)	Rocking (Ex. 2)	*Movement* - Likely to be unusual in the circumstance of a station and a visual indication of some distress of the individual. It may draw attention of others around. This might be identifiable using surveillance technology to pick out selected observable gestures or body movements.
Looked for the train (Nar) Looking for trains (CCTV)	Looking down the track. Looking at the infrastructure (Ex. 1) Checking for trains Looking around, looking for trains at the end of the platform (but not making eye-contact) Not train spotters (Ex. 2)	*Activity* - This needs to be differentiated from passengers who are looking for a train that may be late. Perhaps the person is looking for a specific train that they are expecting (as a result of careful planning) or they may be looking for any train (the next available train that looks fast enough). There seems to be a focus on the trains, on which track they are coming on, to the exclusion of other interactions with people. It seems from the expert report that this behaviour may be distinguishable from others employing visual search behaviours (i.e. train-spotters)
Looking at the information display (CCTV)	Impatience (Ex. 1) Checking times of trains (Ex. 2)	*Activity* - This needs to be differentiated from passengers who are looking at the information display

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	***Behaviour type classification* and Commentary**
		for a train that may be late or to re-plan a journey. There may be additional indications of agitation, beyond that which would be expected, as the person has presumably committed to their decision and are awaiting an opportunity to take their life (possibly waiting longer than expected). Depending on circumstances, there may be little time for intervention
Something is "not quite right" (Sam)	Something is not right, "gut feeling", out of character for the location (in behaviour or appearance), "it looked odd and out of place", potentially involving combinations of age, behaviour, clothes and location of the person) (Ex. 1) Unusual behaviour – out of character for the location (Ex. 2) Behaviours, unusual behaviours, different to usual commuter behaviour. People who are out of character for a location. "Gut feeling", recognition that something is not right. *Ex. 3) Unusual behaviour (Ex. 5) Unusual, erratic behaviour (Ex. 1)	*Appearance* - Non-specific nature of behaviour, but might be identified as being unusual for the railway context or for the individual. These could be identifiable using surveillance technology if a good profile of typical behaviours is known.
	Smoking (Ex. 2)	*Activity, Appearance* - Might draw attention if it is prohibited in the location and might draw attention if this is accompanied by other behaviours or visual cues that indicate a state of agitation
Carrying alcohol (CCTV)		*Appearance* - Might draw attention if it is prohibited in the location and might draw attention if this is accompanied by other behaviours or visual cues that indicate a state of agitation or lacking control (e.g. being drunk)
	Multiple signs (Ex. 3)	*Appearance* - Combinations of indicators. Non-specific in nature, but recognition of the fact that it is likely to be many, rather one, visual cues to draw attention to a person that might be at risk of incident. However, it may not be easy to articulate what these are in any given situation.
Suspicious responses to questions (e.g. revealing a fascination with fast trains) (Sam)	Argumentative, violent. Asking suspicious questions – which platform for the fast, non-stopping train (Ex. 2) Speech patterns, types of words used (Ex. 3) Aggressive Suspicious questions (Ex. 5)	*Interactions* - Suspicion might be raised by how people interact with others. This may be initiated by the suicidal person who may inadvertently betray an intention by a request for information, or may be evident if someone else interacts with a person who is raising suspicion.
Visible signs of despair, vulnerability, feeling low (e.g. constant smoking) (Sam)	Distress, agitation, crying hysterically, visual indication of mental health issues (Ex. 1)	*Emotional response, Appearance* - These may be strong indicators of risk in the proportion of people who might display these in a period leading up to an incident. There are many reasons why a person may not display

