



**A study of passengers' anxiety on the London Underground  
to help design its information environment**

**By**

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## **Abstract**

Provision of information has been used as a strategy to relieve travel-related anxiety. This study is motivated by the successful attempts for reducing the anxiety. Although, passengers' anxiety about using public transport (PT) has already been discussed, the London Underground passengers' anxiety has rarely been a target of investigation in the academic literature. Anxiety associated with the Underground use is reported to be greater than other PT modes. Although the existing studies discussing PT passengers' anxiety have attempted to provide solutions for anxiety reduction, few endeavours have been made to offer them based on the investigated causality between determinants of anxiety and its arousal. Thus, this study fills the gap by identifying antecedents, and verifying their effects on anxiety about the Underground use. This, in turn, furnishes theoretical grounds for designing content of information with an aim to relieve the anxiety in the circumstance that little data exists, which can be utilised for developing information for the purpose. To achieve the goal, two sets of phases have been engaged. First, a questionnaire (N=81) was conducted to identify anxiety triggers. The results revealed that they were other people's anti-social behaviour, overcrowding, noise, and late-night travel. An expert group interview was carried out to investigate what efforts are made to support passengers in the anxiety inducing situations. Second, examination was performed to understand about the passengers' anxiety based on theoretical knowledge about anxiety, and to determine its antecedents. A research model was formulated including six factors, perceived invulnerability, perceived physical ability, trust in other passengers (informal social control), confidence in the authorities, safety knowledge, and perceived uncontrollability. The effects were assessed through structural equation modelling, using questionnaire data (N=269). The results uncovered that perceived invulnerability, perceived physical ability, and confidence in the authorities have negative indirect effects on anxiety through perceived uncontrollability, and safety knowledge has a negative direct effect on anxiety. The confirmed anxiety buffering effects of the factors will be suggested to be used for developing content of information to help relieve the arousal. The study contributes to knowledge by identifying the determinants of the passengers' anxiety, and testing their effects on anxiety, and to produce theoretical support to create service information environment which helps relieve the anxiety.

## **Publications**

### **Conference papers**

Kim, J., Gustafson-Pearce, O. & Lee, H. 2016, "European Transport Conference 2016", Exploring Passengers' Anxious Response on the London Underground and Suggestions for Its Alleviation Association for European Transport, , 05/10/2017.

Kim, J. & Gustafson-Pearce, O. 2016, "Passengers' anxiety about using the London Underground", Intelligent Rail Transportation (ICIRT), 2016 IEEE International Conference on IEEE, , pp. 165.

Kim, J. & Gustafson-Pearce, O. 2016, "A pilot study into users' anxiety in the London Underground network environments (for the purpose of re-designing safety information)", DS 85-1: Proceedings of NordDesign 2016, Volume 1, Trondheim, Norway, 10th-12th August 2016, .

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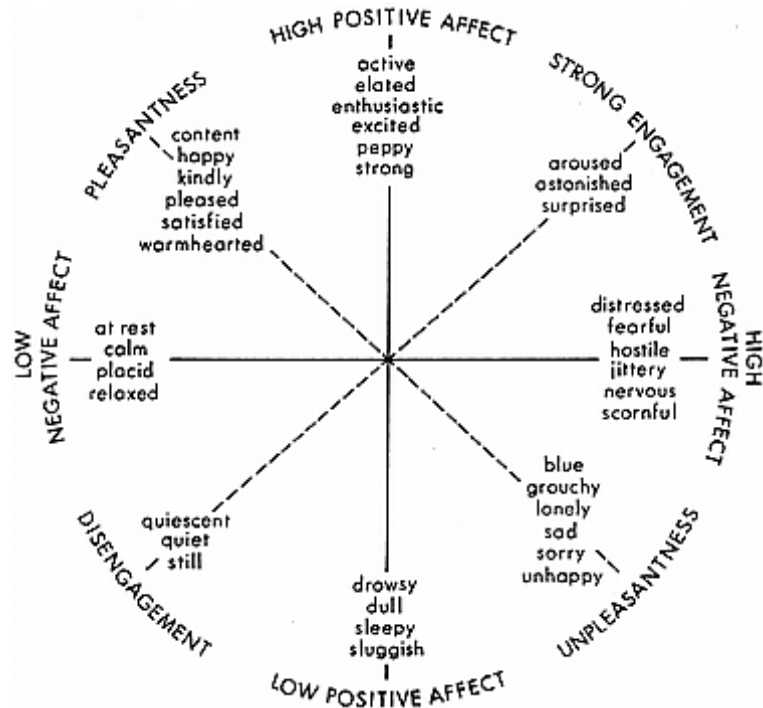
## **Chapter 1. Introduction**

### **1.1 Research motivation and background**

Provision of designed information has widely been used for relaxation of anxiety associated with travel using public transport, or accompanied in medical situations, such as in pre-operative or pre-screening periods. Regarding travel related anxiety, an attempt to treat transport related phobia in the Budapest Underground environment through providing information using virtual reality has been made (Lanyi et al., 2004). Additionally, studies about offering information using virtual reality have been conducted which successfully helped reduce travellers' anxiety (Lee and Oh, 2007; Ahn et al., 2013). Further, a number of study results reveal that patients' anxiety in pre-operative or pre-screening periods was decreased significantly (Danino et al., 2005; Kiyohara et al., 2004; Ng et al., 2004; Sjöling et al., 2003; Luck et al., 1999; Marteau et al., 1996; Kilborn and Labbé, 1990; Grey et al., 2000). Accordingly, this present study has been motivated by the previous successful endeavours for anxiety moderation through providing designed information, thus, it is assumed that information might be able to be effectively used for mitigation of passengers' anxiety associated with the London Underground travel.

Freud stated "anxiety (or dread) itself needs no description; everyone has personally experienced this sensation, or to speak more correctly this affective condition, at some time or other" (Freud, 1969 cited in Spielberger, 1972). He defined anxiety as "something felt", which is a highly unpleasant affective state that is universally experienced (Spielberger, 1972). Anxiety is regarded as a response to anticipated threat accompanied by physical and/or bodily arousals (Spielberger, 1979). Anxiety as an emotional state, that is a response to a threat which is interpreted to be dangerous in the situation (Spielberger, 1979), can better be understood in the dimensions of emotion. The dimensional analysis of emotions enables researchers to see more clearly about what anxiety is by comparing it with other emotional expressions. The attempt for mapping of the emotions has the purposes to identify emotional experiences, and to investigate the dimensions of

sentiment shared by other emotions. Differences and similarities can be ascertained by the 'relationships' among the emotions (Barlow, 2002). A circumplex model is considered as the optimal presentation of them (Plutchik and Conte, 1997). In the model, emotions are placed in a circular structure with presenting the relationships among them. Emotions which are positively correlated are positioned close to each other, on the other hand, those which are negatively correlated are located on the opposite side of the circumplex. Four bipolar dimensions are demonstrated which are placed 45 degrees apart, they are, "pleasantness (happy vs. sad), positive affect (excited vs. sluggish), engagement (aroused vs. still), and negative affect (distressed vs. relaxed)" (Watson and Tellegen, 1985). Anxiety-related emotional experiences are presented as high negative affect, which are positioned on the opposite side of the circle, in which strongly negatively correlated emotional expressions are placed. In order to help the passengers stay in the relaxed state (low negative affect dimension), supports should be offered by the service provider to create an environment to buffer anxiety.

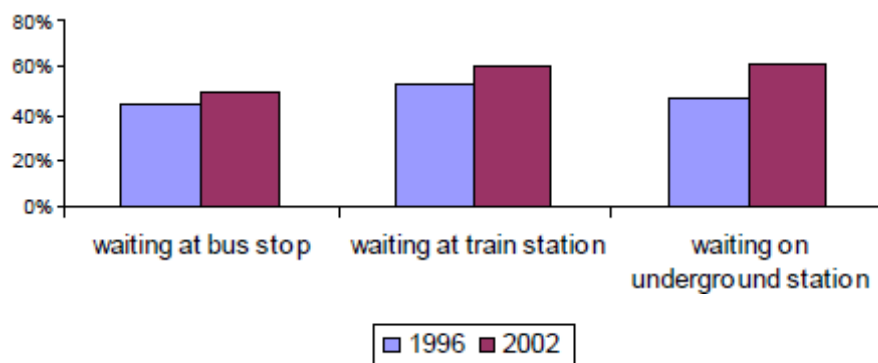


**Figure 1.1** The two-dimensional structure of affect (Watson and Tellegen, 1985)

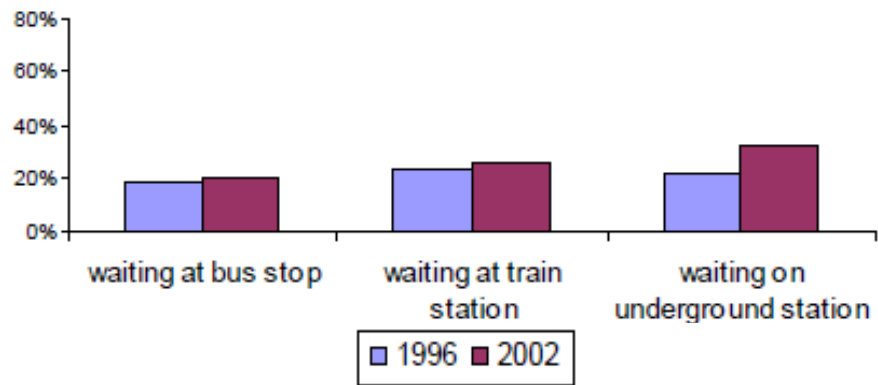
In addition, anxiety is a normal phenomenon which can be felt in our daily life in reaction to threats (McIntosh et al., 1998). Not surprisingly, as all transport modes involve associated risks, anxieties and fears during travel

are common (McIntosh et al., 1996). Further, even healthy individuals have feeling of anxiety during travel (McIntosh et al., 1998). In public transport environments, anxiety is experienced particularly when passengers encounter difficult situations, such as crowding, delays, and accessibility to stations (Cheng, 2010). In addition, passengers' anxiety about personal security arises from the effect of perceived level of crime, and their anxiety occurs from a lack of route knowledge, or trust in reliability of the service. It may also result from exposure to individual physical barriers, such as a long distance from home to a station (Transport for London, 2009). As the number of public transport users keeps increasing, passengers tend more to suffer from anxiety and stress in public transport environment (Cheng, 2010).

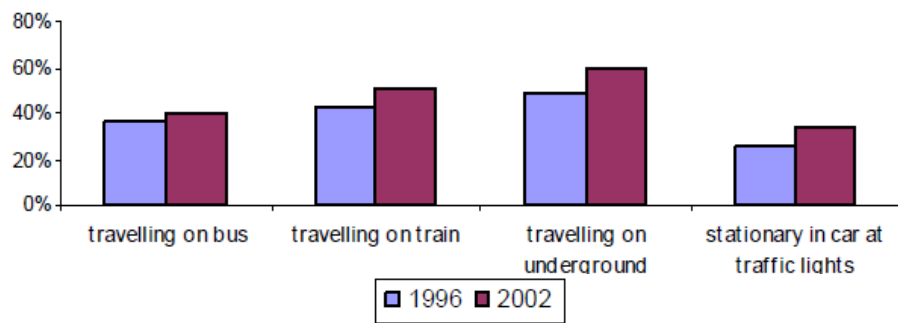
Particularly, higher level of anxiety is experienced when travelling by the London Underground than when travelling on other modes, such as, bus, train, or being in a stationary car (e.g. at traffic lights). When travelling in the daytime, few concerns about using the other modes were reported, whereas concerns about using the London Underground were expressed by the both male and female respondents, across all ages, and ethnic groups that they felt unsafe. Especially when travelling after dark, the Underground travel induced the greatest level of anxiety among the both male and female respondents. Sixty percent of the female respondents, and thirty two percent of male respondents addressed that they did not feel safe while travelling on the Underground after dark. In the both day-time and night-time travels, female respondents presented higher level of anxiety (Crime Concern, 2004).



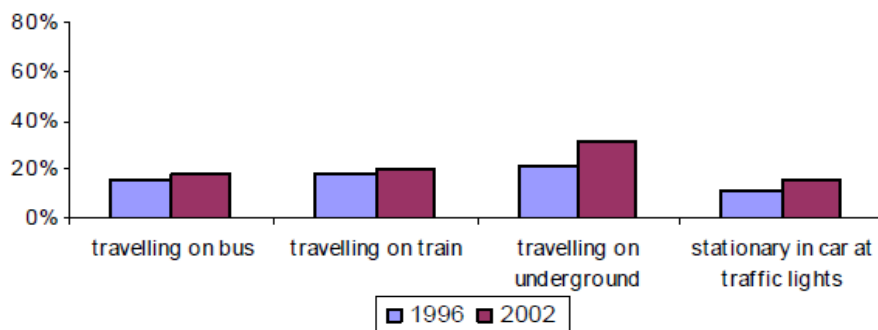
**Figure 1.2** Percentages of female respondents feeling very/rather unsafe after dark while waiting dark  
(Crime Concern, 2004)



**Figure 1.3** Percentages of male respondents feeling very/rather unsafe after dark while waiting  
(Crime Concern, 2004)



**Figure 1.4** Percentages of female respondents feeling very/rather unsafe after dark while using public transport  
(Crime Concern, 2004)



**Figure 1.5** Percentages of male respondents feeling very/rather unsafe after dark while using public transport  
(Crime Concern, 2004)



Despite the reported greater levels of anxiety experienced by the passengers, passengers' anxiety about using the London Underground has scarcely been the focus of academic attention. Considering the significant role of the London Underground system, which is one of the major public transport modes in London, carrying around 1.37 billion passengers per year (TfL, 2017), their anxiety associated with the Underground travel deserves attention.

There are a number of studies discussing passengers' anxiety in public transport environments in the relevant academic literature. Cheng's study investigates rail passengers' anxiety by measuring the levels of anxiety aroused by encounters with service events when travelling on rail with using Rasch method. The method enables researchers to compare person parameters to item parameters, in order to ascertain the items that can hard to be overcome by certain rail users. Anxiety was triggered by the items, such as, crowdedness, delays, rail station accessibility, searching finding the right train, and transferring (Cheng, 2010). Gidron's study examines the associations between anxiety about terrorism and frequency of use, and coping strategies (problem or emotion focused coping) among bus commuters in Israel (Gidron et al., 1999). Anxiety and health problems associated with air travel are investigated in McIntosh's research, the main anxiety inducing events are take-off, landing, and baggage reclaim, in addition, anxiety reduction strategies are addressed (McIntosh et al., 1998). Moreover, anxiety about personal safety and health issues when using public transport is discussed (Rubin et al., 2009; Goodwin et al., 2009; Tirachini et al., 2013; Handley et al., 2009; Zhang et al., 2008; Crime Concern, 2004; Science Application Information Cooperation, 2003). Also, anxiety about uncertainty regarding travel time or waiting time is addressed (Webster and Bly, 1982; Ibrahim, 2003; The Urban Transportation Monitor, 2003 cited in Tam and Lam, 2005; Sun et al., 2003 cited in Mazloumi et al., 2009; Khattak et al., 2003; Shalaiak et al., 2012; Ferris et al., 2010; Parker, 2008). Furthermore, anxiety about routing or navigating is explained (Adler and Blue, 1998; Warra, 2009; Wardman et al., 2001; Stradling, 2002). However, with the exception of Cheng's, McIntosh et al.'s, and Gidron et al.'s, Rubin et al.'s, and Goodwin et al.'s studies, anxiety or anxiety-related arousal/symptom were not directly measured in the other aforementioned studies. Besides, few studies regarding passenger's anxiety attempt to propose potential solutions to the problem by identifying factors which result in the arousal of anxiety, and confirming the relationships among them. Thus, the present study fills the gap by defining influencing factors, and

confirming the magnitudes of the effects of them, and proposing possible solutions to the problem.

The theoretical grounds for identification of the determinants of anxiety are sought out from the theoretical backgrounds of anxiety. Particularly, the Spielberger's state-trait model of anxiety is applied, since the model is beneficial in understanding the process of anxiety induced by a stressor which is perceived as threatening, whose focus of observation of anxiety is not limited to anxiety as a type of mental disorder. The model highlights the stage of threat appraisal in the entire process, since the intensity of anxiety is determined by the outcome of the appraisal. The appraisal process is explained by Lazarus's cognitive theory of coping and stress (Lazarus 1966; Lazarus and Folkman, 1984), elucidating the process intervened between the stressor and stressful responses. Once the situation seems harmful, that is determined based on the assessment of the individuals' comparative power against the stressor, and its imminence or ambiguity, then the process for minimising the effects of the harm is initiated. The process is called coping (Lazarus and Opton, 1966). It can be reasoned that the effects of appropriate resources for coping hypothetically result in anxiety reduction. Hence, the identified influencing factors of the passengers' anxiety will be used for structuring the required content of the information whose expected function is to relieve the anxious arousal.

Information design principles are consulted to enhance an understanding about designing information. According to the International Institute for Information Design, information design is "the defining, planning, and shaping of the contents of a message and the environments in which it is presented, with the intention to satisfy the information needs of the intended recipients" (International Institute for Information Design, 2017). In terms of how to design information, it is addressed that developing firm rules of information design is not possible, however, there is one of the main principles that information designers should bear in mind which is "it depends" (Pettersson, 2010a). Also, it is difficult to predict what information would work or not, since information design is considerably context-dependent (Jaconson, 2000). Given these factors, for the present study, information design principles are considered as guidelines to help define, plan, shape of the contents of the message with the purpose to relieve passengers' anxiety in the London Underground environments. Through the process, in this thesis, new knowledge is created by addressing the gap in the previous knowledge that little has been discussed regarding information

about passengers' anxiety on public transport, the London Underground in particular, which tends to elicit higher anxiety than other modes. It gives comprehensive data for designers to develop re-create information platforms for the passengers.

The grounds for reduction of the anxiety is sought out from the related theoretical background of anxiety and stress which was previously mentioned. Regarding the information needs which are intended to be satisfied by information design, they are explained that "people do not usually have information needs per se", rather in certain situations when they are under pressure, or faced with difficulties or problems, their "cognitive and emotional needs" may be satisfied through gaining appropriate information, and then applying it (Nicholas and Herman, 2010). For example, Gutteling's study regarding risk information seeking, the results demonstrate that the greater the industrial risk is perceived, the more their information needs arise (Huurne and Gutteling, 2008). In this study, it is assumed that anxiety triggering situations may be associated with information needs, such as, information for coping which plays a role in moderating the level of stress results from a threat inherent in the situation.

In sum, anxiety is an emotional state as a response to potential threat which is universally experienced (Spielberger, 1972). It is also commonly experienced in public transport environment (McIntosh, 1996). Particularly, passengers' reported anxiety felt in the London Underground environment was greater than other modes of public transport, such as bus, train and private car (Crime Concern, 2004). Passengers' anxiety in public transport has been investigated, such as, mainly, rail (Cheng, 2010), bus (Gidron et al., 1999), and flight (McIntosh et al., 1998), however, few studies investigate causal relationships between determinants of anxiety and provides suggestions for anxiety reduction based on the confirmed effects of the factors. Thus, this study attempts to fill the gap by identifying the influencing factors of anxious arousal, through applying the Spielberger's state-trait model of anxiety (Spielberger, 1966; 1972), and the Lazarus's cognitive theory of stress and coping (Lazarus, 1996; Lazarus and Folkman, 1984), and then examining the effects of the factors on anxiety.

Consequently, the ascertained factors are expected to be used as the components which have anxiety buffering effects for the content information which is intended to meet users' information needs in the anxiety inducing situation in the circumstance that little information has been discovered regarding passengers' anxiety. The comprehensive data generated through

the research is intended to benefit service providers and future designers to re-design information platforms that help relieve the passengers' anxious arousal.

## **1.2 Research aim and objectives**

### **1.2.1 Aim**

To develop theoretical grounds for designing information with the aim to reduce passengers' anxiety by identifying the antecedents of anxiety, and establishing and testing a causal model of anxiety, which explicates the relationships among the antecedents and the level of anxiety, in order to provide insights for service providers and future designers to re-design information environments that help alleviate the passengers' anxious arousal

### **1.2.2 Objectives**

In order to achieve the aim of the study, five objectives are established as follows.

- **Objective 1 (Chapter 2)**

To critically review the literature regarding information design principles and the pre-existing studies discussing anxiety reduction through information provision, as well as to comprehensively review the documented studies about passengers' anxiety associated with public transport travel, and lastly the relevant theories and models of anxiety

- **Objective 2 (Chapter 4)**

To explore passengers' anxiety about encounters with negative situations in the London Underground service environment

- **Objective 3 (Chapter 5)**

To develop a conceptual model of anxiety, and a set of hypotheses which explicate the influences of the factors on the passengers' anxiety

- **Objective 4 (Chapter 6)**

To test and modify the proposed model of anxiety through testing the hypotheses against empirical data

- **Objective 5 (Chapter 7 and 8)**

To provide recommendations for designing information which aims to reduce the passengers' anxiety associated with the Underground travel, and to elucidate theoretical and practical implications of the study

### **1.3 Research questions**

- The overall research question for this study is what are the antecedents of the London Underground passengers' anxiety?
- Do encounters with negative situations in the London Underground environment trigger anxiety, if so, what are the main triggers and how do the aspects of anxiety differ across demographic characteristics? – Explorative study
- Do the factors identified based on the theoretical background of anxiety affect the passengers' anxiety, and how the factors whose buffering effects are confirmed will be applied to help designing information aiming to relieve anxiety? – Quantitative study and discussion

### **1.4 Structure of the thesis**

This thesis is organised into eight chapters, as they are presented and summarised below.

- **Chapter 1. Introduction**

This chapter discusses the background of the study, and outlines the current situations relating to passengers' anxiety associated with travel by public transport, and defines the problem, and the gap in the literature. It also

introduces the potentiality of anxiety reduction through provision of information. Further, it establishes the aim and the objectives of the study.

- **Chapter 2. Literature review**

A critical review of literature about designing information, and its functions as well as process is conducted. A review of the documented studies about anxiety reduction through provision of information is presented in order to explore the possibility to relieve passengers' anxiety through designed information. Moreover, a review of the pre-existing literature pertaining to passengers' anxiety experienced in public transport environments is implemented, and a gap in the relevant literature is suggested. A comprehensive review of the literature regarding anxiety, and theories and models of anxiety is conducted.

- **Chapter 3. Methodology**

This chapter discusses methodology underlying this research embracing research tradition, research paradigm, research purpose, research approach, research strategy. In order to answer to the formulated research questions, the most suitable research methods are chosen and justification of the selection is described.

- **Chapter 4. Explorative study**

This chapter describes identification of anxiety inducing situations in the London Underground environment, and coping resources and supports for passengers provided by the service provider, Transport for London. An exploratory questionnaire was used as a method, and exploratory data analysis technique was applied. Further, an expert group interview was conducted to investigate further about the supports provided for the passengers in the service environment. It was followed by photography of the London Underground environment.

- **Chapter 5. Research model**

This chapter presents a research model developed on the basis of the understanding about the relevant theoretical ideas of anxiety which

demonstrates proposed relationships among the factors affecting passengers' anxiety.

- **Chapter 6. Results**

This chapter demonstrates the analysis process of the data gathered through a questionnaire survey to assess the conceptual model. Descriptive statistics for an analysis of demographic characteristics and general opinions about the service, exploratory factor analysis for an examination of the underlying structure, and structural equation modelling for the assessment of the conceptual model and the hypotheses will be used. The results of the tests will be presented.

- **Chapter 7. Discussion**

This chapter demonstrates the results of the model and hypothesis testing, with a presentation of previously reviewed literature elucidating the hypothesised relationships, and interpretations from the findings.

- **Chapter 8. Conclusion**

This chapter concludes the thesis by revisiting the aim and objectives, and summarising the findings from the explorative and quantitative studies, followed by recommendations for designing information. It also furnishes a description of theoretical and practical contributions, as well as limitations and propositions for future work.

## **1.5 Contribution to knowledge**

This study has produced theoretical and practical contributions to knowledge. Theoretical contributions are proposed as follows.

Theoretical contributions are proposed as follows.

- Legitimisation of the need for investigation of passengers' anxiety in the London Underground by critically reviewing the relevant literature regarding public transport user studies

- Formulation of research model which explicates the potential relationships between the determinants of anxiety and anxious arousal through the effect of perceived uncontrollability
- Examination and confirmation of the effects of the determinants of anxiety on anxious arousal through structural equation modelling (the verified significant relationships: 1) perceived invulnerability → - perceived uncontrollability → anxiety, 2) perceived physical ability → - perceived uncontrollability → anxiety, 3) confidence in the relevant authorities → - perceived uncontrollability → anxiety, 4) safety knowledge → - anxiety)
- Clarification of the interrelationships among the factors through ascertaining the mediating effect of perceived uncontrollability

Practical contributions can be summarised as follows.

- The process conducted through the quantitative and deductive approach to inquiring into anxiety taken in this research is expected to provide novel insight to future designers about how to define and verify important elements which can be closely connected to the contents of information pertaining to anxiety reduction.
- The findings from the present study structural equation model testing will provide evidence-based data to service providers and future designers to create information environments which help relieve passengers' anxiety associated with the Underground travel.



## **Chapter 2. Literature review**

### **2.1 Introduction**

Literature review is a significant stage before commencing research. It needs to deliver the pre-existing knowledge about the issue of interest by describing “what is already known”. Related theories and documented research in the area are commonly examined, thus, this review will perform as a background and rationales of researchers’ inquiry (Bryman, 2016). Hence, this chapter discusses issues regarding passengers’ anxiety on the London Underground, and seeking for rationales and potentials to reduce it through provision of designed information, thus, four main domains of literature will be discussed. First, the concept of information design, and potentiality of designing information for passengers’ anxiety reduction will be discussed. Second, the pre-existing literature related to attempts to alleviate anxiety through information provision will be delineated. Third, it will be followed by a review of literature regarding passengers’ anxiety in public transport service environments. Fourthly, the concept of anxiety, and the relevant theories of anxiety will be reviewed. Lastly, a gap in the existing literature will be discussed.

### **2.2 Developing and designing content of information with the purpose to reduce the London Underground passengers’ anxiety**

This section consists of four sub-sections which describes background knowledge regarding designing information for the London Underground passengers’ anxiety reduction. They are first, design, second, information, third, information design, and fourth, potential for anxiety reduction through restructuring information by tackling information needs which may arise in anxiety-inducing situations.

### **2.2.1 What is design?**

“To design indeed means to plan, to organize” (Lauer and Pentak, 2011).

Design has a wide range of meanings according to the context when and how it is used. Among them, for this present study, the meaning of design is closer to planning for problem solving. Definitions of design and those in association with information will be described starting from reviewing its dictionary definitions. According to the Oxford English Dictionary, the term design is explained in the context of “a plan conceived in the mind, and related senses”, as “a plan or scheme conceived in the mind and intended for subsequent execution; the preliminary conception of an idea that is to be carried into effect by action; a project”. In the context of “an artistic sketch, and related senses”, it is defined as “the art of drawing or sketching; (hence) the process, practice, or art of devising, planning, or constructing something (as a work of art, structure, device, etc.) according to aesthetic or functional criteria; (also) this as a subject of study or examination”, and “The completed product or result of this process; the arrangement of features in something planned or produced according to aesthetic or functional criteria; a particular shape, style, or model” (Oxford English Dictionary, 2017b).

Design is described as a set of practices of identification of problems and the “intellectual creative effort of an originator”, through demonstrating itself in “drawing or plans” which embrace “schemes and specifications” in order to solve the identified problem (International Institute for Information Design, 2017). Design is understood as practices for developing and generating a product from “a need, product idea or technology to the full documentation needed to realise the product” and to meet the user’s and stakeholder’s perceived need. The activities result in solutions which are engineering/non-engineering nature, physical or virtual, or a mixture of both. In this context, the term product represents a far wider term as it is extensively perceived as an artefact which is commonly mass-produced (Blessing and Chakrabarti, 2009). Design is identified as “a systematic or intensive planning and ideation process” which is conducted before developing something or executing specific plans to solve problems (Smith and Ragan, 1999). Design is an inquiry which is involved with the aim to create “some new thing of practical utility”, which is a “goal-directed process”. It accompanies with investigation of “ill-defined situation”, findings, and problems with suggesting ways to give changes. The ill-defined nature inherent in design problems implies that the problems and solutions are not clear, and they should be discovered by the designer. Problem solving is involved in designing,

however “all problem solving is not designing”. Problems arise from the discrepancy between the current situation and the wanted situation. Practice of designing requires solving a problem through an understanding of it. Understanding and solving a problem might be procedures which are carried out in as simultaneous or sequential manner (Rowland, 1993).

### 2.2.2. What is information?

According to the Oxford English Dictionary, information is defined in the context of “the imparting of knowledge in general” as “knowledge communicated concerning some particular fact, subject, or event; that of which one is apprised or told.”, “contrasted with data: that which is obtained by the processing of data”, “the action or fact of imparting the knowledge of a fact or occurrence; communication of news; notification” (Oxford English Dictionary, 2017c). The origin of the term of information is *informatio*, which stands for a “conception or an idea”. Information means “data, details, facts and intelligence”, and a meaning imparted to particular data, data which is processed in a computer, “an internal structure” that is used in regulation of processes, “a formal written statement or accusation”, a measure to inform against an individual, “a form or essential character” given to something, and materials of information in a certain category. Information may be interpreted from a variety of standpoints in relation to how it is created, presented, produced, disseminated, searched, categorised, indexed, stored, attained, processed, valued, reacted, utilised, and renewed. In order for these activities to be operated, persons who are equipped with the related skills are needed. Their views on information are influenced by the persons’ prior experiences and values. Also, information is mentioned as merchandise, which is distinguished from goods of other kinds in the sense that “the right of exclusive use” is not given to the recipient of the provided information being dissimilar to a sale of tangible products (Pettersson, 2010b).

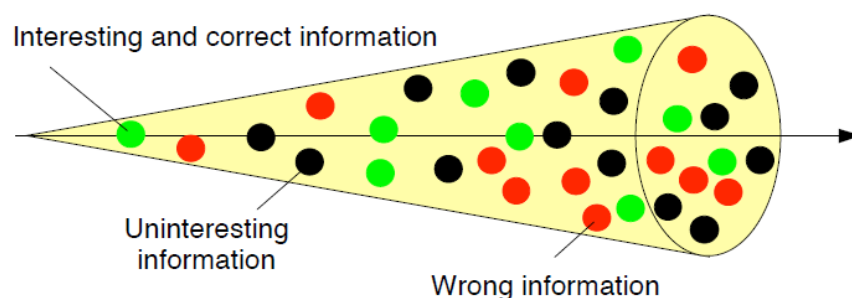


Figure 2.1 Information cone  
(Pettersson, 2010b)

Information cone is expanding with the increase of information. It contains significant information, information which is uninteresting, but correct, and information which is not correct including disinformation (Pettersson, 2010b).

Information is identified as "the result of processing, manipulating and organizing data in a way that adds to the knowledge of the person receiving it" (International Institute for Information Design, 2017).

The concept of information is often explained in comparison with data, thus discussing the distinction will help enhance the understanding about information. Ackoff illustrates that data indicates symbols which present the characteristics of events and objects. Information is composed of data which was processed with the purpose to improve its usefulness. Information also presents the characteristics of events and object as data, however, information does so in a more compact and useful manner than data. He describes the difference between them is "functional, not structural". It is addressed that information respond to certain questions begging with "who, what, when, where, and how many" (Ackoff, 1989). It seems important to note about the added process which makes data more useful, and the intended functions that information has which relate to responding to the particular questions. Since, this view parallels to the expression that tremendous amount of things which stimulate our senses in our daily life are not information, but they are merely data (Shedroff, 2000). Data is described as product of creation or research which is valueless for most of us (Wurman, 2000). Communication-wise, it is not a suitable product. What is needed in order for data to have its value is organisation, transformation, and presentation so it can become meaningful and valuable. In other words, information is as the first level which is appropriate for communicating with the audience, that disseminate meaningful messages which present the "relationships and patterns (the context)" from the data. This Shedorff's description is initiated from a discussion about our levels of understanding. Data and information are positioned in the spectrum understanding which includes knowledge and wisdom. Knowledge is an understanding achieved through experience, and is communicated through establishing interactions with others or systems, so that the meanings from the information can be understood. Wisdom is more philosophical and abstract than the former levels and less is known about how to generate or affect it. It is a combination of "all the processes and relationships" which were comprehended through experience. It is described as outcome created

through personal process embracing “contemplation, retrospection, and interpretation”.

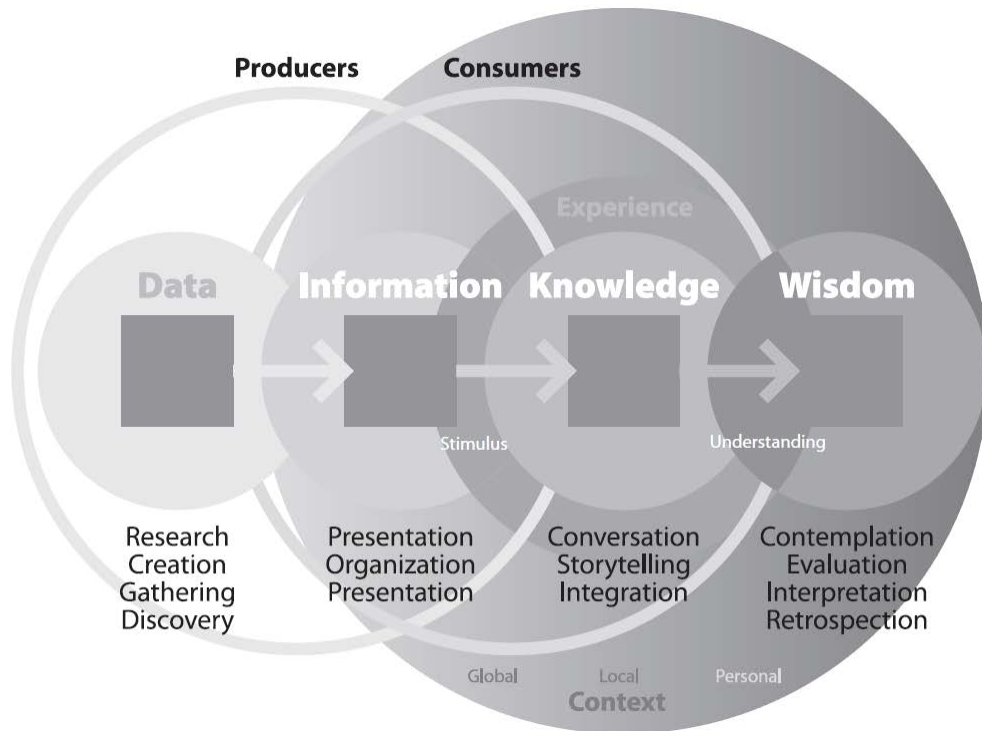


Figure 2.2 The understanding spectrum  
(Shedroff, 1994)

### 2.2.3. Information design

In order to enhance an understanding about design of information, relevant literature on information design and its principles will be reviewed. Thus, this section will discuss information design, its functions, and process, as well as its potentiality as a tool to be used to reduce the passengers' anxiety in the London Underground environment. Information design is particularly important as a part of service design process. Since, information design has “underlying and explicit” effects on the service design process, in the context that customers' perceptions about the values of the provided service, and any of the transferred information between the customers and provider, which is essential part of service experience, are influenced by information design. Information plays an important role in supporting users to access the needed content in an easier manner by minimising complexity and abstractness so that the information can be more absorbable and comprehensible (Stickdorn et al., 2010).

### **2.2.3.1. Information design, its backgrounds and purposes**

Dervin gives interesting discussions about practices of information design. She distinguishes information design into two classes according to the perspective about how information is conceptualised. They chiefly diverge based on the advancement of new technologies for communication which results in the need of information design as a new practice. On one hand, information instructs people about the reality about the world, such as its history, future, functioning, their place, their feasible actions as well as the expected consequences. Information in this view is considered as helpful which provides values for their survival, with justifying the necessity of “economic and effective” dissemination of information. In this view, it is implicated that information is able to be readily passed on, as if it is a concrete object across time, place and people, and information is considered as a “natural thing” which is movable by natural means. Hence the need of the new practice of information design results from “unnatural forces” which are at work. The new technologies have enabled people to do what was previously done, faster on a greater scale, and at larger distances. However, apart from the utilisation of the new technologies, what information design offered is not seen to be different from that of old methods which are either old technologies or non-technological actions. Hence, it is believed that information has “always been designed”, and alternative manners to conceptualise activities of information design can be deterred by the assumption that information design is a newly suggested practice (Dervin, 2000). The former view on information design is more relevant to this present study, in the sense that provision of designed information is considered as a type of support for the passengers focusing more on its content, and function rather than the speed, scale and distances which have been considerably enhanced through the introduction of the new technologies.

When it comes to definitions of information design, which is a relatively recently introduced as a discipline (Jacobson, 2000), its concepts and functions vary according to the context. The most recent definition of information design described by the International Institute for Information Design is that “the defining, planning, and shaping of the contents of a message and the environments in which it is presented, with the intention to satisfy the information needs of the intended recipients” (International Institute for Information Design, 2017).

Shedroff explains information design as a part of information interaction design. Developing information and experiences which are “valuable, compelling, and empowering” is one of the vital capabilities. Regardless of tools or mediums which are used to deliver, such as print or electric products, broadcasting, or human voices or bodies, the creating process is almost the same. The process includes problem solving, responding to users, and communicating with others which apply “across all the types of media and experiences”. The intersection of the issues is indicated as ‘information interaction design’, and information design is addressed as one of the disciplines (along with interaction design, and sensorial design), which shares the intersection. Information design is the practices of organising and presenting data into meaningful and valuable information. It is explained by distinguishing information from data, which is produced from creation or research that is not sufficient to be communicated. Data should be organised, transformed, and presented so that it can acquire meaning (Shedroff, 1994; 2000).

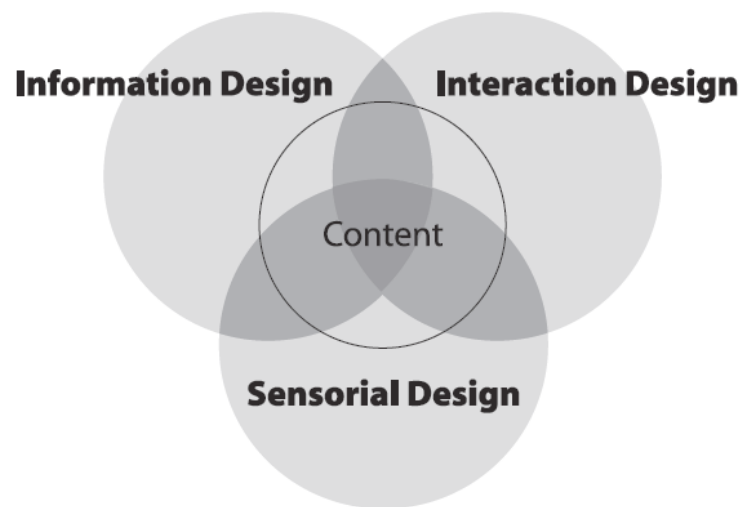


Figure 2.3 Information interaction design  
(Shedroff, 1994; 2000)

Information design is identified as the “art and science” for preparation of information with the purpose that it is able to be harnessed by people in an efficient and effective manner. The objectives are described as to create documents which can be easily understood, quickly and accurately retrieved, and which can facilitate effective actions. Also, they are to develop interactions using resources which are “easy, natural, and as pleasant as

possible”, and to enable easy and comfortable way-finding in three-dimensional or virtual spaces. The “efficiency and effectiveness” at achieving the communicative purpose are the values that differentiate information design from different types of design. Again, the efficiency and effectiveness are highlighted in the context of the need of information design in two ways. First, individuals’ information needs cannot be met by simply storing a significant amount of information and retrieving it in our highly complex modern society in which communication networks are operated with growing efficiency and effectiveness. Therefore, the capability of providing “the right information to the right people at the right time, in the most effective and efficient form” is highly required. Second, information processing is what professionals do every day. The poorly designed information will cause inefficiency in their performance and the organisations (Horn, 2000). In information design, two major issues which are, its function and its properties as a problem-solving tool need to be highlighted. First, understanding about function of designed information is suggested as one of the important components of it. For example, what matters when designing government documents is different from what may be issues when designing way-finding signage. Information in these situations is seen to perform certain functions, such as assisting user to fill a form, or find ways. In this sense, understanding the function is the most significant perspective of effective information design. Second, when information is used for users to accomplish specific objectives, mental activities are engaged which can be regarded as problem-solving. Offering the needed information by users in the situation requires understanding about the way they resolve problems to determine where and when it should be accessible. “Information is not an end itself.” The quality of design is not simply measured by the designed product, but gauged by users’ behaviour and satisfaction. Without the thinking borne in mind, information design might result in “merely the design of good (i.e., beautiful) information displays”. Also, it may not always be the best and the only intervention strategy (Passini, 2000). The main purpose of information design is to boost individuals’ understanding about a certain discourse or conversation in which they are participating, through systematically arranging and using “communication carriers, channels, and tokens”. In the stage of conception, products are not restricted to traditional media, which is considered as one of the merits of information design. Information designers focus more on meaning, rather than on the mediums which deliver meaning. There are few ways to anticipate what information design would work or not because it is



highly context-dependent. The elements which determine the success of information can hardly be replicated, such as the environments where knowledge is transferred, the stakeholders, the media utilised, and the ultimate goals of the provider and recipient (Jacobson, 2000). Information design signifies activities practiced to make visual materials clearer and more comprehensible, which are developed for directing, educating, explaining, or informing. Effectively designed information is expected to achieve a number of purposes, first, it facilitates users navigation, understand of complex “facts, figures, directions, and demands”, second, it assists people to complete a task, and resolve problems. Third, it helps reduce frustrations, fourth, it focuses on people and the content used by them, and ensure that the content as well as how it is presented and delivered serve them (Lipton, 2007).