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	***Behaviour type classification* and Commentary**
	Nervous, jittery, fidgety, anxious, fearful. Desperate / despair. Crying, emotional. (Ex. 2) Visible indication of being upset (Ex. 3) Emotional (Ex. 5)	these or why people may not be seen to display these prior to an incident.
Stood alone on the platform (Nar) Looking disconnected, not interacting (especially when approached with an offer of help (Sam)	No eye contact, staring, not interacting with anyone. Being isolated or alone. (Ex. 1) "In their own thoughts" (Ex. 1) Determined, focused, not noticing others. Standoffish, withdrawn, lonely, isolated. (Ex. 2) Lack of eye contact / interaction (Ex. 5)	*Interactions / lack of interactions* - A lack of interaction with others may be typical of the majority of people at stations. There may be visual cues that could be used to identify when this lack of interaction is indicative of suicidal intent. The willingness to interact can be probed with an offer of help (assuming that staff, or members of the public, identify a person who may be at risk and are willing to approach them).
	Unusual dress (Ex. 1) Unusual clothes (Ex. 2) Unusual clothes (Ex. 3) Clothing (Ex. 5)	*Appearance* - This has been noted in a number of incidents and include those putting on unusual clothing prior to an incident and those with a single minded focus and wearing clothing that is not appropriate to the location (e.g. nightwear, hospital gowns). This may draw attention to people at risk of incident if there are people in the vicinity to recognise this and intervene.
	Well-dressed (Ex. 1)	*Appearance* - This is not unusual for the railway where people are travelling to business meetings or engaging in other leisure pursuits. Being well-dressed in this context could be indicative of careful preparation for the event, or responding to impulse.
Covered the upper part of the body in a plastic sack (Nar)		*Appearance* - This instance was related to an event on the open line and would be less likely in a crowded area of a station. This might reveal some planning for the event and a desire for concealment, or containment.
Speaking on a mobile phone (Nar)	Texting, making calls, typing on a laptop (Ex. 2)	*Interaction* - This is not unusual in this railway context. This might need to be considered in conjunction with other visual cues that might reveal indications of distress or suicidal intent. In these cases, these might be modern day equivalents of suicide notes.
	Happy – as a decision has been taken, a weight has been lifted (Ex. 2)	*Emotional response, Appearance* - This is not unusual in this type of context and is contrary to what would be expected as a pre-suicidal behaviour. This might be valuable if there is some disconnect or lack of concordance between a range of visual cues.
	Hanging onto a fence – the last thing holding the person back (Ex. 2)	*Activity* - Indicative of severe distress and likely to be unusual behaviour in the railway context. There may be limited time to react to intervene.
	Suicide note, including a note of apology to the driver. (Ex. 2)	*Interaction* - This is a strong indication of intent, but may not be identified prior to an event.
Stood close to the platform edge (including standing close to the platform end ramp) (Nar)		*Activity* - This might be difficult to distinguish from the behaviour of other passengers at a station (unless near to the platform ramp), especially on a crowded platform where people may be queuing and keen to get early access and a seat on a train. This might potentially be

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	***Behaviour type classification* and Commentary**
		coupled with behaviours of looking for the train along the line (though again typical of passengers awaiting the train)
Stepped back temporarily (Nar)		*Movement* - This is likely to be very close in time to the point of access to the track and therefore of limited use in prevention, unless someone is close enough to intervene physically. It could suggest a temporary withdrawal from the plan or last moment fears, or a deliberate movement to push off from the platform into the path of the train.
Moved from behind an object (Nar) Came / ran from behind a building (Nar)		*Movement* - This is likely to be very close in time to the point of access to the track and therefore of limited use in prevention, unless someone is close enough to intervene physically. There may be opportunities to identify people in transit to (or on early arrival at) the place of concealment. This might indicate some planning of the event, the desire for some seclusion during contemplation of the event and desire not to be stopped during the act.
Pushed past passengers (Nar)		*Movement* - Indicates a late movement towards the train and is likely to be very close in time to the point of access to the track and therefore of limited use in prevention, unless someone is close enough to intervene physically. This is indicative of not wanting or not considering seclusion for the event.
Climbed a power line gantry (Nar)		*Event* - Getting access to a particular location and found to be a less common form of rail suicide.