### **2.2.3.2. Process of information design**

Information design may be illustrated that, having a purpose of fulfilling the intended receivers' information needs, it consists of “analysis, planning, presentation and understanding of a message – its content, language and form” (Pettersson, 1998; 2010a). “Aesthetic, economic, ergonomic, as well as subject matter requirements” will be expected to be met by the well-designed information sets (Pettersson, 2010a; 2002; Petterson and Avgerinou, 2016). Information design is multi-disciplinary because it has been gathered with a wide range of academic disciplines, such as art, information and communication sciences, cognition and behaviour, and technologies related to media production. Also, it is multi-dimensional, since its principles do not bear on particular languages or cultures. Information design principles should assist designers to create effective information sets, however firm rules can hardly be determined for explaining how a message and information sets can best be designed. (Pettersson, 2010a). Thus, particular information problems should be analysed and understood, as well as possible solutions need to be suggested by information designers according to the situation. Therefore, situations of information design can be represented as “it depends” (Pettersson, 2010a). Further, Pettersson suggests information design principles, named functional principles which guide information designers to create effective information sets which meet requirements of intended receivers. The principles includes several stages, such as, defining problem, providing structure, providing clarity, providing simplicity, providing emphasis, and providing unity stages. As the present

study investigates the initial stage of information design, hence, the “defining the problem” stage seems suitable to be consulted. In the “defining the problem” phase, which is represented as “introductory analysis and planning phase”, there are a number of activities to be conducted. For example, they are, organisation of the project, investigation of the target audience and their attributes and requirements, analysis of the intended message, collection and review of the facts and data, establishment of the objectives, selection of a method for shaping the message and appropriate medium, and evaluation of results from previously designed information sets. In the phase, when creating the intended messages, which are needed by the recipient for performing particular tasks, or improving new skills, experience, and understanding, several advices are given. First, the purpose and objective need to be defined. Second, required facts and data are to be collected to be used in the design process. Third, words, images or graphics can be considered to be used. What makes the message more effective depends on the content of the information, and the medium, and the amount of time allowed for users to interact with the information (Pettersson, 2010a).

Information design is defined as what is done to create a document (or communication) which “works for its users” that means the needed information can be found, the found information can be understood, and the understood information can be used appropriately. Redish suggests a process of information design which starts from an understanding about what the designer tries to achieve, who is the target audience, and how is the information used (Redish, 2000).

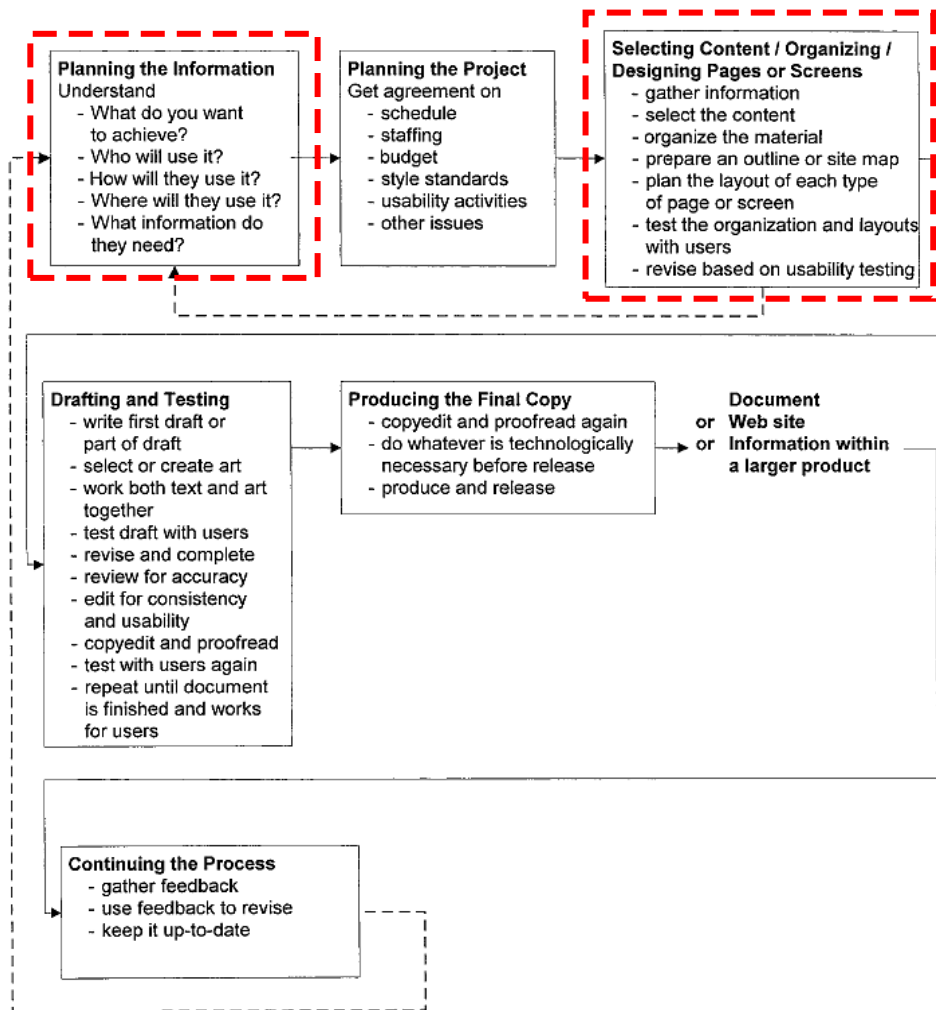


Figure 2.4 A model of the information design process  
(Redish, 2000)

As aforementioned, this present study discusses an initial step of information design, as it is shown in the Redish's model, the two marked stages in the first row are tackled in particular. In the planning the information stage, the purpose of designing information, how the users are, and what information they need will be focused. The purpose and the users of designed information is to help reduce the London Underground passengers' anxiety, and potentially, as reviewed previously, knowledge on coping resources would need to be strengthened. In the selecting content/organising/designing pages or screens stage, attempts will be made for gathering information, selecting the content will be investigated.

#### **2.2.4. Potential information needs in anxiety inducing situations**

As reviewed previously, the importance of understanding the users' information needs in the process of designing information has been mentioned by a number of authors (International Institute for Information Design, 2017; Horn, 2000; Pettersson, 1998; 2010a). Accordingly, this section will review the relevant literature about information needs, and connect the knowledge with anxiety to help seek for potentiality for its reduction.

Information needs are described as a gap or a discrepancy between the current state and a desired condition in a considerable body of relevant literature, such as Belkin's (1982) "anomalous states of knowledge", Dervin's (Dervin and Nilan, 1986) "gaps" (cited in Williamson and Asla, 2009). Information needs occur when people perceive dissatisfaction with their present state, when recognising a discrepancy between the current situation and "a more informed state" when attempting to fulfil one's task by a number of authors (Shenton and Dixon, 2004). Atkin (1973) states that information needs emerge from "extrinsic uncertainty" derived from a "perceived discrepancy between the individual's current level of certainty about important environmental objects and a criterion state he seeks to achieve" (cited in Shenton and Dixon, 2004). He also mentions that uncertainty motivates individuals to seek information in order to reduce it, and they recognise their gap between "what they know and what they want to know" which is salient (Atkin, 1973 cited in Case, 2007). Belkin's ASK hypothesis represents that "an anomalous state of knowledge" that leads to information needs to resolve the anomaly (1982). The concept is suggested in the dimension of investigation on problems in information science, contemplating on "the effective communication of desired information between human generator and human user" (Belkin, 1977). In terms of anomaly, Belkin points out inadequacy of users' level of knowledge relating to their ability for goal achievement. A deficiency of knowledge, uncertainty in situations and various problems could be regarded as the anomaly (Belkin, 2005). Sepstrup (1977) and Dervin's (1982) view regards that "need for information consists of the process of perceiving a difference between an ideal stage of knowledge and actual stage of knowledge" (cited in Van De Wijngaert, 1999). Reviewing further on Dervin's view, she addresses information needs from the perspective of communication system which intends to assist people to be informed, to achieve understanding and to handle their problems, distinguishing it from information system which

“collects, stores, retrieves, and delivers information”. She assumes that “every urban need” is connected to information, however, little information is used to resolve difficult situations effectively, whilst people express numerous needs of information. In other words, they can hardly know what their exact needs are (Dervin, 1976). This perspective seems different from Atkin’s view, in the sense that he maintains individuals do sense the gap and constantly make a comparison between the desired state and their present state of knowledge described as uncertainty (Case, 2007). In a similar perspective of Dervin’s, Nicholas argues that individuals do not feel that they need information, however, difficult events or tasks give rise to information needs, which is consistent with Krikelas’s point that majority of people will mention that they do not have information needs, but the kinds of information they need will have to do with their environments (Henefer and Fulton, 2005). The more recent view about information needs which is in line with Dervin’s view (1976) is described that “people do not usually have information needs per se”, rather in certain situations when they are under pressure, or faced with difficulties or problems, their “cognitive and emotional needs” may be satisfied through gaining appropriate information, and then applying it. In addition, it is claimed that “three basic human needs”, which are physiological, psychological, and cognitive needs lead to a need of information. This notion can be linked to the argument that the types of individuals’ information needs at different levels can be explained by Maslow’s hierarchy of needs (Nicholas and Herman, 2009). For example, individuals seek coping information when they are at the physiological needs level, which is the lowest, further, individuals search for helping information on safety and security in order to know how to protect themselves when they are at the level of safety, which is the second lowest (Norwood cited in Nicholas and Herman, 2009). They also argue that when it comes to “unrecognised information needs”, people’s information needs are not always known and an information gap is not recognised, therefore they do not know that they can gain useful information. Furthermore, with reference to information needs and risk perception, in Huurne and Gutteling’s study regarding risk information seeking, the results demonstrate that the greater the industrial risk is perceived, the more their information needs arise (Huurne and Gutteling, 2008). Therefore, in this research, the gap generated by the discrepancy between the passengers’ current level and the required level of knowledge on how to handle anxiety inducing situations during the passengers’ journeys will be assumed as when users’ information needs arise.

## **2.3. Anxiety reduction through information provision**

This section will discuss individuals' anxiety reduction through providing necessary information. Travel-related anxiety alleviation will be described first, followed by anxiety reduction in other situations, especially those relating to medical operations and screenings.

### **2.3.1. Attempts for anxiety reduction through information provision in public transport environments**

First, reduction in travel-related anxiety is discussed in Lee and Oh's study regarding the effect of virtual reality features provided on a hotel website on potential travellers' anxiety (Lee and Oh, 2007). The experiment was initiated from a background that individuals who experience the greater degree of anxiety or suffer from generalised anxiety disorder would want to feel more assured of safety, and familiar with the site. Additionally, the internet is considered as an effective tool for providing information for psychological treatment (Tate and Zabinski, 2004). Hence, the researchers developed virtual reality (VR) tours to offer information including the hotel's exterior, lobby, guest room, and restaurant allowing 360-degree-angle views. The experiment was conducted twice with 55, and 55 university students respectively. They were asked to imagine that they were supposed to visit an unknown place in the tropical region, and the place to stay would be the hotel presented on the website. They were given 50 minutes in total to take the VR tour. A designed survey was conducted after the tour. The results revealed that the greater the participants' anxiety about a certain trip is, the more psychological relaxation could be experienced through the use of the VR features of the hotel website (Lee and Oh, 2007). Second, Lanyi et al. attempt to create virtual Underground environment for treatment of phobia. The motivation of the approach is that using virtual reality (VR) has been effectively deployed for medical purposes. Especially in psychotherapy, VR is verified as an effective tool for treatment of anxiety, body-perception difficulties, post-traumatic stress disorder, and phobias. Phobia is as a type of anxiety disorder, individuals suffer from it experience an "extreme, unrealistic fear of a particular situation, activity or object". When the individuals who are phobic are exposed to the feared event of object, they make a great effort to avoid them. The Underground was selected as the mode for the VR treatment development because the Underground is one of the PT modes in Hungary in which passengers' fear of using PT is more

frequently reported than other methods. Therefore, VR was used for the purpose to treat phobia of using the Underground, desensitisation is applied to the VR therapy as the same approach taken in the regular psychotherapy. In terms of the development process, an interactive VR was created based on the video created in one of the stations in Budapest which allowed the users to walk in the space, and also, stop, restart and continue, and go back in an easy manner for both patients and clinicians so that they can concentrate on the treatment. The actual testing was not included in the paper, however it presented the potential of reducing the level of anxiety through an approach through an application of an information-oriented means (Lanyi et al., 2004).

### **2.3.2. Attempts for anxiety reduction through information provision in medical environments**

Provision of information is widely used in medical environments with the objective of reducing patients' anxiety. Two types of anxiety inducing situations will be reviewed, they are pre-operative, and pre-screening periods. First, attempts for anxiety relaxation in relation to pre-operative period, the significance of information provision to the patient and relatives is highlighted in considering its efficiency in anxiety reduction (McGaughey and Harrison, 1994). The argument is supported by Hathaway's study results that demonstrated that an intervention of pre-operative instruction had a positive impact on operative outcome, and the intervention was particularly effective for the patient who presented high degrees of fear or anxiety (Hathaway, 1986). Danino et al. (2005) attempt to examine the impact of information provision through an informational CD-ROM on anxiety reduction of patients waiting for aesthetic abdominoplasty or breast reduction. The CD-ROM provides images with verbal and written form of information about the knowledge and anxiety of individuals preparing to undergo the same types of surgery. In total forty patients participated in the study, prior to the surgery they were given a leaflet delivering information about the procedure, and then completed the Spielberger State-Trait Anxiety Inventory (STAI form Y-1) which is one of the most commonly used anxiety measurement scale (Spielberger, 2010). The half of the participants was randomly chosen patients were assigned the CD-ROM and watched it, and the other half of them were not assigned it and did not watch it. Both groups of the participants completed the STAI the day before the surgery, and the results were compared. The results uncovered that the patients who watched the

CD-ROM presented significantly lower level of anxiety than the patients who did not watch it (Danino et al., 2005). Kiyohara et al. conducts an investigation regarding the level of understanding about surgery information and the degree of anxiety of the patients scheduled for surgery. Responses from one hundred and twenty interviewed patients (including 82 males, and 38 females), out of the randomly selected one hundred forty nine patients were used for analysis of the study, with exclusion of twenty nine illiterate patients from an anxiety screening. The method is described that the patients were interviewed by two students, and were asked to open questions about their knowledge regarding the diagnosis, the procedure of the upcoming surgery, and anaesthesia type. It was followed by completing the Spielberger State-Trait Anxiety Inventory (STAI). The results related to the level of knowledge and anxiety showed that patients who were unfamiliar about the surgical process demonstrated significantly greater state anxiety. Thus, the authors conclude that patients' state anxiety in the pre-operative period may be decreased by increased level of knowledge about the surgery procedure (Kiyohara et al., 2004). Ng et al. discusses the influence of information provision in pre-operative stage on patients' anxiety in relation to oral surgery. The investigation was initiated on the basis that patients' anxiety is a common phenomenon in dental practice (Stabholz and Peretz, 1999). One hundred ninety two patients who were scheduled to dentoalveolar surgery operated by six dental practitioners were the subject of the investigation (including 90 female and 102 male participants). The procedure was firstly, the patients were randomly divided into four groups, and provided with pre-operative information. The information was offered to each group as follows, 1) basic information, 2) basic information with detailed description of operative process, 3) basic information with detailed description about the expected recovery, 4) basic information with both the process and recovery, respectively. The information was supplied by trained clinicians at each clinic through both verbal and pictorial formats. Secondly, the patients completed Depression Anxiety Stress Scales (DASS), in order to measure their level of trait anxiety. Then, the patients were separated into high trait anxiety, and low trait anxiety groups according to the test results. Thirdly, the patients were asked to record self-rated anxiety before, during and ten minutes after the surgical processes. The results demonstrated that significant reduction of anxiety was found in the group of patients who were given the information about expected recovery only as well as information about the operative process and expected recovery ( $p < 0.01$ ). Also, information about the operative process had a significant effect in anxiety



reduction ( $P < 0.05$ ). Hence, it is concluded that providing information regarding operative process as well as expected recovery results in relaxation of anxiety in all the procedures undergone by the patients, such as “the immediately pre-, the intra and postoperative anxiety levels” (Ng et al., 2004). Sjöling et al. attempt to identify the effect of provision of pre-operative information on patients’ state anxiety, post-operative pain, and satisfaction. Investigation into the patients’ state anxiety is described as one of the secondary objectives of the study, and it was motivated on the basis that provision of information is seen to have a positive impact on patients’ anxiety reduction, and physical recovery as well as coping outcome (Gammon and Mulholland, 1996). In the Sjöling et al.’s experiment, in total sixty patients were divided into two groups, treatment, and control group. Regarding the procedure, first, both groups were provided with routine information which described a process before surgery, such as people who they would meet, blood samples, and electrocardiogram in through a verbal format. Second, for the treatment group, they were offered more specific information regarding advice to be active in their treatment, advantages of post-operative pain which is well-treated, and risks accompanied by severe post-operative pain through a verbal format and a leaflet. Trait anxiety was not found to be different in the groups, however state anxiety was significantly lower in the treatment group (Sjöling et al., 2003).

Second, literature regarding anxiety reduction through information provision in pre-screening period will be reviewed. Luck et al. conduct a study on the impact of video information on anxiety of patients who were scheduled for colonoscopy. The background of the study was documented positive effects of information provision on alleviation of patients’ anxiety (Marteau et al., 1996), on enhancement of post-operative recovery (Johnston and Vögele, 1993), and on participation in treatment decisions based on better understanding about their suggested care (Cassileth et al., 1980 cited in Luck et al., 1999). With regard to the methods, one week before the scheduled colonoscopy, patients received a leaflet which delivers information about the test, and they were asked to complete Spielberger State Anxiety Inventory (STAI form-Y). One hundred fifty patients participated in the study (198 patients were asked to participate in the trial, 48 patients were excluded), they were divided into two groups through the randomised placement, seventy two patients were allocated to the video group, and seventy eight patients were allocated to the no-video group. No differences were found in terms of their baseline characteristics between the two groups. The patients in the former group watched a ten-minute

information video, which showed a discussion about the procedures between a narrator and a patient who had the test before. On the day the colonoscopy was scheduled, all the patients were requested to fill in the STAI again. The results demonstrated that the group of patients who watched the video scored significantly lower level of state anxiety than who did not. Thus, it is interpreted that an information video contributes to diminishment in patients' anxiety (Luck et al., 1999). Marteau et al. (1996) investigates into the effect of supply of information booklet on anxiety of female patients who were prepared for colposcopy. In the study, the effectiveness of two different information booklets is compared. One booklet was simple, and briefly presented information on procedures, behavioural instructions, and outcome. The other one was complex, and conveyed detailed information on procedures and outcome. One hundred and twenty four patients were asked for the trial, however, only sixty four patients participated in all the three questionnaire studies. They were asked to complete Spielberger's State-Trait Anxiety Inventory (1970), after making the appointment, before and after the colposcopy. They were randomly divided into four groups, all the groups were given the appointment and clinician information regarding the test procedures. The first group (N=13) was not given additional information, and the second group (N=21) was provided with the simpler version of booklet. The third group (N=15) was offered the complex version of booklet, and the fourth group (N=15) received the both types of booklets. The results revealed that the women who were offered simpler booklet showed lower level of anxiety than those who received no booklet or the complex booklet after the acceptance of their appointment, further they presented lower degree of anxiety than who were not supplied with the booklet on the day of the scheduled colposcopy. Thus this study suggests that brief and simply illustrated booklet can help reduce high degree of anxiety related to detecting and treating cervical abnormality (Marteau et al., 1996). Grey et al. examines an information-oriented intervention conducted with a purpose to mitigate anxiety of patients scheduled for magnetic resonance imaging (MRI). The study was initiated based on the grounds that significant level of anxiety is experienced during MRI examinations (Kilborn and Labbé, 1990). A protocol for anxiety reduction was developed and its effectiveness was evaluated. In the study, sixty four patients participated in the entire process, and they were separated into two groups, the first group (control group, N=35) went through standard procedures, provided with limited information about the procedures of scanning in advance, and the second group (experimental

group, N=29) was offered a booklet which demonstrated information on the procedures of scanning, advices on cognitive anxiety relaxation strategies, as well as a taped-recorded noise of scanner, a control room visit before they entered to scanner, a device for signalling for music volume adjustment, accurate timings of scans, and a clock during scanning. Their levels of anxiety were assessed through subjective ratings and Spielberger's State-Trait Anxiety Inventory (a retrospective version) (Spielberger, 1983) before, during, and after scanning. The results showed that although no significant differences were found in the degrees of anxiety measured immediately before and after the scan, the patients in the experimental group demonstrated significantly lower level of anxiety during the scan than those in the control group, according to the anxieties measured through the both methods. It is interpreted that applying some changes can mitigate patients' "scan-related anxiety", however further examination may be needed to identify exactly where the anxiety reduction occurred (Grey et al., 2000). As reviewed, the methods of delivering information, and the amount and the content of information provided to the users or patients vary, however, there have been successful cases reported in the literature. This presents the potential of provision of designed information as an intervention for reducing passengers' anxiety experienced in the London Underground environment.

## **2.4. Anxiety in public transport environments**

Passengers' anxiety experienced in public transport has been discussed in the pre-existing studies regarding public transport use. The issues on anxiety in the environments are mainly seen to be classified into three categories. They are, first, anxiety about personal safety and health, second, anxiety about uncertainty regarding travel or waiting time, third, anxiety about wayfinding, routing or navigating. According to the categories, the relevant literature regarding anxiety in public transport will be reviewed.

### **2.4.1. Anxiety about personal safety and health issues**

First, with respect to personal safety and health issues, the most relevant research on the Underground passengers' anxiety is Cheng's survey study which explores passengers' anxiety associated with train travel, which

identifies users' level of anxiety about episodes. The interesting aspect of this study is that the passengers' anxiety was analysed through the Rasch model which assesses anxiety by comparing item difficulty and subjects' capability. The results revealed that the main factors which were associated with anxiety were "crowding, delays, accessibility to railway stations, searching for the right train on a platform, and transfer processes". Furthermore, the aspects of the respondents' anxiety differed between genders, age groups, and varied according to frequency of use and types of trips (Cheng, 2010). Gidron investigates Israeli bus commuters' anxiety regarding terrorism and users' coping strategies (emotion, problem-focused coping and denial). A questionnaire was used as a method. The results present that commuting frequency and emotion-focused coping showed negative correlation with anxiety, and problem-focused coping presented positive correlation with anxiety. Frequency of commuting was negatively associated with anxiety about terrorism, which was interpreted that commuting had a desensitisation effect. Based on the results, desirable coping strategies which are a combination between problem-focused and emotion-focused coping, and minimisation of perception of vulnerability (healthy denial) are suggested as beneficial (Gidron et al., 1999). McIntosh et al. examine perceived anxiety and physical health problems associated with air travels revealing that health problems are strongly correlated with perceived anxiety. In addition, it is discovered that the respondents' common strategies for mitigating anxiety are alcohol, cigarette use, and relaxation or distraction. The degree of female respondents' anxiety and physical symptoms are greater than those of male respondents. The main stimuli of anxiety are reported as flight delays, take-off and landing, and customs and baggage reclaim (McIntosh et al., 1998). Rubin et al. investigate behaviour change connected to public perceptions, and anxiety about the outbreak of swine flu, through using telephone survey. As a response to a question that avoiding PT reduces the risk of getting swine flu, as one of the avoidance behaviours, the respondents tended to agree to it (forty nine percent of the participants) (Rubin et al., 2009). Similar to the Rubin et al.'s study results, Goodwin et al. examine psychological responses to swine flu with employing a questionnaire method, the results revealed that the most anxious respondents were the most tended to decrease the use of public transport ( $r = .48, p < .001$ ). The anxiety was assessed through measuring the degrees of worry about catching the virus (Goodwin et al., 2009). Tirachini et al. review the relevant literature regarding the effects of overcrowding in PT, in terms of its negative influences on health and wellbeing of passengers,

elevated anxiety and stress are mentioned, as well as perceived risk to the passengers' personal safety (Tirachini et al., 2013). Handley et al. study concerning anxiety and phobia associated with travel by PT amongst the survivors in the London bombings in 2005, with using a screening questionnaire. The results uncovered that forty five percent of the 596 participants reported phobic fear about PT. It also revealed travel anxiety was a commonly experienced problem amongst the respondents (Handley et al., 2009). Zhang et al. investigate into an effect of a newly introduced system which provides real-time transit information on University of Maryland College Park campus. The system was provided through five different forms, bus-finder terminals at chosen shops, a large screen, a voice response system for telephone inquiries, websites for web inquiries. A before-and-after survey was conducted to identify attitude and perception change resulted from the introduction of the system. The results showed that passengers' perception of security at night, and overall satisfaction were significantly increased, however, waiting anxiety was not found to be reduced (Zhang et al., 2008). According to the Department for Transport report regarding people's perception about personal security, a number of events are described which might evoke anxiety in PT environments. Travelling by the Underground was more anxiety-inducing than other types of transport modes for both male and female passengers across all age and ethnic groups in the daytime. Almost twenty percent of female respondents reported that they do not feel safe when travelling on the Underground during the daytime. Anxieties while waiting when passengers travel after dark are mentioned, and the anxieties are higher among female passengers. In relation to travelling after dark, anxieties are addressed especially about when passengers are walking to stops or stations, and they are expressed by both male and female users. These anxieties could be a barrier to use of PT for potential users. In addition, female passengers expressed higher anxieties about anti-social behaviour and being a victim of crime. Also, older people tend to experience greater anxieties about anti-social behaviour and being a victim of crime, although the chances are lower than young people. Also, rowdy and noisy groups, and alcohol or drug use can create an unsafe environment when passengers are waiting or using PT. Further, presence of graffiti, litter, and PT environments which are poorly maintained can be triggers of passengers' anxieties (Crime Concern, 2004). According to the survey results conducted by Science Applications International Corporation whose sample size was 358, sixty percent of the respondents reported that the information from "Transit Tracker information" provided at bus stops

relieved their anxiety at the bus stop. Fifty five percent of the respondents reported that the information boosted their perception of personal security at the bus stop (Science Application Information Cooperation, 2003).

#### **2.4.2. Anxiety about uncertainty regarding travel or waiting time**

Second, anxiety about uncertainty regarding travel or waiting time will be reviewed. It is mentioned that considerable amount of anxiety will be elicited due to uncertainty about the time of arrival of the next vehicle and whether it will arrive or not (Webster and Bly, 1982). Installation of television at Singapore Mass Rapid Transit stations that show popular movie trailers, news about sporting events, and music videos is mentioned that it helped reduce commuters' anxiety and boredom (Ibrahim, 2003). In New Zealand, a device which offers information about bus arrival for passengers, which is called "BusFinder" has been set up, and it was seen to improve perception of reliability of the bus service, but it did not effectively relieve users' anxiety experienced when they are waiting for buses (The Urban Transportation Monitor, 2003 cited in Tam and Lam, 2005). Reduced travel time variability lowers the level of anxiety and stress resulting from uncertainty, as well as that in deciding departure time and route options (Sun et al., 2003 cited in Mazloumi et al., 2009). In Khattak et al.'s investigation into intention to pay for travel information, addressing that there are three key factors of transport systems, the network, users, and travel information system, it proposes that people might more tend to pay for better quality of travel information in a certain circumstance. It is when uncertainty about travel time is large (e.g. due to congestion caused by incident), and only the individuals who receive the information about the incident, so that they can divert their routes, whereas uninformed individuals choose the congested path. Hence, perceived merits, such as reduction of anxiety, and saving travel time are more valued than perceived expense of information acquisition (Khattak et al., 2003). Shalaiak et al.'s study regarding use of haptics to interfaces of visual map for PT information systems suggests the system's main advantage as using the system on users' mobile devices will lead to anxiety reduction because they can find the closest bus stop, and bus arrival time, and consequently visitors are less likely to miss destination bus stop. This is assisted by vibration alarm which notifies users about bus arrival, and approaching of the bus to their destination stops (Shalaiak et al., 2012). Ferris et al.'s survey study pertaining to real-time arrival information provision for PT, the results revealed a number of positive impacts of it.

They are suggested as, increase in the level of overall satisfaction with PT, decrease in time of waiting, increase in perception of safety, and a health benefit resulting from increased walking while utilising PT. As the implications of the study, the provision of real-time arrival information is accepted as a method for increasing the number of passengers through reducing the level of anxiety, and enhancing reliability (Ferris et al., 2010; Parker, 2008).

### **2.4.3. Anxiety about journey planning, routing, and navigating**

Third, literature addressing anxiety about journey planning, routing, and navigating will be reviewed. Adler and Blue discusses that “Advanced Traveller Information System” delivering real-time travel information to travellers will result in efficient allocation of passengers to possible routes and modes. In turn, the system can help relieve travellers’ anxiety and stress about journey “planning, wayfinding, and navigating”. The system is an essential part of “Intelligent Transport System”, and the both systems support travellers’ pre-trip and en-route trip decision making (Adler and Blue, 1998). Warra’s research attempting to identify the need of the older and disabled users for PT journey planning through both qualitative and quantitative methods, it proposes that a potential positive effect on experience of anxiety prior to their journey is expected. This can be achieved through tailored information which is likely to decrease complexity and improve usability, as well as to meet their specific needs and reassure accessibility, which in turn, will lead to usability of the PT environment (Warra, 2009). Stradling (2002) investigates into transport users’ needs, which are hoped to give insight to stakeholders to create more marketable PT service. In the factor analysis results using the questionnaire data gathered from 241 respondents who had experience of interchanging at bus stations in Edinburgh city centre (Wardman et al., 2001), travellers’ anxiety is mentioned as one of the four factors which were extracted from sixteen perspectives about bus and rail interchanging. The first factor was related to trip generated anxiety, and five items were grouped together representing this factor. First, they were worry regarding making connection, arriving at destination in time, waiting longer than they expected, as well as not feeling in control, and feeling confident during the interchange process and the journey. The second factor was associated with physical effort, such as walking and waiting, and the third factor was connected to concern about personal safety during the interchange and journey, and the position of

waiting. The last factor was concerning cognitive load about pre-trip journey planning. The first and the third factors were identified as affective efforts. It is added that emotional efforts are seen taxing and may be the most significant barrier to prefer PT over private mode (Stradling, 2002).

As reviewed in this section, passengers' anxiety in PT environment has been mainly focused on three issues, passengers' perceptions of personal security, travel time, and travel planning, routing and navigating. In terms of travel time, it seems somewhat certain that the anxiety triggered by uncertainty about transport arrival time which is connected to waiting time can be relieved by provision of information about the estimated time. Consequently, there seems to be little room for improvement regarding the issue. Thus, the focus will be narrowed down to the other issues, such as personal safety or travel planning including routing and navigating. The studies discussing the issues are not seen to directly measure the levels of passengers' anxiety with the exception of the Cheng's (2010), Gidron et al.'s (1999), and McIntosh et al.'s (1998) studies. Additionally, few studies suggest solutions for anxiety reduction through identifying the determinants of anxious arousal in the environment, and verify the effects of them on the arousal. Therefore, the direction of the present study is determined as identification of influencing factors of anxiety in the London Underground environment on anxiety, and examination of the effects of the factors, which will then perform as theoretical grounds for anxiety reduction that can be used for designing information. This will be enabled by the theoretical support of theoretical ideas that will be reviewed in the following section.

## **2.5. Anxiety**

Anxiety is commonly defined in conjunction with, or with being compared to fear, therefore, further understanding about anxiety will be encouraged through reviewing the differences between anxiety and fear. Further, anxiety will be delineated in the dimension of emotion in the sense that anxiety is widely accepted that it is an emotional state, consequently, perspectives of emotion which underlie the approaches to inquiry of anxiety which diverge into three different dimensions, such as behaviour, biology, and cognition will be described. These views help when understanding anxiety, however, in order to fulfil the aim of the present study, which is to develop theoretical rationales for reduction of passengers' anxiety, as well as to achieve



stronger managerial implications, the cognitive side of anxiety will be highlighted. Since, this view is closely tied to cognitive behavioural therapy of anxiety, which tackles maladaptive cognitive appraisals of threat, which has become popular amongst clinicians (Barlow, 2002). A potential benefit of use of theories of emotions is that they allow researchers to see how emotions are evoked which will enable them to define what the antecedent of the emotions. Lazarus strongly states that theories of emotions should not only be able to define what emotions are by focusing on the responses, but also to assist to give insight to resolve emotion-related problems. It is argued that the primary task of a theory of emotion is “to find a way to integrate eliciting conditions in the environment and person, mediating processes such as thoughts, motives, action tendencies, and physiological activity, all of which are part of the complex configuration we call an emotion”. In order to achieve this, the causal variables which influence emotion need to be considered (Lazarus, 1991).

### **2.5.1. What is anxiety?**

According to the Oxford English Dictionary, anxiety is defined as “Worry over the future or about something with an uncertain outcome; uneasy concern about a person, situation, etc.; a troubled state of mind arising from such worry or concern”, “An instance or case of this; a cause of, or matter for, worry or concern”, “Strong desire or concern for something to happen or to do something; an instance of this” (Oxford English Dictionary, 2017a). In academic literature, Freud is seen as the most significant contributor to improvement of understanding of anxiety (Izard, 1977; Spielberger, 1972). He explains anxiety as “something felt”, which is experienced with “feelings of apprehension, tension, nervousness, and worry”, as well as physical responses (Freud cited in Spielberger, 2010). The responses are “palpitation, and disturbances in respiration, sweating, restlessness, tremor, shuddering, and the like” which arise from activation of autonomic nervous system. This is a humans’ unpleasant emotional state or condition (Freud, 1924 cited in Spielberger, 1972). Anxiety is a “state of tension” which is unpleasant, which is induced by “some danger to the organism” (Weiss and English, 1957). Anxious arousal is evoked when a situation is seen as threatening or dangerous, which is associated with “tension, apprehension, and worry”. Individuals who are in this state, experience changes in somatic and behavioural reactions result from the activated autonomic nervous system. The level of the arousal increases proportionally to anticipated

harms from potential threats (Spielberger, 1979, p. 15). It is understood that anxiety as “adaptive in motivating behaviour” that supports individuals’ coping with the potential risks (Spielberger, 2010). The concept of potential threat or risk is essential in explaining the nature of anxiety, and it is further identified in this definition, “the apprehension cued off by a threat to some value that the individual holds essential to his existence as a personality. The threats are defined that they might be to “physical life (a threat of death), or to psychological existence (the loss of freedom, meaninglessness)”, or “to some other value which one identifies with one’s existence (patriotism, the love of another person, “success,” etc.)” (May, 2015). Furthermore, Barlow explains what can be experienced in a situation involving a threatening event by proposing a statement describing what an individual who is experiencing anxiety might say, “That terrible event could happen again, and I might not be able to deal with it, but I’ve got to be ready to try” (Barlow, 2002). In other words, anxiety can be characterised as “future-oriented mood”, and “negative affective state” that urge individuals to prepare for upcoming future danger. Cognitive vigilance and bodily responses which offset helplessness are seen as attributes of anxiety (ibid). According to American Psychiatric Association, anxiety is defined as “apprehension, tension, or uneasiness which stems from the anticipation of danger, the source of which is largely unknown or unrecognised” (American Psychiatric Association, 1975). It is also identified as “the apprehensive anticipation of future danger or misfortune accompanied by a feeling of dysphoria or somatic symptoms of tension”. The danger in this context might be either external or internal (American Psychiatric Association, 2000). In the later version of the manual, it is said that responses, such as “muscle tension, vigilance in preparation for future danger”, commonly arise in a state of anxiety. It is also commonly associated with avoidant or cautious behaviours. Although, the stages of anxiety and fear might overlap, but anxiety is distinguished from fear, which is a reaction to “real or perceived imminent threat”, in the sense that anxiety is a response to anticipated future risk. Anxiety and fear are reported to be relieved by avoidance behaviours (American Psychiatric Association, 2013). Anxiety is a reaction from anticipating a threat that is a “formless event”, associated with uneasiness and tension, which is closely connected to fear which is accompanied by tension and unpleasantness (Rachman, 2013). In sum, what can be known from the definitions is that anxiety is a negative emotional state, which is induced by anticipation of threat, which tends to be associated with physical, emotional, cognitive changes, mainly in preparation for the threat.

### **2.5.2. Anxiety and fear**

Anxiety and fear are sometimes equated in the psychological literature (Edelmann, 1992). Especially in the field of direct intervention to behaviour in treatment of phobias and fears, an assumption is accepted that anxiety has cues which are identifiable, even though some are more diffuse. Additionally, a large number of clinicians are not accustomed to distinguish anxiety and fear (Barlow, 2002). However, historically, they have also been considered as distinguished concepts. They are differentiated mainly on the basis of the “presence or absence of cues” (Edelmann, 1992). Amongst early theorists, for example, Kierkegaard and Freud distinguished them based on the “presence or absence of cues”. Hence, responses to an objective cue are considered as fear, on the contrary, “a diffuse, objectless apprehension” is regarded as anxiety, which is a state looking out for “hidden cues”. Additionally, the consideration of the existence or non-existence of cues has played an important role in differentiation between anxiety and fear, and it has facilitated theorisation of anxiety (Barlow, 2002). In a similar vein, anxiety is differentiated from fear in the context that anxiety does not involve an external threat source which is clearly identifiable. The anticipation of threat leads to “a state of undirected arousal” (Öhman, 1993). Along with the differentiation based on the existence or absence of cues of threat, they are regarded to be dissimilar. A vast amount of academic literature regarding anxiety describes it in conjunction with the concept of fear as one of the basic emotions (Edelmann, 1992; Craske, 1999). Fear has been mentioned as one of the basic human emotions by emotion theorists (Power and Dalgleish, 2015; Oatley and Jenkins, 1996; Izard, 1992), whereas anxiety is seen as an affective-cognitive structure (Izard, 1992). In this view, anxiety is a “cognitive association or elaboration rather than an emotion”, understood as cognitive processes which are less hardwired and more associated with individuals’ personal life experiences, unlike fear which is “hardwired biological events of primitive origin (Craske, 1999). Fear is one of the six basic emotions listed as “happiness; surprise; fear; sadness; anger; and disgust/contempt” by the advocates of the concept of basic emotion with obtained evidence (Ekman et al., 1972, cited in Power and Dalgleish, 1997). Specific emotions which are called ‘basic’ are considered to possess characteristics, “innate neural substrates, innate and universal expressions, and unique feeling-motivational states”. A diversity of emotional

experiences is accounted for as a “function of emotion-cognition interactions” which lead to “affective-cognitive structures” (Izard, 1992).