Table 3 Summary of immediate / short term behaviours from reports and observations

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	**Commentary and *Behaviour type classification***
Dropping possessions / leaving things behind (CCTV)	Leaving coats, clothes, bags (Ex. 1) Removal of shoes. Taking clothes off and leaving in pile on the floor. Leaving bags, wallets, items behind. Giving things away. (Ex. 2) Leaving things behind, giving things away (Ex. 5)	*Event* - Visible event, potentially attracting attention, but likely to be a short time before an incident in many situations and therefore minimal time for interventions. This might be identifiable with surveillance technology to identify dropping of items.
Carrying personal items (e.g. photographs) (Sam)		*Action* - May be unusual in this type of location and therefore attract attention of people nearby, though images may be small and only people in the immediate vicinity would be able to identify these types of items. Some items / personal effects may not be identifiable immediately as holding significance for an individual, though might look out of place in the context.
Walked / ran to the edge of the platform (Nar) Sudden moves to the platform edge (CCTV)	Sudden moves forward (Ex. 1)	*Movement* - Deliberate movement, often at speed to avoid intervention or when an opportunity has been identified or encountered. Potentially limited opportunities to intervene. This might be identifiable with surveillance technology to detect unusual speed of movement, but might be confused with people running for trains in this location.
Slow deliberate moves to the platform edge (CCTV)	Walking near to the platform edge (especially at fast lines), beyond the yellow line (Ex. 1)	*Movement* - Movements may also be without speed, or people may in a rather overt way be close to the edge of the track, potentially focussed on what is to come and oblivious to what is going on around them and not worrying about how people might intervene. There may be a little more time to intervene if people are in the right location, aware of potential warning signs and able to react.
Danced to the edge of the platform (Nar)		*Movement* - Descriptions of the movement to the platform edge may be illuminating, potentially indicating the state of mind. These movements may be unusual in the railway context and draw attention, but are close in time to the suicide event and may give limited opportunities for prevention, unless someone is in a position to identify and respond to this.
Pulled coat up around the head before jumping (Nar)		*Action* - An unusual action, presumably to restrict the view of the oncoming train. The action may be observable, but very close to the point of accessing the track, with limited opportunity to intervene.
Dived off the platform as if into a swimming pool (Nar)		*Movement* - This describes how the person left the platform in order to make contact with the train. This suggests a very deliberate action, possibly at some speed, with very little or no time to intervene.
Jumped / stepped from the platform onto the line (including stepping from platform end) (Nar)		*Movement* - These describe a number of ways in which the person left the platform to be on the track for a short period of time before being struck by the train. These suggest very deliberate actions, possibly at some

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	**Commentary and *Behaviour type classification***
Jumping onto the track / climbing down onto the track (sometimes with arms out) (CCTV) Repeated attempts to access the track (Sam) Crouched down and rolled off the platform (Nar)		speed, with little time to intervene. Descriptive content can imply an element of reluctance in the final example.
Stood on the track in the path of the train (Nar)		*Posture* - This describes how the person stood waiting for the approach of the train. At this point there is little that anyone can do if the train is in the vicinity, without affecting their own personal safety.
Walked / ran across the tracks (Nar)		*Movement* - Movements across tracks can be to get access to a line on which a train is travelling (e.g. a fast line which does not have a facing platform, or where the facing platform in secured against access). These could be fast movements with some urgency or made more slowly. It is very difficult for someone to intervene at this point without very high risks to personal safety. Surveillance systems to detect a track incursion could allow notification to be sent to drivers, but the success of this will depend on the train speed, frequency and location.
Walked / ran on the tracks (Nar)		*Movement* - Movements could be along the tracks, perhaps to find a location outside the station. There may be some opportunities to make interventions, depending on local circumstances (e.g. staff availability at the station and ability to stop trains in the area, dependent upon the frequency of trains).
Laid down on the track in the path of the train (Nar) Knelt on the track (Nar) Sat on the track (Nar) Crouched on the track in the path of the train (Nar) Curled into a ball (Nar) Placed head on the track in the path of the train (Nar) Crouched down (Nar) Sitting on the track (CCTV) Appeared to the looking for something on the track (Nar) Bent down as if to pick something up (Nar)	Crouching down in front of the train (Ex. 2)	*Posture* - Descriptive accounts of the postures adopted as the person waited for the oncoming train. Some show an indication of planning to ensure fatality. Some indicate defensive posture or resignation.
Arms in the air / arms outstretched (Nar) Appeared to be smiling (Nar) Looked towards the driver (Nar) Turned and faced the train (Nar) Head lowered waiting for impact (Nar) Not facing the train (Nar) Turned to face away from the train (Nar)	Open arms in front of the train. (Ex. 2) Smiling, acceptance (Ex. 2)	*Posture, Movement* - Additional descriptive detail on the postures or movements of people as they awaited the oncoming train. Some of these might indicate relief, sorrow, fear, or defensive gestures. These are postures etc. that could give some insight to the state of mind of the person, but have little value in terms of identification of risk at this late stage in time (such as through a proximity surveillance system). It might be possible to identify the state of mind of people earlier through their gestures and movements at an earlier point in time at the station.