Table 2.1 A list of the major basic emotion theorists  
(adapted from Power and Dalglish, 1997)

Reference	Fundamental emotion	Basis for inclusion
Ekman et al., 1982	Anger, disgust, <b>fear</b> , joy, sadness, surprise	Universal face expression
Izard, 1971	Anger, contempt, disgust, distress, <b>fear</b> , guilt, interest, joy, shame, surprise	Hardwired
McDougall, 1926	Anger, disgust, elation, <b>fear</b> , subjection, tender-emotion, wonder	Relation to instincts
Panksepp, 1982	Expectancy, <b>fear</b> , rage, panic	Hardwired
Plutchik, 1980	Acceptance, anger, joy, <b>fear</b> , sadness, surprise	Relation to adaptive biological processes
Tomkins, 1984	Anger, interest, contempt, disgust, distress, <b>fear</b> , joy, shame, surprise	Density of neural firing
Watson, 1930	<b>Fear</b> , love, rage	Hardwired

For theorists who differentiate anxiety and fear, anxiety is viewed as a cognitive-affective structure, which is thought to be more pervasive than fear (Ekman, 1992; Izard, 1992). For instance, Izard claims that anxiety is experienced in combination with fear which a dominant emotion in the combination, along with other basic emotions, such as particularly, “distress, anger, shame, guilt, and interest” (Izard, 1977). Later, she differentiates anxiety from fear, by suggesting four different basic emotions, such as, fear, excitement, anger, and sadness. The chief reason for indicating them as basic emotions is that they are thought to involve “innate neural substrates, innate and universal expressions, and unique-feeling-motivational states”. Additionally, basic emotions are considered to be hardwired, and their “biological and social functions” are vital in evolutionary and adaptive senses. In the case of fear, it is closely connected to safety and security, which are maintained through avoidance behaviour. On the contrary, anxiety is seen that it results from cognitive process, which is less hardwired and more tied to life experiences of the individual (Izard, 1992)

In sum, anxiety and fear are differentiated chiefly based on the presence or absence of cues of threat, and also distinguished on the basis of comparison between anxiety as a cognitive-affective state and fear as one of the basic emotions. In this context, a synthesised view of differentiation of anxiety and fear, embracing the concept of threat, and fear as an emotion will be introduced. Craske, pointing out that disagreement has been created in the usage of the terms, such as, worry, (anticipatory) anxiety, fear and panic, has attempted to delineate the conceptual positions among them. She further gives accounts that anticipatory anxiety and fear are dissimilar, in the context that anxiety is a response to future threat which is approaching, which will be associated with “fight/flight mobilization” that is ready to be activated when necessary. On the contrary, fear is a reaction to imminent threat, which accompanies strong intense arousal (Craske, 1999). The Table 2.1 illustrates different emotional states which result from varied degrees of imminence of threat imposed. Imminence in this context is clarified as “physical and temporal proximity”. It distinguishes anxiety from worry. The rationales are established based on the factor analysis results of anxiety symptom questionnaires which generally extract two underlying structures (Mathews, 1990). They are reported as awareness of physiological responses, and cognitive aspects, for instance, unwanted and obstructive thoughts (Lehrer and Woolfolk, 1982). Worry is considered as the latter ones, which can be represented as a “cognitive component of anxiety” (Craske, 1999). Worry is cognitive sides of anxiety which has a functional aspect as preparation (Barlow, 1988). It also facilitates individuals’ coping and reduces the level of surprise when they are faced with anticipated negative situations (Mathews, 1990). Different responses are accompanied in the each state, which are “most adaptive” to the degrees of threat imminence. First, when there is no threat in the situation, individuals remain in the “preferred mode of safety and control”. Second, in the state of worry, which is represented as cognitive-verbal stage, autonomic arousals are suppressed for preparing for threat. Third, in the state of anticipatory anxiety, cognitive processing is engaged to a certain degree looking out for cues of threat, as well as somatic responses are aroused that will be connected to fight/flight reactions which will be set in motion when needed. Lastly, in the state of fear and panic, strong intensity of arousals are associated with limited cognitive processing as a response to immediate danger (Craske, 1999). The Table 2.2 delineates varying responses according to the levels of imminence of threat from worry to fear and panic which summarises the perspectives of worry, anticipatory anxiety, and

fear/panic. As reviewed earlier about the difference between anxiety and fear as a basic and discrete emotion which barely engages cognitive process, anxiety is less hardwired, more cognitive, and more complex than fear.

Table 2.2 Threat imminence continuum for humans  
(Craske, 1999)

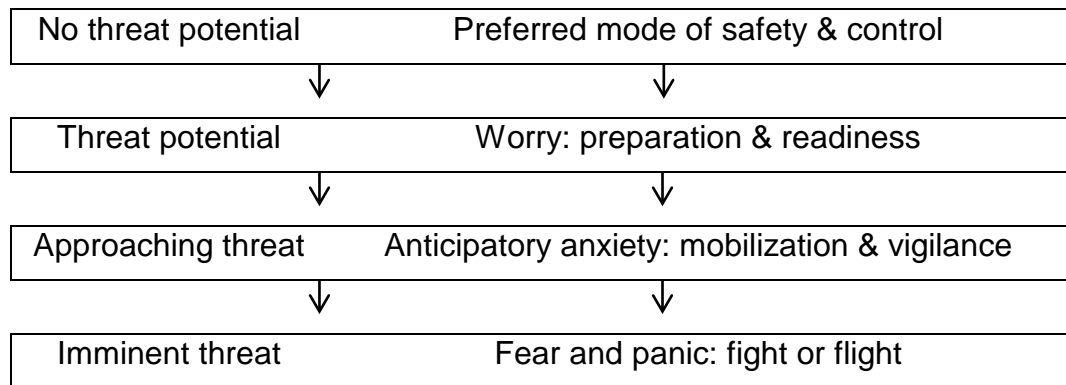


Table 2.3 Response dimensions for levels of threat imminence  
(Craske, 1999)

Threat potential	→	Approaching threat	→	Imminent threat
↓		↓		↓
Worry	→	Anticipatory anxiety	→	Fear and panic
Less hardwired				More hardwired
Cognition				Emotion
Complex cognitive				Concrete and visual
Autonomic suppression				Autonomic expression
Left hemisphere				Right hemisphere
Behavioural caution				Escape or fight
Inaction				Action
Diffuse				Stimulus bound
Slow				Fast
Chronic				Discrete

### **2.5.3. Emotion and anxiety**

Anxiety, considered as a cognitive-affective structure, which is experienced with various emotions, such as distress, sadness, and anger, however, fear is a dominant one amongst them (Izard, 1977). Additionally, Barlow accounts anxiety using a metaphor that “if the experience of emotion is Lewis Carroll’s Wonderland, anxiety is the Red Queen. Always a future threat, often an unbearably overwhelming present danger, the Red Queen dominates Wonderland in the same way the study of anxiety has dominated emotions.” In this sense, he adds that, the nature of anxiety can hardly be discussed without clarifying its position in the dimension of emotion (Barlow, 2002). Considering the Izard’s and Barlow’s views on anxiety, interpreting anxiety in the context of emotion seems to be a prerequisite for gaining an appropriate level of understanding about it. Therefore, this section will be devoted to further discussion on anxiety through examining a theoretical background of emotion. Consequently, relevant perspectives and theories of emotion and anxiety will be reviewed. This will help clarify the direction for the following steps which will be contributed to developing intervention strategies for anxiety reduction by enabling to define how anxiety is considered for the present study.

It has been mostly agreed by emotion theorists that emotion is composed of several elements. They are “subjective experience of affect”, expressive behaviours, “a function of the nervous system”, and “cognitive perception or appraisal”. First, affect includes a wide variety of states of feeling, such as, sadness, anger, or happiness. It is viewed as a “slippery subject for science”, since the knowledge about it depends on a form of introspection which is uncertain and qualitative. Thus the other elements have been thought to be more suitable for scientific investigation, and emphasis has been placed on them accordingly (Barlow, 1988). Emotion theorists have focused on one of the aspects or another for most of the last century, consequently approaches to the inquiries into anxiety have been supported by the traditions of the research into emotion. Thus, the three aspects of emotion, as well as anxiety will be reviewed (Barlow, 2002).

#### **2.5.3.1. Emotion as expressive behaviour**

First of all, emotion and anxiety as expressive behaviour will be discussed. This tradition was initiated by Darwin, highlighting “behavioural expression, including facial expression” as the essential feature of emotion. This view

has had an influence until today, and been supported by experimental evidence and the perspective that the types of emotions exist and they are “universal and the product of our evolution”, which are not entirely malleable (Ekman and Davidson, 1994). This inquiry on emotion considers emotions are “innate patterns of reaction”, which have a functional significance, which have been developed in various life forms. The basic emotions are not unmodifiable or unchangeable, but they are consistently presented from birth in humans across cultures, and continents (Izard, 1977). For example, in Darwin’s experiment, the qualities and expressions of emotions were observed to be the same in those who were born blind and in the subjects normally sighted (Barlow, 2002). In relation to the adaptive quality of emotional behaviours, the two main functions can be suggested, preparational and communicational functions. For instance, fear urges the animal to prepare for danger to take immediate actions, such as fleeing from, or fighting against it. Further, the animal expressing fear signals to other animals to react to the danger, which in turn influences their “chance for survival” (ibid).

### **2.5.3.2. Anxiety as expressive behaviour**

The perspective of considering anxiety as expressed behaviour, anxiety is seen as a hybrid or mixture of emotions which are intrinsic and fundamental. In the background of this idea, fear is regarded to be basic and fundamental emotion observed across cultures, species, and ages, which is the dominant feeling in the blend of emotions (Izard, 1977). Furthermore, anxiety is considered to be “something very vague, imprecise, and muddled”, and it tends to be modified by life experiences and learning, unlike basic emotions. Anxiety is interpreted as “stable affective-cognitive structures” which is developed through the process of learning with fundamental emotions. They are similar to traits which are formed as a result of “affective-cognitive interactions” as a certain pattern, which occur repeatedly (Barlow, 2002).

### **2.5.3.3. Emotion as biology**

Second, the view that emotion and anxiety are considered as biology will be mentioned. This tradition of inquiry about emotion was initially undertaken by Cannon. It criticised the James-Lange theory of emotion with arguing that emotion was chiefly a function of brain. In the James-Lange’s notion of



emotion, experience of emotions was believed to occur from the “all parts of the organism”, including skins, muscles and viscera. However, Cannon’s claim was supported by experimental evidence, when the viscera was completely separated from the central nervous system, by transecting “the spinal cord and the vagus nerves of dogs” which destroyed the connection between the brain and other parts of the animal, emotional behaviours were not altered (Cannon, 1927). He rather argued that hypothalamus was thought to be the part of emotion, whose destruction led to a drastic loss of most of the components of emotion, which could be identified as expressive behaviours with somatic responses with subjective affective experiences. This tradition of investigation into emotion has focused on understanding about processes of the brain which are active in certain emotional states. In the initial stage of the inquiry, identification of neuroanatomical sites which are associated with emotional states was main a concern, for instance, through observing emotional changes resulting from extirpation of different parts of the brain (Barlow, 2002). However, in modern psychology, Lang emphasises neural structures of the brain, rather than focusing on particular areas of the brain, which are engaged in processing and arousal of emotions (Lang et al., 2000). Nevertheless, the earlier view which asserted that emotional experiences which are connected to certain parts of the brain are primitive, and that neurobiological links may exist which enable activation of emotions with little engagement of cognitive process (Izard, 1992; Zajonc, 1984). It was supported by empirical evidence which revealed that there exist the neural pathways, which are connected to arousal of emotions (LeDoux, 1998; Lang et al., 2000). What was discovered in the subsequent studies is that it is hard to define the specific areas which evoke particular emotions, since activation of the identical area of brain might provoke different emotional expressions in different circumstances. In the more recent study, emotions are investigated with regard to their relationships with the systems of neurotransmitter and neuromodulators (Barlow, 2002).

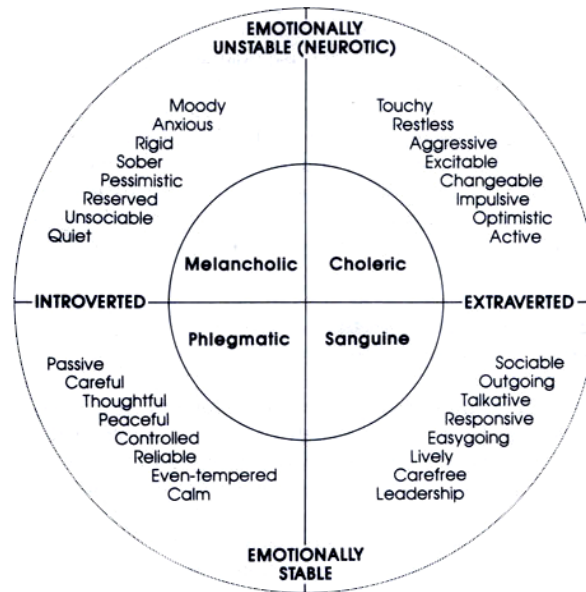


Figure 2.5 Eysenck's personality model  
(EI-Nasr et al., 2009)

#### 2.5.3.4. Anxiety as biology

As the relevant theories explaining anxiety from the perspective of biology are the theory of personality (Eysenck, 1967; 2009), and the behavioural inhibition system (Gray, 1982; Gray and McNaughton, 2003). First, in the Eysenck's theory, two different dimensions of individuals' personality are suggested based on factor analysis results, which are introversion and extroversion, and neuroticism and stability. The former dimension explains personality according to the degrees of cortical arousal. Emotions which are positive and pleasant are related to moderate degrees of arousal, and those which are negative and unpleasant are connected to either excessively high or low arousal. Individuals tend to remain in the state in which the arousal is moderate and avoid the extreme arousals (Eysenck, 2009). Individuals' resting levels of arousal vary and they are determined biologically and consistent, and the degrees of arousability lead to differences in behaviour. For example, for individuals who have reactively low degrees of cortical arousal, higher optimal cortical arousal levels, and a larger amount of stimulation are sought out. They are classified as extraverted. On the other hand, for introverted individuals, lower arousal and stimulation levels are found to be optimal (Barlow, 2002). The latter dimension describes personality by introducing an axis whose one end is neuroticism, and the other end is stability. These two contrasting qualities are determined by

reactivity of autonomic nervous system affecting activity of limbic system. Neurotic individuals are considered to show a tendency for intense activity of nervous system, and present less habituation (Eysenck, 2009). In his theory, reactivity of autonomic nervous system is thought to be the intrinsic biological factor which determines the individual tendency. Also, anxiety is viewed to be rooted in the interactions of cortical arousal, reactivity of autonomic nervous system with the effects from limbic system (Barlow, 2002).

Second, in the behavioural inhibition system, originally coined by Gray (1975), whose establishment was initiated on the basis of the studies regarding the effects of classical anxiolytics on the experimental animals' behaviours will be discussed. In order to control "the inhibition of ongoing behaviour", including the elevation in vigilance and arousal, that can result from the encounter of "pain, punishment, failure, loss of reward, novelty, or uncertainty" (Gray and McNaughton, 2003). This system consists of three systems, firstly, behavioural inhibition system (BIS), secondly, behavioural approach or activation system (BAS), thirdly, fight-flight system (FFS) that contribute to elucidating individuals' personality and emotions (ibid; MacAndrew and Steele, 1991). Firstly, BIS reacts to "novel stimuli" or those concerning punishment, or nonreward, through inhibition of ongoing behaviour, increase in arousal, and redirection of attention toward the related stimuli. Anxiety is constituted by the activities in the BIS, and it is relieved by anxiolytics (Gray, 1982). A biological base of anxiety is explained as "exaggerated inhibition" arising from the stimuli as a reaction of BIS (Barlow, 2002). Secondly, BAS is a system responds to reward or safety (nonpunishment) signals with facilitation of approach. A great part of individuals' behaviours are regulated by the two systems (Gray and MacNaughton, 2003). Thirdly, FFS is activated by primary punishing (e.g. pain) and frustrative stimuli, unlike BIS which reacts to secondary stimuli. As responses to FFS, heightened autonomic arousal, avoidance, propensity for escape, and defensive aggression are presented (Barlow, 2002)

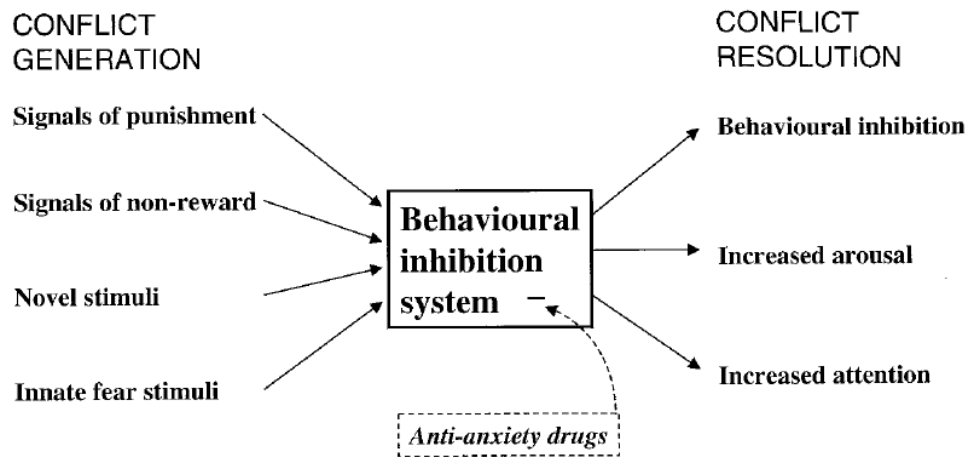


Figure 2.6 The behavioural inhibition system  
(Gray, 1982, cited in Gray and MacNaughton, 2003)

### 2.5.3.5. Emotion as cognition

Third, the perspective which considers emotion and anxiety as cognition with emphasising cognitive dimensions of emotion and anxiety, and appraisals intervened in the process of emotion in the situation will be illustrated. The approach was initiated by Schachter and Singer, whose theory named “two-factor theory of emotion” or “cognition-arousal theory” (Scherer et al., 2001), addressed that “the emotional states are a function of the interaction of cognitive factors with a state of physiological arousal” (Schachter, 1964). It criticised previous work on emotion, such as the Cannon’s claim, by stating that similar arousals can be experienced about different cues of emotions, and arguing that “the variety of emotion, mood, and feeling states are by no means matched by an equal variety of visceral patterns”. Therefore, what needs to be prioritised in understanding emotional states, are cognitions which contribute to labelling an emotion in the situation as well as psychological arousal (Schachter and Singer, 1962). The same heightened arousals can be identified differently according to the context, for example, the emotion evoked when jumping from an airplane without a parachute would be called fear, however, the emotion triggered when having sexual relations would be labelled as love. Hence, appraising the context, identifying causality, following the perceived arousal states which are undifferentiated and generalised are considered to be important in understanding emotions (Barlow, 2002). Although the two-factor theory did not investigate into specific emotions, it is seen to be influential, in the sense that it started to take cognitive elements into consideration in experiments in

emotions, and contributed to introduction of cognitive paradigm (Scherer et al., 2001). With this initiation, appraisal theory has been developed which claims that organisms' perceptions about changes in the environment related to their well-being arouse emotions, which is represented as appraisal. It is also believed that emotions are not separable from thoughts. The factors which are involved in the appraisal are suggested as, "temperament, physiology, culture, current goals, and past life experiences, so that similar events can provoke different emotions in different people, or in the same person at different times" (Ellsworth, 2013). What appraisal means is a process of the evaluation of the significance of the situation for well-being. The significance is associated with concerns which are satisfied or obstructed (Frijda, 1986). The concerns mean "the individuals' needs, attachments, values, current goals, and beliefs", which are cared about by the individuals. It is highlighted as a component which performs to evoke and differentiate emotions, and the strength, as well as somatic responses, behavioural expressions, and feeling (Moors et al., 2013). The pioneering theorists are Arnold (1960), and Lazarus (1966) (Moors et al., 2013; Scherer et al., 2001).

- **Arnold's appraisal theory of emotions**

First of all, Arnold is thought to be the pioneer of cognitive theory of emotion in modern psychology. She recognised a drawback of previous inquiries into emotions, and it was that a single or a few elements of the condition were focused. She, instead, argued that "a complete theory of emotion" should be able to deal with experiences of emotion, as well as emotional actions, and expressions (Reisenzein, 2006). Hence, in her cognitive theory, an assumption was made that appraisals initiate emotional sequence, and elicit suitable actions and emotional experiences, which lead to associated somatic responses, which are considered to be important, however the actions and experiences are not initiate by the physiological reactions (Scherer et al., 2001). Several achievements of her theory regarded to have "unmatched explanatory power" are worth being addressed. First, types emotions are significantly differentiated. Second, individuals may react with dissimilar emotions to the same event. Third, events which do not have in common may elicit the same emotional reactions. Fourth, identical emotional reactions can be triggered by information gathered through a different manner (Reisenzein, 2006).

- **Lazarus's cognitive theory of stress and coping**

Lazarus developed and popularised the appraisal approach in the inquiry of emotion (Reisenzein, 2006). Lazarus (Lazarus, 1966; 1991; Lazarus and Folkman, 1984) established a theory of emotion, called "the cognitive theory of stress and coping", which involves and highlights the significance of cognitive appraisal. Lazarus made progress the cognitive approach with criticising the practices of behaviourists for treating emotions as an intervening motivational factor. He states that the substantive properties of the emotional reaction which is assumed to motivate individuals are hardly examined by simply observing behavioural patterns which are adaptive or maladaptive (Scherer et al., 2001). What he focused more was to identify the underlying nature of cognitive appraisal which results in different emotional responses, and the determinants of the cognitions (Lazarus et al., 1970 cited in Scherer et al., 2001). He defines that cognitive appraisal is comprised of "a continuing evaluation of the significance of what is happening for one's personal well-being" (Lazarus, 1991), which can be regarded as the process to categorise an event, and its diverse aspects (Lazarus and Folkman, 1984). The necessity of understanding individuals' cognitive appraisal process arises from the need of identifying individual differences in the intensity and type of emotional responses, and variations among them. Their sensitivity and vulnerability to, or interpretations and responses about certain events greatly vary, for instance, in the comparable situation, some feel anxious or depressed, others feel angry or challenged. There are two classes of appraisals, which are primary and secondary appraisals. Primary appraisal is concerned with "Am I in trouble or being benefited, now or in the future, and in what way?". Primary appraisal can be classified into three types, first, irrelevant, second, benign-positive, third, stressful. First, in terms of irrelevance, it is mentioned to be considerably adaptive to differentiate whether cues are irrelevant or relevant, since the judgement will lead to an action only when it is required. Second, regarding benign-positive evaluation, it is made when the consequences result from an encounter with a situation are interpreted as positive. Pleasurable emotional responses can be represented of the appraisals, however, those involving no apprehension are rare. It reveals complexity of appraisals which depend on "person factors and the situational context". Lastly, with regard to stress appraisals, they involve "harm/loss, threat, and challenge". Harm/loss means certain damage which has already been inflicted to the individual, such as, anticipating disease or injury, or recognition of loss in self-esteem, or of valued and loved ones. Threat indicates harm or loss which has not been



### **2.5.3.6. Anxiety as cognition**

- **Beck's cognitive model of anxiety**

A cognitive approach to anxiety is taken by Beck who emphasises a cognitive process as a crucial component in states of anxiety. Anxiety is considered to have adaptational dimensions, in the sense that anxiety behaviours function for the evolution of organisms. He uses a term “the master system”, namely, “the psychobiological or organism totality”, which has certain purposes to self-preserve, feed or to breed to implement the “master plan”. The master system consists of two different systems, primal and subsystems, which are corresponded to anxiety symptoms. The two systems have “cognitive, affective, behavioural, and physiological” functions, and they are organised and integrated by the master system. In terms of primal reactions, those to life-threatening events are described as fight/flight, freeze, or faint. Adaptiveness, in this context, is tied to the purposes which are rooted in evolutionary principles pertaining to organisms’ survival. Also, it is regarded as a “strategy in response to threat”, in the sense that “human beings are so designed as to experience an intensely unpleasant emotion (anxiety)” as a response to present risk, and motivated to take action to alleviate the arousal. He explains anxiety disorder as a malfunctioned system for activation and termination of a defensive reaction to a threat (Beck et al., 2005). Pathological anxiety states involve an overestimated or biased perception of risk (Beck and Clark, 1997). Beck focuses on a cognitive dimension of anxiety, and his theory is centred on misinterpreted or exaggerated danger (Barlow, 2002). He introduces “a cognitive model of anxiety” (Beck et al., 2005), which places emphasis on an information processing aspect of anxiety which is “schema-based”. The model considers a central feature of anxiety disorder to be distorted or erroneous interpretation of stimuli as threatening and dangerous which may damage one’s mental or physical well-being (Beck and Clark, 1997). In anxiety states, the biased information processing results in images and autonomic thoughts which are associated with the related threat. Motor, physical, and affective elements are elicited as a response to anxiety by the images and thoughts. In this approach, the autonomic thoughts, and the schema which underlies the biased interpretation are tackled to be altered. In this sense, this manner of approach is more appropriate as “a theory of anxiety disorders” (Barlow, 2002).



- **Spielberger's a trait-state conception of anxiety**

With regard to the main implication of this model for this study, it offers a theoretical guidance on understanding about the process from external or internal stimuli whose results lead to a state of anxiety and the components which are engaged in the process. A Trait-State Theory of Anxiety elucidates anxiety phenomena by suggesting important variables and their possible interrelations with presenting a conceptual model, A Trait-State Conception of Anxiety which is shown below. It also proposes the importance of defense mechanisms which function to relieve anxiety when experienced.

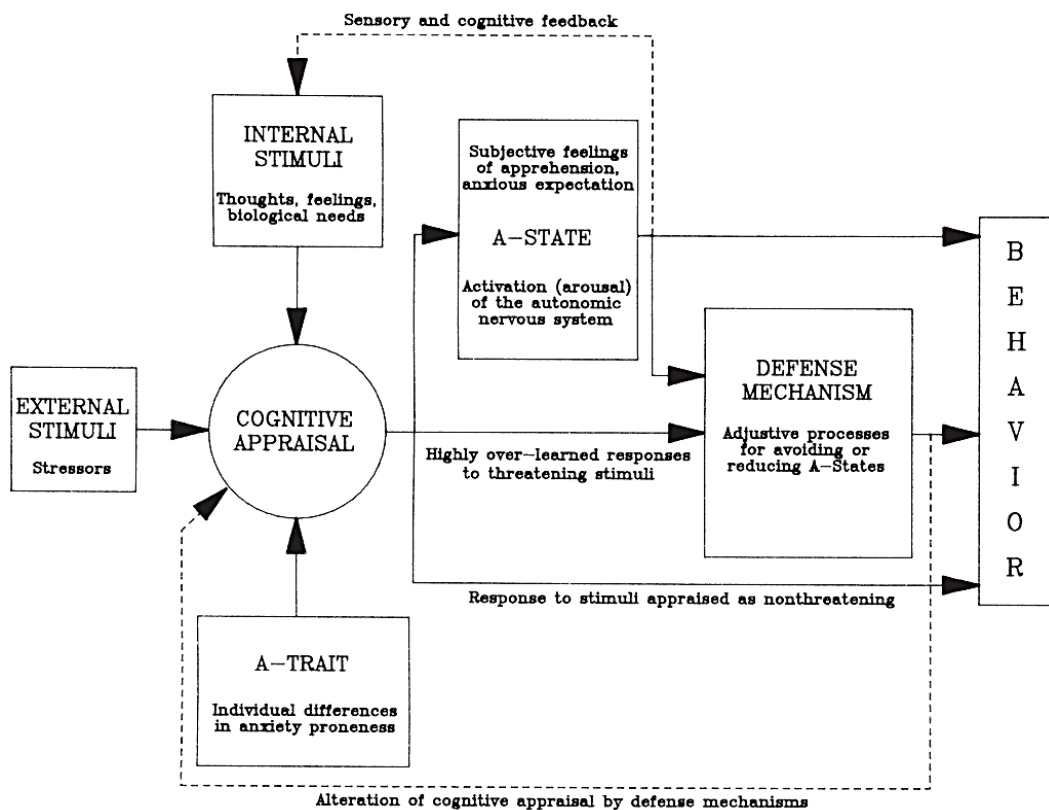


Figure 2.8 A trait-state conception of anxiety  
(Spielberger, 1972 cited in Barlow, 2002)

This model points out important factors which need to be considered when understanding anxiety phenomena. Spielberger addresses that state anxiety should be distinguished from trait anxiety, as different constructs. State anxiety is identified as “a transitory emotional state or condition” arouses when stimuli are subjectively appraised threatening, regardless of “the object danger”. Threat is counted as perceived harm inherent in the environment or stimuli, which is appraised by the individual (Spielberger, 1979). Individuals

in this state feel tense and apprehensive with “activation of autonomic nervous system”. The level of A-state varies situationally, unlike trait anxiety. Trait anxiety is described as individual variances “in the disposition to perceive a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with A-State reactions”. Intensity of arousal depends on appraisal of stimuli, which are either internal or external, or both (Spielberger, 1972). Appraisal stage is important in the sense that intensity of anxious arousal is affected by it (Spielberger, cited in Barlow, 2002).

- **Hallam’s theory of anxiety as a personal construct**

Hallam’s perspective on anxiety is seen to be close to cognitive approach in its epistemological foundations (Barlow, 2002). As Izard’s standpoint on anxiety (1977), Hallam argues that scientific status cannot be given to anxiety (Barlow, 2002), and he claims anxiety has been created to communicate about sensory experience which is ambiguously perceived and poorly understood (Hallam, 1985). He considers anxiety as “a multireferential lay construct” in the context that the construing process involves interpretation of a variety of information sources, or “a metaphor” in the sense that it is based on combinations of events which are interpreted by the individual. Individuals’ beliefs, their linguistic skills, or problems relating to identity may be included in the events (Barlow, 2002). The main concern of anxiety is thought to be identifying “the antecedents of reports of anxiety”, which are the causes for individuals to report anxiety (Hallam, 1985), and anxiety needs to be observed or reported with care by the individual, since it is not observable for others. The nature of anxiety can be investigated by understanding the functional interrelationships of numerous referents which are reported by individuals, in the context how the referents are interpreted by them (Barlow, 2002).

#### **2.5.3.7. Integrated view**

Since the 1980s, inquiry on emotion has been actively rediscovered (Gross, 1999) after a “relative dormancy” for almost the half of the century. New approaches to research on emotion have revisited emotions focusing on distinctiveness of emotions and their functions. The functions are delineated as “a clever means, guided by evolution” which insures our actions and conducts for organisations’ survival and prosperity. This significant aspect of

emotion, which is agreed by most of emotion theorists, cannot be fully understood by investigating through the lens of the behavioural, neurobiological, and cognitive aspects in isolation. Consequently, the necessity of integrated view arises in this context (Barlow, 2002). Izard suggests “a multi-system model of emotion activation”, which is developed based on the need of theoretical idea which explains generation of emotions considering multiple processes. He argues that the significance of roles of emotions in evolutionary and adaptive perspectives, one single mechanism cannot sufficiently identify the generation of emotions. The alternative approach embraces four classes of systems which generate emotion, which are “neural, sensorimotor, motivational, and cognitive” systems. All processes of emotion generation involve a neural system, however emotions can be generated by the neural system without reference to the other classes of generating systems (Izard, 1993).

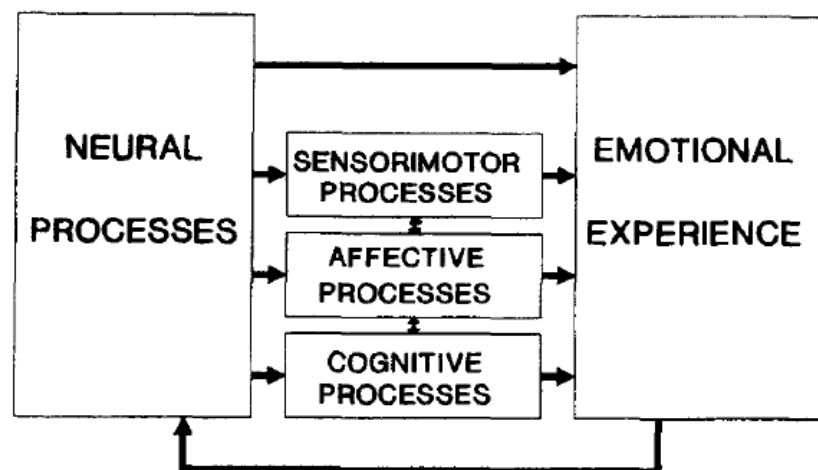


Figure 2.9 A multisystem model of emotion activation  
(Izard, 1993)

In addition, Lazarus who is a prominent cognitive theorist of emotion (Izard, 1993) advocates that biological universality in processes of emotions (Lazarus, 1995).

- **Lang’s bio-informational theory of emotional imagery**

Lang is regarded to be a prominent theorist of emotion and fear (anxiety), who suggests “a bio-informational theory of emotional imagery” (Lang, 1979; 1994a), with taking an integrative approach (Barlow, 2002). The theory assumes the image in the brain is as a conceptual network that controls

particular “somatovisceral patterns” and establishes a prototype for expressive behaviours (Lang, 1979). Emotions are considered as action dispositions, which are experienced when certain emotional episodes in memory are retrieved. This process is considered to involve information processing. Emotions are coded as “networks” that mutually stimulate information units, and the fundamental network is presumed to be neural. The emotion, in this context, consists of concept units which are interrelated. Further, three basic classes of the higher level concepts are proposed, they are stimulus, response, and meaning units. Stimulus units mean presentations of perceptual events, response units indicate “the three basic response systems or output procedures”, which are behavioural expressions, and physiological responses, and verbal expressions, and meaning units are represented as interrelated semantic knowledge (Lang, 1994a). Information regarding behaviours and events entails unit representation, and connectivity is found amongst representations. Information network can be viewed as “a memory of an informational episode” which includes the stimuli of emotions, physiological reactions, as well as relevant semantic knowledge. The memory is stimulated by input matching certain part of the representations. In addition, emotional memories are considered to be pertaining to highly motivated behaviour, such as, freezing, escaping, and, attacking. Links to “subcortical motivation circuits” which modulate reactions of visceral mobilisation, approach or defence are included in the emotional memories. The links to “hard-wired reflex systems” account for coherence of network, and might explain persistence of patterns of behaviours (Lang, 1994b). The emotional networks are directly connected to primary motivational systems in the brain which perform to activate behaviours which are vital for organisms’ survival, having evolutionary significance (Lang, 1994a). Fear and anxiety are seen as behaviour programs, which are regarded as vital parts of “defensive motivational system”, which are stored in memory. In therapeutic approach for fear or anxiety reduction, for the fearful or anxious individuals’ prototype of fear images which are retained in their memory as a form of the emotional image needs to be processed. The “template” can be evoked for processing in various ways either “imaginal or in vivo”, however, successful therapy should process all facets of it (Barlow, 2002; Lang, 1977). The information processing may enable to shape individuals’ new prototype of response system, prior to behaviour change that is associated with less or non-anxious reaction to the original fear-related stimulus (Rachman, 1980; Foa and Kozak, 1986 cited in Barlow, 2002). In sum, the integrative approach,

emotions are regarded as “a unique aspect of our experience” which is accompanied by significant activities for human beings “as individual members of a species”. Emotional experience is associated with affect which is seen as motivational function, further emotions present behavioural patterns which are primitive (sometimes irrational), and these are connected to functioning of subcortical brain functioning. It is recently confirmed by brain imaging that the subcortical emotion circuits exist and they are distinguished from “more cortical inputs” which are related to more rational appraisals which are more rational (Barlow, 2002). Thus, the integrative approach is justified which asserts that emotions should be studied from a comprehensive perspective embracing neurobiological, behavioural, as well as cognitive systems (Barlow, 2002; Gross, 1999).

- **Barlow’s process of anxious apprehension**

Barlow who highlights the importance of an integrated approach to study in emotion and anxiety developed a model of anxiety “the process of anxious apprehension”. He explains that “anxiety can best be characterized as a unique, coherent cognitive-affective structure within the defensive motivational system”. The main importance of this model is that the negative affect followed by the propositions, inter alia, perceived uncontrollability, intervened between the initiators of anxiety and cognitive, somatic or behavioural responses. Based on the concept, he develops a model presents elements of anxiety and explain their interactions as a structure. The model elucidates anxious apprehension as a process initiated from “situational contexts, or the presence of arousal from other sources capable of tapping the propositions of anxiety” which leads to negative affect. Perceived uncontrollability is emphasised as a significant negative effect, which is experienced when “focused largely on possible future threat, danger, or other potential negative events”, leads to cognitive and somatic arousal. Specifically, it arises in situations when individuals perceive that they cannot predict or deal with the negative consequences of potential threat or danger, or cannot get expected results accompanying helplessness. In this state, attention is shifted to assessment of their ability to deal with the upcoming threat, in addition, psychological or physical arousal is experienced. Somatic state is mentioned as readiness, which might be a physiological attribute that help counteract powerlessness. Also, vigilance is described as a feature of anxiety, which induce individuals to be ready for potential risks (Barlow, 2002).

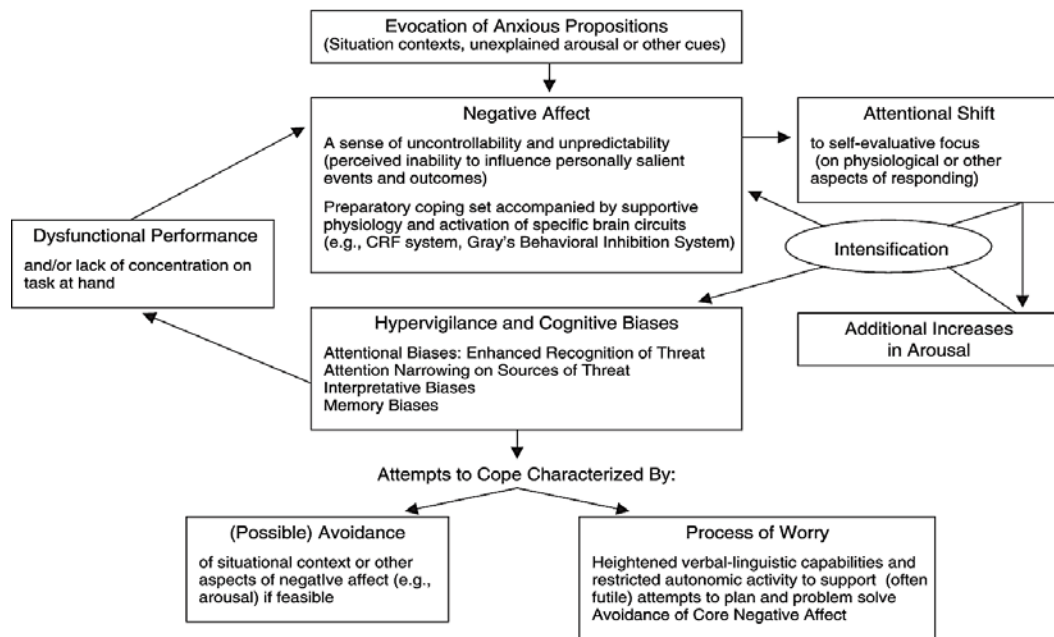


Figure 2.10 The process of anxious apprehension  
(Barlow, 2002)

In sum, in the present study which aims to develop theoretical grounds for re-designing information environments with the purpose to reduce the London Underground passengers' anxiety, anxiety is understood as an emotional state experienced as a result of cognitive appraisal. Since, the cognitive view of emotion and anxiety is widely accepted as premise amongst specialists in cognitive or cognitive-behavioural therapy for emotional disorders. It is because patients' maladaptive appraisals are tackled for treatment processes (Barlow, 1988; 2002). Also, the cognitive approach is suggested by Bagozzi et al. (1999), and Jonson and Stewart (2005) as a promising avenue for studying emotion in the context of consumer behaviour (Watson and Spence, 2007). Thus, the Spielberger's model seems more applicable to elucidate the passengers' anxiety than other theories or models of anxiety because it emphasises the functions of cognitive appraisal as the core part in the process of anxiety. It is described that the appraisal of potential threat is an important process, in the sense that its consequences function as a determinant of the level of activation of state anxiety (Barlow, 2002). The Lazarus's, who is one of the cognitive emotion theorists, theory of psychological stress provides the explanation about the process of threat appraisal (Spielberger, 1966). Consequently, the Spielberger's model in conjunction with Lazarus's theory will provide theoretical basis for formulating research model and hypotheses which will

be described in Chapter 5. For the present study, working definition of the London Underground passengers' anxiety is established as 'uncomfortable mental and/or somatic arousal results from the cognitive appraisal of potential threat encountered in the London Underground environment'. As the threat appraisal process is highlighted in the Spielberger's model which determines the level of anxious arousal, therefore, cognitive appraisal stage will be further discussed in the next section. Since it will perform as a basis for identifying potential influencing factors of passengers' anxiety whose effects need to be strengthened or diminished through information provision by design intervention.

#### **2.5.4. Threat appraisal process in anxiety inducing situations**

As stated earlier, in the Spielberger's trait-state theory of anxiety, the threat appraisal stage and its consequences are important, because activation of anxiety is dependent on the outcomes of the evaluation. Specifically, state anxiety reaction results from individuals' personal judgement about the situation depending on whether it is threatening or not. Also, its intensity and duration will depend upon how threatening it is based on an individual's perception of a risk will be, and how long the individual's perceived threat will last respectively (Spielberger, 1972). Therefore, it seems reasonable to say it needs to be further investigated what contributes to perception of threat in cognitive appraisal process (1966). Spielberger applies concept and cognitive appraisal process advocated by Lazarus, who is a leading expert in stress research (Spielberger, 1979). Lazarus argues that theoretical frames should give an account of associated phenomena, as well as elucidation on "the process intervening between the stress stimulus and stress response, and identify the factors that influence these processes", proposing the theory of psychological stress. In this sense, it provides a basis for investigation of psychological stress, and threat appraisal. It is regarded that the aspects of threat-anxiety are embraced by features of stressor-stress reactions, in the sense that seeing stress as "transaction between person and environment", which starts from perceiving the situation as threatening (Spielberger, 1979, Lazarus and Folkman, 1984, p.32). The concept of threat is involved in "psychological stress analysis", unlike other kinds of stress appraisal. Threat is defined as anticipated harms/losses which have not yet happened (Lazarus and Folkman, 1984). In other words, when a situation is perceived as harmful (neither benign nor beneficial), cognitive appraisal process is set in motion. The appraisal is categorised

into two types of appraisal, 'primary appraisal', and 'secondary appraisal'. The 'primary appraisal' is classified into two classes depending on their antecedents, which are first, "one consists of factors in the stimulus configuration", and second, one includes "factors within the psychological structure of the individual". The 'secondary appraisal' is initiated when an environment is "appraised as threatening", in an attempt to remove or reduce the threat (anticipated harm), which is called 'coping process'. Coping is defined as the process engaged in managing the demands occurring from the relationship between the person and the environment, and the emotions generated in stressful situations (Lazarus and Folkman, 1984). Three major classes of factors are described in this process. First, level of threat, second, factors inherent in stimulus constructs or environments, such as "locatability and character of the agent of harm", feasibility of resources for preventing the harm, situational restrictions regulating the action which can be considered. Lastly, components which exist in individual's mental structure, for example, "the pattern of motivation which determines the price of certain coping alternatives, ego resources, defensive dispositions, and certain beliefs about the environment and one's resources for dealing with it" (Lazarus and Opton, 1966).