Pre-existing data (Narrative reports – Nar; CCTV description – CCTV; Samaritans – Sam)	**Workshop exercises (Exercise 1-5)**	**Commentary and *Behaviour type classification***
Turned sideways (Nar) Covered ears (Nar)		
Walked / jumped in front of the train (Nar) Jumped / stepped from the platform into the path of the train (Nar) Jumping in front of the train (CCTV)		*Movement* - The movement to jump or step in front of the train may be at the precise point in time that the train passes through the station, so there is limited time for people to react and intervene.
Leaned forward into the path of the train (Nar) Leaning forward into the path of the train (CCTV) Sat on the platform with legs over the edge (Nar) Laid down on the platform with head and shoulders overhanging into the path of the train (Nar)		*Posture, Movement* - In a small number of cases people made contact with the train without leaving the platform. It may be possible to identify people in close proximity to the platform edge prior to the arrival of the train. In some circumstances it may be possible to spot some of the unusual behaviours (sitting, lying), but some of the actions may be too late to make any intervention.
Contact with overhead power lines (Nar) Hanging from a bridge (Nar) Set on fire (Nar) Jumped / fell from a bridge (Nar)		*Event* - Other events that resulted in fatality in a small number of circumstances. It may be possible to identify suspicious behaviours in the period leading up to these events, but sometimes these are carried out in isolated locations.

Table 4 Framework of visible aspects of behaviours that can be identifiable at railway property

Description of behavioural types	Sub-classes and summary of evidence from workshops and historical data sources	Potential for observation, including use of surveillance technologies to support identification and response to specific behavioural types
Emotional response	*Non-specific visual indications* • Non-specific indications of: despair, vulnerability, distress • looking disconnected • calm, happy or smiling, as if a decision has been taken.	Some of the visible indications, whilst not specified clearly, may be out of character for the location and identifiable if people are in a position to observe the response or if surveillance technology could identify the response early enough. These responses may be a sufficient time in advance to enable an intervention. Various reports indicate suspicion of emotional responses of people at railway property, with similar findings in the literature (e.g. Mishara et al, 2016; Lukaschek et al, 2011). These appear to be recognisable to the observer (deGelder and Hortensius, 2014), though the examples of the reports do not give much more detail on what has been observed (e.g. nervous, jittery, fidgety, crying). There is potential for understanding more about the postures, gestures and movements that could be associated with these affective states (e.g. see below on postures associated with affective states) and facial expressions (e.g. Ekman and Friesen, 1971, Parrot, 2000) to identify six primary emotions of happiness, sadness, anger, surprise, disgust and fear.
Appearance	*Illness / well-being* • Non-specific indicators of illness or depression, but may be difficult to characterise with certainty. *Clothing* • Unusually dressed or smartly dressed. *Appearance in a context* • Being in the wrong place at a station / unusual place at a station or railway location • Being inconspicuous or conspicuous at railway property • Standing alone • Hiding underneath bridges • Being conspicuous and appearing out of place • Something that is "not quite right" • Carrying alcohol • Smoking • Reconnaissance / repeated visits to a station. *Multiple indications* • Non-specific multiple signs.	Visual indications at railway property are not always likely to attract the attention of observers. Some of these aspects of appearance may not be different to the appearance of others at the station, but there are likely to be some characteristics of appearance that enable identification of risk. It may not be easy to articulate what these are, though people may be aware that something is not right in any given situation. It may be easier to identify unusual aspects of appearance if there is a good understanding of normal behaviour and appearance of people at stations. Detecting these characteristics of appearance relies on the presence of people nearby (who can recognise things that are unusual for the location) or ability of suitably sited relevant technology to identify the presence of people in a place where they should not be (e.g. detection of trespassing and movement into forbidden areas or places of concealment, Spirito et al, 2005). Frequent visits to a station for reconnaissance might be identifiable if coupled with other behaviour that could raise awareness in people / staff at the station, though this would need to be differentiated from that of a frequent commuter. Relevant technology (e.g. iris, facial recognition, Bird et al, 2005), could potentially be used at entrance gates to a station, though this could inhibit free movement into the station. Some of these indications may be more readily identifiable in combination with other cues.
Posture / gestures / movements	*Postures and movements associated with emotional expression*	Many of these behaviours are strong indicators of risk, but rely on the presence of observers with sufficient ability or appropriate surveillance systems, to be able to identify and react to these postural / movement characteristics.

Description of behavioural types	Sub-classes and summary of evidence from workshops and historical data sources	Potential for observation, including use of surveillance technologies to support identification and response to specific behavioural types
	• Sitting on a bench at the platform, possibly with head down • Getting up and sitting back down again • Rocking • Stepping back temporarily • Crouching, kneeling or curling into a ball, placing the head on the rail, standing with open arms / arms in the air, leaning forward, head lowered waiting for impact • Turning to face the train, turning to face away from the train, turning sideways. *Movement around the station / platforms* • Walking / running on the platform • Movement up and down stairwells • Walking to platform ends • Moving from behind an object or building. *Movement towards the platform edge* • Pushing past passengers, • Walking / running / dancing to the edge of the platform • Jumping / stepping / diving / rolling off the platform • Leaning forward into the path of the train • Laying down on the platform. *Movement on / towards the track* • Walking / running across the tracks • Walking / running on the tracks • Standing / laying / kneeling / sitting / crouching on the track • Jumping / stepping in front of the train • Jumping / falling from a bridge.	Some of the movements that have been identified in this study are clear indicators of intention, but occur a short period of time prior to impact in a suicide attempt and allow little opportunity for intervention. Sitting for prolonged periods of time would need to be differentiated from the sitting behaviours of other passengers. There is potential for surveillance technologies to help with identification of erratic body movements and gestures (e.g. detecting changes in stance from upright to prone postures or tracking movements at specific body parts such as the torso (e.g. identifying rocking) (Balan et al, 2007; Vats and Chan, 2016), though there is risk of occlusion from crowds or difficulties in tracking movements throughout the station. There may be postural indicators of affective state (e.g. similar to the head lowered posture – grief, sadness, shame - see detail from Kleinsmith and Bianchi-Berthouse, 2013 in Figure 2 in this paper). Similarly, Martinez et al, (2016) and Aviezer et al (2012) refer to the potential to interpret the expression of emotion through observation of the position of various body parts (e.g. head and trunk), which can be identifiable at a sufficient distance (more so than facial expressions). The speed and quality of movements (Dael et al, 2013) can be informative (e.g. the observation of someone dancing to the platform edge, potentially indicating a serene affective state, Kleinsmith and Bianchi-Berthouse, 2013). Opportunities might be available to identify other types of gestures and facial expressions at ticket purchase locations, entrance barriers or other locations around the station, assuming that there are people with sufficient ability or suitably located sensor systems. It may be necessary to overcome potential problems with using these effectively in fluctuating lighting conditions or where there are various visual distractions at stations. There are a range of movements around platforms or other areas of railway property. Surveillance technologies could be useful to detect wrong direction movements (e.g. towards platform ends or against the crowd flow) (Kang et al, 2004) or intrusion close to the platform edge (e.g. Black et al, 2005), though there is a high potential for false alarms (e.g. where people do not know where they should be going, maintenance people getting legitimate access to the track, trainspotters) or frequent movements close to the platform edge in the normal course of events at station platforms.