## **2.6. Chapter summary**

This chapter discusses the relevant literature to support for the study of passengers' anxiety in the London Underground environment and its reduction, and the theoretical backgrounds for provision of designed information. The chapter was composed of four sections. First, documented literature regarding design of information was explained, focusing on its initial process which is tackled in the present study, along with a discussion about potential information needs in anxiety inducing situations. Second, attempts of reducing travel related anxiety in public transport environment or patients' anxiety in pre-operative and pre-screening periods through information provision were discussed. Third, the pre-existing literature about passengers' anxiety in public transport environment was described. As previously mentioned, when it comes to the current understanding achieved through reviewing the existing literature regarding passengers' anxiety in public transport environment, few studies have endeavoured to produce research outcomes regarding reduction of passengers' anxiety through defining influencing factors of the arousal, and suggesting potential



strategies on the basis of confirmed relationships among the effects of the factors and anxiety. This was mentioned as the gap in the pre-existing literature about passengers' anxiety in public transport environments. Lastly, the concept of anxiety was discussed starting from the review of the definitions, and the differences between anxiety and fear because anxiety has been commonly explained in conjunction with, or in comparison with fear. It was followed by the review of the theories of anxiety based on the understanding of three traditions in studies of emotion, and the suitability to apply the cognitive approach to inquiry of anxiety was addressed. Hence, this study will attempt to fill the gap by examining causal relationships through discovering constructs which would have associations with anxiety, and verifying their significances of the relationships. Then, the confirmed factors will be suggested to be linked to designing information with the purpose to relieve the passengers' anxiety. This is particularly important in the circumstance that little information has been created which can support the service providers and designers to create information environments which help relieve the Underground passengers' anxiety.

## **Chapter3. Methodology**

### **3.1. Introduction**

Methodology represents “the approach or paradigm which underpins the research” which has philosophical meaning, distinguished from methods which are techniques or tools for data collection and analysis (Blaxter, 2010). Therefore, this chapter will be allocated to describe methodology underpinning this present study, embracing the review of traditions of research, research paradigms which include philosophy, research purposes, approaches, types, and strategies. It will be followed by delineation of how the present study was structured on the basis of the designed methodology, including the descriptions about the methods applied for data collection and analysis. The Table 5.1 presents the related information demonstrated according to the flow of the research procedures which consist of five phases.

Table 3.1 Research framework

<b>Phase 1</b>	<p style="text-align: center;"><b><u>Literature review</u> (Chapter 2)</b></p> <ul style="list-style-type: none"> <li>• <b>Literature review and literature gap identification</b> <ul style="list-style-type: none"> <li>· Anxiety, and theoretical backgrounds of anxiety</li> <li>· Anxiety in public transport environments</li> <li>· Anxiety reduction through information provision</li> <li>· Designing information</li> </ul> </li> </ul> <p style="text-align: center;">↓</p>	
<b>Phase 2</b>	<p style="text-align: center;"><b><u>Explorative study</u> (Chapter 4)</b></p> <ul style="list-style-type: none"> <li>• <b>Identification of anxiety-inducing situations</b> <ul style="list-style-type: none"> <li>· Method: exploratory survey questionnaire</li> <li>· Analysis: exploratory data analysis</li> </ul> </li> <li>• <b>Investigation of coping resources</b> <ul style="list-style-type: none"> <li>· Method 1: TfL expert group interview</li> <li>· Method 2: Photographs in the Underground environment</li> </ul> </li> </ul> <p style="text-align: center;">↓</p>	Inductive approach / Exploratory purpose
<b>Phase 3</b>	<p style="text-align: center;"><b><u>Research model</u> (Chapter 5)</b></p> <ul style="list-style-type: none"> <li>• <b>Research model and hypothesis formulation</b> <ul style="list-style-type: none"> <li>· Identification of potential influencing factors of anxiety</li> <li>· Development of a research model and hypotheses based on the relevant theoretical ideas (Spielbergers’s trait-state model of anxiety, Lazarus’s cognitive theory of stress and coping)</li> </ul> </li> </ul> <p style="text-align: center;">↓</p>	
<b>Phase 4</b>	<p style="text-align: center;"><b><u>Findings</u> (Chapter 6)</b></p> <ul style="list-style-type: none"> <li>• <b>Operationalisation</b> <ul style="list-style-type: none"> <li>· Development of measurements of the constructs</li> <li>· Design of questionnaire drafts</li> <li>· Piloting of the questionnaire drafts</li> <li>· Analysis: descriptive statistics, internal consistency</li> </ul> </li> <li>• <b>Data collection and analysis, and hypothesis testing</b> <ul style="list-style-type: none"> <li>· Method: explanatory survey questionnaire</li> <li>· Analysis: descriptive statistics, exploratory factor analysis (extraction of underlying factors), confirmatory factor analysis (validity, reliability, model fit), structural equation model testing (magnitude of the causal relationships, model fit)</li> </ul> </li> <li>• <b>Reject or accept hypotheses</b></li> </ul> <p style="text-align: center;">↓</p>	Deductive approach / Explanatory purpose
<b>Phase 5</b>	<p style="text-align: center;"><b><u>Discussion and conclusion</u> (Chapter 7 and 8)</b></p>	

### 3.2. Two traditions of research

Robson addresses two traditions of social research, which are quantitative and qualitative research. Although they can be used for varied philosophical perspectives, they are often believed to be different research paradigms. The characteristics of quantitative research are demonstrated that quantified numerical data (represented with numbers) is obtained, and objectivity is pursued with distance between the researcher and individuals maintained. Researchers test the existing knowledge (theories) through deductive approach. Positivism and postpositivism are proposed to be close to quantitative view. On the other hand, the properties of qualitative research are presented that non-numerical, and objectivity is not highly appreciated, and it is considered that it hinders researchers' involvement. Researchers gather data first and observe if meaningful patterns emerge through inductive process. Constructivism is suggested to be related to qualitative stance (Robson, 2016).

Table 3.2 The differences between qualitative and quantitative research  
(Blaxter, 2010, adapted from Oakley 1999)

Qualitative paradigms	Quantitative paradigms
<ul style="list-style-type: none"> <li>· Concerned with understanding behaviour from actor's own frames of reference</li> <li>· Naturalistic and uncontrolled observation</li> <li>· Subjective</li> <li>· Close to the data: the 'insider' perspective</li> <li>· Grounded, discovery oriented, exploratory, expansionist, descriptive, inductive</li> <li>· Process-oriented</li> <li>· Valid: real, rich, deep data</li> <li>· Unrealizable: single case studies</li> <li>· Holistic</li> <li>· Assumes a dynamic reality</li> </ul>	<ul style="list-style-type: none"> <li>· Seeks the facts/causes of social phenomena</li> <li>· Obtrusive and controlled measurement</li> <li>· Objective</li> <li>· Removed from the data: the 'outsider' perspective</li> <li>· Ungrounded, verification oriented, reductionist, hypothetico-deductive</li> <li>· Outcome-oriented</li> <li>· Reliable: hard and replicable data</li> <li>· Generalizable: multiple case studies</li> <li>· Particularistic</li> <li>· Assumes a stable reality</li> </ul>

### 3.3. Research paradigm

Guba defines the term paradigm as "a basic set of beliefs that guides action" of commonplace practices, or disciplined investigations. They are believed

to be starting points which give shapes to “what inquiry is”, and how it is implemented. Four main paradigms are proposed, which are positivism, postpositivism, constructivism, and critical theory (Guba, 1990; Guba and Lincoln, 1994).

### **3.3.1. Positivism**

For positivists, the social world exists externally to the researcher. The only knowledge which is available to science can be achieved through direct observation or experience. What can be sensed, such as, seen, or smelt constitutes reality. Also, facts are believed to be value-free, which means science distinguishes facts from values. Quantitative data gained through applications of rigorous procedures and rules forms basis of science. (Robson, 2016; Gray, 2014). Positivists argue that regularities discovered from gathered data through observations indicate that general laws are operative. The laws are represented by clarified relationships among observable events, and inclusion of phenomena, and events which are not observable are dismissed. “Certainties about the nature” claimed by positivists have been significantly challenged, particularly in the field of social sciences (Gray, 2014).

### **3.3.2. Postpositivism**

This perspective is closely tied to positivism, which can be identified as a “modified version of positivism” (Guba, 1990; Blaxter, 2010). Unlike positivism, it is accepted that it is limited for human beings to genuinely perceive a real world due to the fact that their “sensory and intellectual mechanisms” are not perfect (Campbell, 1979 cited in Guba, 1990). Consequently, in research, imperfectness of evidence is admitted, with regarding research as a process to refine or reject claimed assertions based on the evidence. Postpositivists believe the reality is distinguished from our observations as positivists, however, postpositivists disagree with positivists’ view that the reality can be discovered in the manner which “uncertainties and doubts” are excluded. Developing accounts which are helpful to understand situations and verify causal relations is considered as researchers’ role (Robson, 2016). This view corresponds to quantitative researchers’ assumption that independent reality exists, which is to be

investigated, and processes of inference which is made based on inferential statistics, with highlighting probabilities (Gray, 2014).

### **3.3.3. Constructivism**

Constructivists argue that truth and meaning do not exist externally, however they can be constructed through the “subjects’ interactions with the world”. Therefore, a wide variety of descriptions about the same situation can exist, and contradictions can be found in equally valid delineations (Gray, 2014). Constructivists, tend to seek for complexity of meanings, with accepting a diversity of views. In addition, they do not tend to narrow down dimensions of meaning, or do not initiate their inquiries from theories or patterns of meaning. Researchers attempt to observe individual’s meanings from a broad perspective through their “personal, cultural, and historical experiences”. Qualitative researchers use this constructivist’s world-view (Creswell, 2014).

### **3.3.4. Critical theory**

Guba introduces critical theory as “ideologically oriented inquiry”. This view rejects positivism, in the context that paradigms are human constructions, therefore values are inevitably reflected in them. In inquiries, what and whose values would be chosen which in turn matter in who would be empowered, and enfranchised (Guba, 1990). Currently advocated values and social structures are challenged and questioned, researchers as well as participants are invited reject “false consciousness” for developing approaches for new understanding, and actions (Gray, 2014).

As the research model development and the main study (Phase 4) of this research chiefly observe anxiety through a lens of theories of stress and anxiety, the positivists’ or postpositivists’ view are seen to be more appropriate than other philosophical perspectives. However, this research is more influenced by postpositivism, and the reason is that causality was investigated through testing hypotheses, presenting the results using statistical inferences in a ‘probabilistic’ manner. This can be observed especially in the model testing and modification process, with including examining validity, and error terms in the analysis (McCouch et al., 2007).

### **3.4. Research purpose**

Three main purposes of research are widely suggested, they are exploratory, descriptive, and explanatory studies (Saunders et al., 2009; Robson, 2002). One study may engage more than one purposes, however, one of the purposes will be predominant, and they may change as research progresses (Robson, 2002).

#### **3.4.1. Exploratory study**

Exploratory study is conducted to better understand problems when attributes of them are not clearly identified. The main purposes are to know “what is happening”, and to view a situation from a new standpoint, and have new insights of it (Saunders et al., 2009). In the process of exploratory study, flexibility and adaptability tend to be involved in order to find a clearer focus of an investigation which was initially broad and vague. Accordingly, through the process a focus gets narrowed down through the process (Adams and Schvaneveldt, 1991). A number of methods are suggested for studies of this purpose, they are literature searches, expert or focus group interviews (Saunders et al., 2009).

#### **3.4.2. Descriptive study**

Descriptive study is carried out to achieve precise explanations of phenomena involving “events, persons or situations”, and to see a clearer picture of them. Researcher may be expected to produce conclusions synthesised based on the descriptions, rather than simply provide a wealth of information about circumstances (Saunders et al., 2016). In a similar vein, one of the drawbacks of descriptive study is that it can hardly account for why things happen (Blumberg et al., 2005 cited in Gray, 2014). This type of studies may be conducted as a succeeding study of exploratory study, or conducted prior to explanatory study (Saunders et al., 2016).

### **3.4.3. Explanatory study**

Explanatory study is chosen when researchers seek for answers to why and how questions. Confirmation of causal relationships among variables is one of the typical types of explanatory study (Gray, 2014). Statistical analysis of quantitative data is proposed as one of the methods for clarifying causal relationships (Saunders et al., 2009).

In sum, this study includes both exploratory and explanatory stages. The Phase 2, anxiety in the London Underground environment has rarely been examined, therefore, a set of studies has been designed to explore the situation to see what were the issues in the particular circumstance, and to determine if the issue of anxiety was an appropriate subject to be further investigated. The phase 3 involved the explanatory nature, which can be represented as an attempt to discover influencing factors of anxiety, and to verify the relationships among the factors and anxiety.

## **3.5. Research approach**

Saunders et al. address two research approaches of research, which are deductive, and inductive approaches. Either one of the approaches will be chosen chiefly based on how certain about use of theory in a study (Saunders et al., 2009), and also based on an answer to a question whether the research starts from theory, or it results in theory (Gray, 2014).

### **3.5.1. Deductive approach**

Deductive approach starts its observation from a general view of a phenomenon and moves to specific information (Gray, 2014). Hypotheses are deduced based on relevant theories and pre-existing knowledge in a specific area, which will then be tested against empirical data, and this process is typically accompanied by quantitative research (Bryman, 2016). Hypothesis is represented as a claim which accounts for a relation between two or more concepts (Gray, 2014).



### **3.5.2. Inductive approach**

Inductive approach begins with particular details of a situation and proceeds to a generic view (Gray, 2014). In other words, generalizable inferences are generated through the process of induction, theory is considered as results of observations. This approach typically engages qualitative research (Bryman, 2016).

In this research, both inductive and deductive phases were included. In the phase 2, which is defined as an exploratory stage, qualitative data was gathered and then analysed. Once, meaningful patterns emerge, such as, anxiety-inducing situations observed in the exploratory questionnaire survey data, and the results influence further decisions for designing the following steps. In the phase 3, deduction was applied starting from the theory of anxiety and stress, proceeding to testing tentative hypotheses. However, the deductive phase was a more dominant approach than inductive phase. It can be explained when considering that one of the major objectives of this study is to provide theoretical grounds for the London Underground passengers' anxiety reduction, through the deductive procedure embracing the research model building and testing processes, which was directly connected to prepare for the basis for the evidence of anxiety reduction.

### **3.6. Research strategy**

Research strategy needs to be chosen with taking account of whether a selected strategy enables researchers to meet the aim and objectives of the research. The selection of a strategy is advised to be made in accordance with the research question, as well as objectives, also taking the extent of previous knowledge and time, available resources, and based on philosophical backgrounds (Saunders et al., 2009). Robson demonstrates two different types of strategies, which are fixed design strategy, and flexible design strategy. The major difference is that whether a study can be pre-specified before data collection or not. In fixed design studies, data is collected after study design is finished, and in most cases, it is represented as numbers, which means the studies are generally considered as quantitative approach. On the other hand, flexible design studies progress "during data collection". Data in this type of study generally is not numerical, and it is seen as qualitative approach. However, in fixed design research, a

small extent of qualitative data can be contained, and in flexible design research, a small extent of quantitative data can be included (Robson, 2016).

### **3.6.1. Fixed design research strategies**

Experimental and non-experimental strategies are suggested as fixed designs (Robson, 2016). First, in terms of experimental strategy, the major concern is to observe changes in the subjects' behaviours that occur as a result of a certain form of manipulation implemented in the situation (Robson, 2016). In a classic setting, two groups are engaged, which are experimental and control groups, the former is exposed to a certain form of designed intervention or manipulation, but the latter is not. Apart from the applied manipulation, aspects of the two groups which are related to the test are analogous (Saunders et al., 2009). Second, unlike experimental strategy, non-experimental strategy does not involve changes of the circumstances or subjects' experiences in the situation. Also, it is different from experimental design in the context that the targeted events or situations can hardly be manipulated. It is advantageous because the phenomena of interest are not disturbed. This type of study is widely used in order to verify relationships between two or more factors. It usually begins with a conceptual framework, which means that the researchers have a relatively clear conception about how "likely mechanisms and the contexts" will operate based on the relevant pre-existing literature. As a widely used type of study for non-experimental designs, survey is suggested. Statistical techniques are required to confirm hypothesised relationships (Robson, 2016). When attempting to examine public opinions, survey is the most suited method which enables to measure "the real world without the artificial manipulation or control as in experiments" (Hsia, 2015). Researchers use analytical survey with an attempt to test a theory, and with a purpose to test relationships between variables. The types of the variables are dependent, independent, and uncontrolled variables. Dependent variables are represented as the subject of the study, and the "gains or losses" result from the influence of the study. Independent variables are causes which lead to changes in the dependent variables. Uncontrolled variables are understood that the results of the study may be confounded by the uncontrollable variables. Minimisation of the confounding effects is recommended (Gray, 2014).

### **3.6.2. Flexible design research strategies**

Three major strategies are proposed as flexible designs, which are case study, grounded theory, and ethnography (Robson, 2016). First, case study is a strategy of in-depth investigation into an event, activity, or individual(s). A wide range of data collection methods can be used for gathering detailed information about a situation (Creswell, 2009). Second, grounded theory is defined as a strategy to build a “general, abstract theory of a process, action, or interaction grounded in the views of participants”. It is described that multiple iterations are involved in the process using collection and refinement of data and interrelationships of classifications of data (Creswell, 2009). Theory progresses through the research, and interactions between analysis and collection of data (Strauss and Corbin, 1994). Lastly, regarding ethnography, the main concern of the inquiry is an investigation into “how a group, organisation or community lives, experiences and make sense of their lives and their world”. Researchers immerse themselves in the environment (Robson, 2016), and chiefly use observations and interviews (Creswell, 2009). The process of the inquiry is flexible, and it progresses with encounters with the realities in the natural situation (ibid).

For the present study, multi-strategy design strategy seemed more appropriate to describe the stages designed for this study than either fixed or flexible strategy. Since, in the exploratory and inductive stage (Phase 2), exploratory questionnaire survey, and expert group interview were used in order to gather sufficient information for developing a research model, as reflecting the flexible nature of exploratory study. Flexible design strategy more suited this purpose and approach used in this phase. In the explanatory, deductive stage (Phase 3 and 4), a research model was established to clarify the relationships among factors, coping resources, control and anxiety. It was then tested through the data collected through explanatory questionnaire survey in order to confirm the effects of the factors on anxiety. Survey was chosen as the suitable strategy, because it is an extensively adopted strategy for non-experimental fixed research designs (Robson, 2016). This process is viewed as a typical case of fixed design research. Both flexible and fixed designs were applied, however, fixed design was viewed as a dominant one.

### **3.7. Research methods**

This section will discuss research methods which were chosen for the each phase of this study considering the reviewed and applied philosophical view, research purpose, approach, strategy which undergirded this study.

#### **3.7.1. Phase 2**

This phase was conducted with an exploratory purpose, through inductive approach. After the review of the relevant literature, the investigation of London Underground passengers' anxiety was initiated. Three different data collection methods were chosen, first, exploratory survey questionnaire, group expert interview, and photography.

##### **3.7.1.1. Exploratory survey questionnaire**

In the pilot study (Phase 2), the established research question was 'Do encounters with negative situations in the London Underground environment trigger anxiety, if so, what the main triggers are, and how the anxieties differ across demographic characteristics?' In order to answer to this question, the aspects of anxiety amongst the London Underground passengers were examined through an exploratory survey questionnaire. The purposes of conducting an exploratory questionnaire were first, to explore if the Underground passengers experience anxiety, second, to investigate main triggers of anxiety, lastly, to have a better understanding about their apprehension by comparing the aspects of anxiety among user groups and demographic factors. The demographic information which was of particular interest was gender. Since, it has been widely reported that gender differences observed in the pre-existing literature on anxiety (Yavuz and Welch, 2009; Catuzzi and Beck, 2014; Ahmed and Alansari, 2004; Armstrong and Khawaja, 2002). For assessing their anxiety, self-report anxiety scales were employed to measure the level of passengers' anxious arousal, since they are widely used to assess severity of anxiety and diagnose it in clinical situations (Julian, 2011) enabling to avoid experimenter's bias and expectation (Antony et al., 2002; Bryman, 2016), and interviewer variability, such as being asked questions in a different order, can be minimised (Bryman, 2016, p.222). Also, self-report anxiety scales have been developed and utilised to measure anxiety about non-clinical situations, such as library anxiety (Bostick, 1992), computer anxiety

(Marcoulides, 1989; Heinssen, 1987). Additionally, administrating a questionnaire is advantageous because it is convenient to code responses and questions, and it is cost and time saving (Gray, 2014).