Description of behavioural types	Sub-classes and summary of evidence from workshops and historical data sources	Potential for observation, including use of surveillance technologies to support identification and response to specific behavioural types
Event / Activity / Actions (or inaction)	*Waiting* • Waiting on disused platforms / at unusual locations • Letting trains go by • Loitering, waiting near stairwells • Standing close to the platform edge. *Searching* • Looking for trains • Looking at the infrastructure • Looking at the information display. *Self restraint or protection* • Hanging onto a fence, • Covering the head / eyes • Covering ears *Accessing unusual locations* • Climbing a power line gantry *Interacting with possessions* • Dropping possessions • Carrying personal items. *Normal activities at stations* • Normal activities at stations – such as buying tickets so as not to draw attention, waiting on the platform.	Many of these activities, events or actions may be typical of others in the normal course of events at railway stations. Some of the actions that have been identified in this study occur immediately prior to impact in a suicide attempt and allow little opportunity for intervention. It may be easier to identify unusual behaviour during activity (Candamo et al, 2010; Paul et al, 2013; Suriani et al, 2013) if there is a good understanding of normal behaviour at stations. Some of the actions may be out of character for the location and identifiable if people are in a position to observe them, or if appropriate characteristics of the action can be isolated and identified using appropriate technology. There is potential for surveillance technologies to help with identification of loitering, triggering alarms if people can be identified, tracked (e.g. through the colour of their clothes) and exceed a threshold of time in a location (Bird et al, 2005). Similarly, surveillance technologies may help with the detection of abandoned objects that have remained stationary for a period of time (Ferrando et al, 2006; Popoola and Wang, 2012), though the reliability can be affected by various factors (Arroyo et al, 2015) such as crowd flow and other environmental conditions (Spirito et al, 2005). Video analytics may also help with detection of abnormal crowd behaviour (e.g. if a crowd congregated, dispersed or flowed in an unusual direction to observe or react to someone who had jumped onto the track) (Candamo et al, 2010, Gallup et al, 2012). This type of crowd behaviour would need to be distinguished from normal crowd behaviours (Kok et al, 2016, e.g. the sudden exit of a crowd from an arriving train at a platform).
Interactions / lack of interactions with people or the location	*With the local environment* • Standing alone, looking disconnected, not interacting, lack of eye contact, staring, focused • Suspicious questions. *In response to an outside intervention* • Suspicious responses to questions, being argumentative or violent, unusual speech patterns or types of words used. *Threats, warnings or explanations* • Speaking on mobile phones / texting, • Writing / having a suicide note, • Threat of suicide • Looking at the driver.	A lack of interaction of a person, or unusual responses to an interaction instigated by others (Vrij et al, 2010), may be identifiable if there is someone who encounters this, recognises the problem and knows how to respond to this at the station. There may be opportunities to identify increased risk of incident during interactions with others (e.g. unusual behaviour or interactions with ticket clerks whilst purchasing tickets, assuming that tickets are not purchased from a machine; unusual interactions / lack of interaction with passengers or staff). Several examples of behaviour in which people are interacting with others (e.g. speaking on phones, texting – threats or final messages) are evident in hindsight, but may be hard to distinguish from other similar, but non-suspicious behaviours at stations.

Figure 1 Summary of behavioural content in previous literature

Gaylord and Lester (1994) (study police records on 56 suicides on the Hong Kong metro)	Lukaschek et al (2011) (survey of 202 police officers in Germany)	Mishara et al (2016) (observation of CCTV recordings on metro in Canada)
Particularly where packages, bags, clothing, jewellery, ID cards and letters have been set down or apparently abandoned; the sudden release of such items as shopping bags and briefcases upon the sound of approaching trains (whereas normal passengers pick up such items in the same circumstance);	Dropping or leaving behind personal possessions	Leaves objects on the platform
Removal of shoes or other items of clothing	Taking off clothing	
Manner in which victims dress prior to the act. As an example, a prostitute will usually be garbed in ornate red silk, adhering to the belief that her ghost, when it returns to harm her enemies, will thus be made stronger. Elderly Chinese, too, when they contemplate suicide often clothe themselves in traditional ethnic fashion	Wearing unusual clothing	
The possession of items that ordinarily would be left home, such as framed family pictures and other items of sentimental value (stuffed toys or dolls, for example)	Carrying personal items	
Erratic behavior, possibly with indications of alcohol/drug intoxication, or conversely over-deliberate moves which look mechanical or ritual, including the act of praying	Erratic communication patterns and gestures	Strange behaviours, Psychomotor agitation (repetitive behaviours, nervousness)
	Aimlessly wandering about	Walks back and forth between the wall and the yellow line. Paces on the yellow line
	Giving the impression of confusion or the influence of alcohol	Seems intoxicated,
The avoidance of eye or face-to-face contact.	The avoidance of eye contact	
Loiters in the proximity of areas where trains make their entrance to stations		
Unusual make-up or disguise, faces hidden with broad hats or scarves,		
		Sits on the edge of the platform Seems to practice jumping Often looks down the tunnel Stares at the tracks or down the tunnel for a long time Anxious or depressive behaviours Looks glum (shoulders hunched, head lowered, looks at the ground)

Figure 2 Nine out of the thirty four affective states*, selected from Table 2 in Kleinsmith and Bianchi-Berthouze 2013

Affective state	Discriminating features
Anxious	Low energy, slow movement, somewhat expanded limbs and torso (citing Gross et al, 2010)
Arousal (high)	Head bent backward, hands vertically extended (citing Kleinsmith et al, 2007)
Defeated	Shoulders slumped forward, the arms extended down and diagonally across the body (citing Kleinsmith et al, 2011)
Despair	Shoulders forward (citing Walbott, 1998)
Disgust	Bowed trunk and head, knees slightly bent (citing De Meijer, 1989)
Fear	Backward head bend, no abdominal twist, forearms raised, weight shift backward (citing Coulson, 2004) Bowed trunk and head, knees slightly bent, downward, backward fast movement, muscles tensed (citing De Meijer, 1989) Regular, smooth and slow movements, jerky and somewhat fast movements (citing Dahl and Friberg, 2007)
Sadness	Forward head bend, forward chest bend, no abdominal twist, arms at side of trunk (citing Coulson, 2004) Small, very slow, very fluid, fairly regular movements (citing Dahl and Friberg, 2007) Low level of upper body movement, slow velocity of head movement (citing Castellano, 2008) Collapsed upper body (citing Wallbott, 1998)
Serene	High velocity of head movements, high quality of motion (citing Castellano et al, 2008)
Terror	Arms stretched sideway (citing Wallbott, 1998)

* Not included from the original source – Anger, avoidance, cold anger, hot anger, antipathy, boredom, concentrating, contempt, content, frustrated, grief, happiness, interest, joy, elated joy, potency, pride, shame, surprise, threatening, warmth, admiration, sympathy, triumphant, valence (high).

Figure 3 Summary of the content of the workshop exercises

Summary of exercise	Details of content / questions
Exercise 1 A written exercise to collect personal accounts of an occasion when someone was acting suspiciously and details of any actions or interventions that were made.	Can you recall an occasion when you saw someone acting suspiciously? Can you describe how they were they behaving? Tell me as much as you can about what they did? What did you see (see Fisher et al, 1987 re the Cognitive Interview)? What did you hear? What did you feel? What drew your attention to their behaviour? What did you do?
Exercise 2 Discussion within groups to identify and write down different types of behaviour of people in the period of time leading up to suicide / attempted suicide Participants then took turns in reading out examples of the behaviours and taking part in a discussion of the behaviours that were listed.	Write down (on post-it notes) as many examples as you can of the type of behaviours of people in the period of time leading up to suicide / attempted suicide - one type of behaviour per sheet (unless they need to be linked). Please feel free to discuss these in your group. Think about different locations - (on a station, at a crossing, other location).
Exercise 3 An exercise that used a scenario of supporting a junior colleague, with a series of questions to explore the knowledge and expertise of the participants in identifying people at risk. Participants provided individual written responses.	How do you help them to identify those at risk? How do you know what to look for? What raises your suspicion in a particular situation? How do you decide when to intervene to stop an incident? What can you do to intervene? What would help you in carrying out your job?
Exercise 4 An exercise to use annotated sketches as a means of collecting detail on how aspects of design of the railway environment can influence behaviours of people. Participants then discussed the content of their sketches.	In your experience, what are the features of the railway environment that influence people's behaviours (e.g. on stations, at crossings, other locations)? Can you give an example of how these can influence the behaviours of people?
Exercise 5 An exercise to produce individual lists of recommendations for identification of people at risk.	What are your top 10 "rules of thumb" for the early identification of those at risk?