In terms of selection of sample groups, convenience sampling was used that is one of the non-probability sampling techniques, which is mentioned as most practical method to use in the exploratory stage of research (Saunders et al., 2009). The London Underground users who lived in and around London were recruited as the participants. This present study focuses more on young people aged between 19 to 44 than older people aged over 60. It is because, according to the London Travel Demand Survey, respondents aged between 25-44 are in one of the age groups of most frequent travellers in London. Also, the age bracket from 19 to 44 embraces the fewest non-traveller group. Non-travellers are described as people who do not take any trips on a designated day in the survey. A student group including full-time and part-time workers contain lower numbers of non-travellers than the not-working and retired groups in the survey. In addition, respondents aged over 65 are seen as the least frequent travellers (Transport for London, 2015). Furthermore, according to the 2001 London Area Transport Survey (LATS) data presenting transport modal split by age, the greatest numbers of the London Underground trips per day are made by the respondents aged between 20 to 24, and 25 to 29. The numbers of the trips of the mode show gradual decrease with age (Schmöcker et al., 2008). Additionally, according to Curie and Delbosc's study results illustrate that respondents aged over 60 made 30 percent fewer trips overall, and 16 percent lower trip on PT compared to the respondents aged under 60 (Curie and Delbosc, 2009). Thus, participants in the group of age between 19 to 44 will be more intensively recruited than other age groups.

Exploratory data analysis techniques were applied to analyse the data to fit the purpose of the study. The method has advantages, for example, it allows researchers to see "what is going on", furthermore to discover patterns and trends (Behrens and Yu, 2003). First, mean values of each item assessing the levels of anxiety were calculated to identify the most anxiety-inducing situations, since the main purpose of this study is to identify potential anxiety inducing situations, which need to be tackled through provision of re-designed information.

### **3.7.1.2. Group expert interview**

Once, the aspects of anxiety were examined, an expert group interview was conducted, in order to investigate what resources/facilities and supports were provided, an expert group interview was conducted. The main purpose of conducting an expert interview was to identify what type of supports and coping resources are provided for the London Underground passengers. Three experts working for Transport for London participated in the interview. In an exploratory stage, discussing with experts in the field is suggested (Gray, 2004). Group interview is an interview which involves an interviewer and more than one interviewee (Bryman, 2016). In semi-structured interview, issues to be discussed are prepared, and questions to be asked are decided prior to an interview. However, the order of the questions can be changed, and additional questions can be asked. Also, researchers are recommended to probe into ideas and opinions in order for interviewees' responses to be expanded (Gray, 2014). Due to the benefits of the flexibility, semi-structured interview was carried out.

### **3.7.1.3. Photography**

Based on the information about obtained through the interview, field research was carried out. According to the information provided by the experts, photographs were used to gather the relevant sources regarding the coping resources for passengers at stations and in trains in the London Underground environments. Photographs are considered as sources of qualitative data, which allow to record facts, such as lifestyles, or conditions of living and working. Photographs are utilised for recalling events in the research process, or as a tool for securing evidence in the data collection process (Gray, 2014). Photographs were used for the present study for the purpose to confirm the experts' comments about the suggested coping resources and supports offered by the service provider, Transport for London.

### **3.7.2. Phase 3 and 4**

These phases were conducted with an explanatory purpose, through deductive approach. The research process in the two phases of the study were designed and carried out according to the "hypothetico-deductive research process" (David and Sutton, 2011). Developing a research

question is the first step of the process, and it was established as 'What are the influencing factors of anxiety, and how strong the effects of the factors on anxiety?'. The entire process consists of six phases.

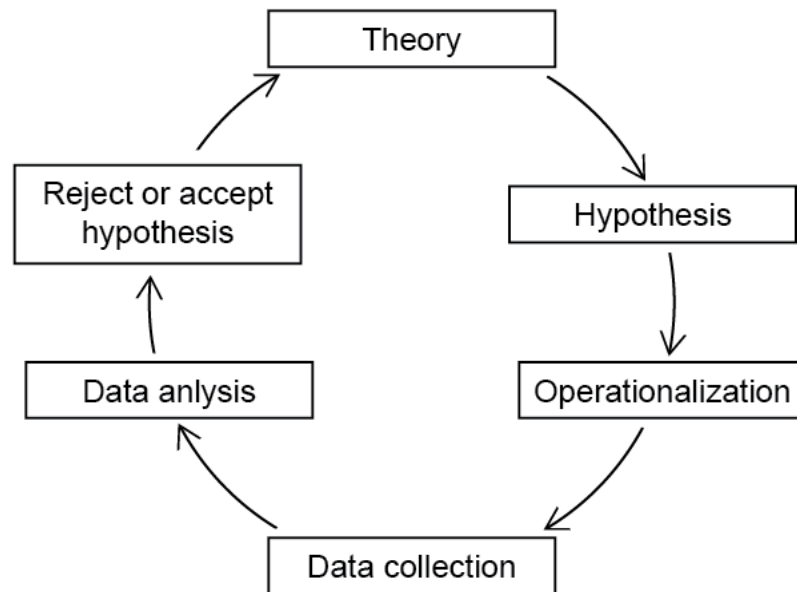


Figure 3.1 The research process in a hypothetico-deductive research model (David and Sutton, 2011)

As the first and second stages, theories regarding anxiety were reviewed, and cognitive theory of stress and coping (Lazarus and Folkman, 1984), and a trait-state model of anxiety (Spielberger, 1972) which explain anxiety as a type of stress results from cognitive appraisals performed as guidance for formulating the research model and hypotheses to be tested (David and Sutton, 2011). The hypotheses were statements which describe relationships between the related coping resources through perceived uncontrollability and anxiety. Third, in the operationalization stage, the relevant literature regarding anxiety, and the selected influencing factors was reviewed to explore how the constructs were operationalised. Then, the measurements were devised, or adapted to suit the purpose of this study, or pre-existing scales were used in order to turn abstract concepts to be measurable (ibid). Two questionnaire drafts were designed and piloted prior to the final draft of the questionnaire form was designed. The purpose of the first draft was to ensure sufficient clarity, and accuracy of the selected

items (Gray, 2014). Further, the objective of piloting the second draft was to select the optimised set of questions which were used to measure the intensity of anxiety. Fourth, for data collection, explanatory survey questionnaire was selected because it is widely used for inferring causality or for identifying associations between independent and dependent variables (Hsia, 2015).

### **3.7.2.1. Explanatory survey questionnaire**

It is known that questionnaires are widely utilised by researchers in the field of social sciences as tools to collect quantitative data (David and Sutton, 2011). Although diverse views on questionnaire coexist signifying advantages and disadvantages, the method has been considered as the “central real world strategy”. However, it is criticised particularly because of its concerns on validity. Validity could be negatively influenced when meaningful information cannot be gathered due to ambiguity caused in questionnaires. It could also be negatively affected by untrustworthy biased responses led by participants’ personal beliefs, or attitudes. Besides, the ambiguity and biases could hardly be reported and delivered to questionnaire experimenters. Nevertheless, merits of the method have widely been stated. For example, in terms of its strong effectiveness, it facilitates rapid collection of a significant amount of data. Furthermore, its adaptability enables researchers to obtain generalizable information from a wide range of people. Additionally, transparency is mentioned as one of the merits of using questionnaire. It means that the whole process from its design, implementation, and results can be open to and assessed by others. Standardisation of data is also reported as a benefit of it (Robson and McCartan, 2016). Besides, comparatively low cost on administration, easiness of coding, and minimised interview bias have been reported as its advantages (Gray, 2014; David and Sutton, 2011). Despite its disadvantages, considering the strengths listed above, as well as the purpose of this study which is to develop and test a causal model through structural equation modelling, questionnaire was seen as the most appropriate method for data collection for it. Since, the technic requires minimum sample size from 100, or according to the calculation method which indicates that sample size should be five times the number of variables, in this case more than 170 (O'Rourke and Hatcher, 2013). Hair et al. suggest minimum sample size of 100 for simple models consisting of up to five constructs, revealing high communalities of items, or 150 for models



composed of up to seven constructs, indicating modest communalities (Hair et al, 2010). Moreover, it is stated that survey questions are utilised for testing formulated hypotheses. Therefore, it seems reasonable to choose questionnaire as a data collection method which enables to gather a significant amount of data from more than the numbers proposed above, and to examine the hypothesised relationships with using the data. Along with them, it is recommended to make use of pre-existing questions in “large-scale repeated studies” depending on the characteristics of research (David and Sutton, 2011). Thus, survey items from the related existing literature will be reviewed for devising questions for this study.

For the data analysis, structural equation modelling (SEM) was utilised. It is considered as a “comprehensive statistical approach”, applied for testing hypotheses which describe potential relationships among variables. It provides benefits by enabling researchers to test complex ideas through user-friendly software programs (Hoyle, 1995). Lastly, according to the results from the data analysis, the developed hypotheses were tested using the data collected.

In terms of selection of sample groups, convenient sampling was used for collecting data. Since the method is extensively used for data collection, and it provides ease of access and enables to collect data quickly. However, it is not easy to control the characteristics of sample (Saunders et al., 2009). In order to make up for the disadvantage, online survey was selected along with paper-and-pencil administration. Online survey enables controlled sampling through selectively disseminating survey to targeted samples (Evans and Mathur, 2005). For example, in the present study, the participants were required to be the London Underground users. Therefore, only the London Underground users were recruited, and the majority of the participants were London residents. Also, recruitment of almost equal proportion between male and female subjects was needed to test gender differences. As described in the section 3.7.1.1, users of younger age group (from 19 to 44) will be at the centre of attention. Thus participants in those age groups will be main subjects for participant recruitment.

For the data analysis, IBM SPSS AMOS Graphics version 20 was used. It enables researchers to present hypothesised relationships among variables, through the processes of model specification, estimation, assessment, and presentation. It allows users to establish behavioural or attitudinal models which include complex relationships (IBM, 2017).

### **3.8. Chapter summary**

This chapter has discussed methodology designed for the present study. It started from research tradition, paradigm, research purpose, approach, and strategy, as well as research methods which were applied to the each phase of this study. This study was closer to post-positivism than other paradigms, and it chiefly had an explanatory purpose however, explanatory stage was involved in the initial stage of the study. It dominantly took a deductive approach, but an inductive approach was also contained in the early phase. Both flexible and fixed design strategies were used, however the latter one performed as a major strategy than the former one, which was employed in the nascent stage. In the Phase 2, based on the reviewed literature regarding negative situations in public transport settings, the conducted exploratory questionnaire was analysed through exploratory data analysis techniques, followed by the expert group interview and photography. In the Phase 3, the research model including the hypotheses was formulated, and in the Phase 4, they were tested against empirical data. Explanatory survey questionnaire was utilised as the data collection method, and structural equation modelling techniques were applied to analyse the data.

## **Chapter4. Explorative study**

### **4.1. Introduction**

This chapter discusses a set of preliminary studies conducted to explore about aspects of anxiety on the London Underground depending on users' characteristics, and identify anxiety inducing situations in the London Underground environments. As reviewed in the previous chapter, anxiety is a response to a potential danger which is interpreted to be threatening. The Spielberger's anxiety model helps improve understanding about anxiety. It is proposed that activation of state anxiety involves "a sequence of temporally ordered events in which a stimulus that is cognitively appraised as dangerous evokes an A-state reaction" (Spielberger, 1966). In this sense, it seems reasonable to argue that identifying potential stimuli which could lead to arousal of anxiety is necessary. Consequently, an explorative study was designed to define potential anxiety-inducing situations in the London Underground environment, and to investigate what is carried out in practice to resolve problems associated with the issues regarding passengers' safety and security to support them. Therefore, the explorative study consists of three sub-studies, which are exploratory questionnaire, and an expert group interview to discuss what kinds of efforts are made, and what types of resources are provided, and photography of the London Underground environments to observe safety information and facilities suggested by the interviewed experts.

### **4.2. Exploratory questionnaire**

#### **4.2.1. Identifying negative situations and events**

A wide range of literature on PT has been reviewed to identify potential negative events and situations in PT environments. The reason for investigating negative events and situations is that anxiety is a response to a potential stressful situation when it is interpreted to be dangerous considered to negatively affect individuals' emotional states. In this sense, identification of situations that potentially harmful seems necessary before taking up further investigation about how much the environments would elicit

anxiety. To make use of relevant literature to establish evidence for defining negative situations and barriers that may discourage customers to decide to use services including transport system has been conducted in published studies. For instance, in Blainey et al.'s study, over 100 previous studies were reviewed to identify barriers to rail use, and 3 categories of barriers, hard, soft, and complimentary barriers, were defined accordingly (Blainey et al., 2012). Also, in Peck's article, published studies were extensively reviewed to identify potential barriers to use of fixed-route public transit (Peck, 2010). Thus, in this study, relevant academic as well as grey and literature addressing negative situations and barriers of PT use was initially reviewed, then the focus of observation was narrowed to PT use in London, and use of London Underground by reviewing reports published by Transport for London. Consequently, in this study, twenty four situations have been chosen as negative situations and events which may lead to elicitation of anxiety. The selected negative situations and the referenced studies are addressed are presented below in the Table 4.1. They will then be used as potential anxiety triggers to be tested how much they would elicit participants' anxious arousal using the questionnaire form which will be described further in the next section.

Table 4.1 Negative situations selected from the relevant existing literature (Kim et al., 2016)

	<b>Situations</b>	<b>Literature</b>
1	Anti-social behaviour	Blainey et al., 2012; Moore, 2011; Stradling et al., 2007
2	Overcrowding	Uittenbogaard and Vania Ceccato, 2014; Mahudin et al., 2012; dell'Olio et al., 2011; Smith and Clarke, 2000
3	Too much noise	Cheng, 2010; Gatersleben and Uzzell, 2007; Stradling et al., 2007
4	Late night travel	Blainey et al., 2012; Loukaitou-Sideris and Fink, 2008; Stradling et al., 2007;
5	Long-waits	dell'Olio et al., 2011; Peck, 2010; Gatersleben and Uzzell, 2007
6	Disruptions	Lyons and Harman, 2002
7	Missing train announcements	Hersh, 2016; Fürst and Vogelauer, 2012; Windle and Burholt, 2003
8	Missing platform announcements	
9	No toilet access	Hine and Scott, 2000
10	Can't find information from signs	Chang, 2013; Broome et al., 2010

11	Can't find exits	Gallon et al., 1995
12	Long walks	Broome et al., 2010; Stradling et al., 2007
13	Platform gaps	Cheng, 2010
14	Unfamiliar journey	Schmitt et al., 2015; Chang, 2013; Lyons and Harman, 2002
15	Staircases	Rosenkvist et al., 2009; Muñoz et al., 2008
16	Missing stops	Chang, 2013
17	Can't get seats	Blainey et al., 2012; Peck, 2010; Cheng, 2010
18	Transfer	Schmitt et al., 2015; Cheng, 2010; Lyons and Harman, 2002
19	Quick doors	Transport for London, 2009
20	Victim of crime	Uittenbogaard and Ceccato, 2014; Currie et al., 2013; Cozens et al., 2003; Smith and Clarke, 2000
21	When I'm moving slow	Rosenkvist et al., 2009; Transport for London, 2009
22	Likelihood of accident occurrence	Uittenbogaard and Ceccato, 2014
23	Fear of getting lost	Schmitt et al., 2015
24	Travelling alone	Yavuz and Welch 2010; Jones et al., 2000; Tulloch, 2000; Lynch and Atkins, 1988

#### 4.2.2. Structure and development of the questionnaire

The questionnaire is comprised of three sections, the first section consists of demographic questions, such as, gender, age and place of residence. The second section includes inquiries on general opinions about the services, for example, comfort and safety, and the last section contains self-report anxiety scales. For the development of self-report anxiety scales, a wide variety of scales which assess anxiety in non-clinical situations have been reviewed, such as the Library Anxiety Scale (Bostick, 1992), the Computer Anxiety Scale (Marcoulides, 1989), and the Computer Anxiety Rating Scale (Heinssen, 1987) which assess subjects' level of anxiety about various situations encountered with the use of library and computer. The scales require participants to rate how much they agree with items including each situation, ranging from "strongly disagree" to "strongly agree", adopting the 5-point Likert scales. Hence, in the designed questionnaire, items were suggested to measure anxiety by asking respondents to answer to the questions, such as, "I feel anxious \_\_\_\_\_" or "I feel worried \_\_\_\_\_" followed by the selected negative situations listed in the Table 4.1. The 5-point Likert scales were used to be rated from "strongly agree" to "strongly disagree", including "neutral" in the middle, thus the lower the score, the greater the level of anxiety.

#### **4.2.3. Piloting the questionnaire**

The designed questionnaire draft and the information consent form were reviewed by three academics in the College of Engineering, Design and Physical Sciences at Brunel University London, and an experienced researcher working as a research manager at a non-governmental organisation in Reading. They helped to see if there was any ambiguity in wording, and how long it took to complete the form. The form was modified accordingly, for instance, the expected time for completing the form. The designed questionnaire form can be found in the Appendix A.1.

#### **4.2.4. Ethical approval**

This study was approved by Brunel University Research Ethics Committee in May 2015. In accordance of the guidelines, the respondents were provided with the information for participants including the consent form, and were asked for agreement to take part in the study. The designed participant information sheet and the approval letter are included in the appendix B.1, and C.1.

#### **4.2.5. Questionnaire administration and data collection**

As this study focuses more on relatively young people aged around 19-44, individuals in the age brackets, who were users of the London Underground were recruited. In the recruitment process, participation of colleagues and students at Brunel University London who frequently used the London Underground service was encouraged. Subsequently, most of them were postgraduate students at the University, and their acquaintances who were personally asked to participate in the study who showed an interest in taking part in the questionnaire survey as volunteers. Students seemed to well match the criteria for the recruitment of the present study, since they are reported to be one of the frequent users of PT (Transport for London, 2015), and they are included in the age group between 20-29, who actively use the London Underground (Schmöcker et al., 2008). In the recruitment process, the respondents were informed about the brief information of the researcher, purpose of the study, management of the collected data (e.g. confidentiality), and expected time for completing the questionnaire form,

and then they were asked to agree to participate in the study. Once they agreed, they were requested to fill in the self-administered electronic or pencil and paper questionnaire form. 3 forms were collected through the former mode, and 78 forms were collected through the latter mode. In total, 81 forms were collected. The data collection was carried out in May and June, 2015.

#### 4.2.6. Data analysis

##### 4.2.6.1. About the sample

In total 81 respondents participated in the study, consisting of 38 males and 43 females. They were the London Underground users living in and around London. Age distribution is shown in the Table 4.2. A significant portion (59.3%) of the respondents was in the age bracket of 25-34, and 35-44. Non-even age distributions may be a limitation of the findings.

Table 4.2 Age distribution

	Age	Frequency	Percent	Valid percent	Cumulative percent
Valid	15-24	2	2.5	2.5	2.5
	25-34	26	32.1	32.1	34.6
	35-44	22	27.2	27.2	61.7
	45-54	6	7.4	7.4	69.1
	55-64	13	16.0	16.0	85.2
	65-74	10	12.3	12.3	97.5
	75-84	1	1.2	1.2	98.8
	85+	1	1.2	1.2	100.0
	<b>Total</b>	81	100.0	100.0	

The respondents who use the Underground more than 2 or 3 times a week, who can be seen as frequent users formed 22.1% of the total valid responses. 23.4% of them were seen as occasional users who responded that they use it 2 or 3 times a month. 36.4% of the respondents were seen as rare users who used it once a month or less.

Table 4.3 Frequency of use the Underground

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4 times a week or more	9	11.1	11.7	11.7
	2-3 times a	8	9.9	10.4	22.1

	<b>week</b>				
	<b>1 time a week</b>	14	17.3	18.2	40.3
	<b>2-3 times a month</b>	18	22.2	23.4	63.6
	<b>1 time a month or less</b>	28	34.6	36.4	100.0
	<b>Total</b>	77	95.1	100.0	
<b>Missing</b>	<b>Other</b>	4	4.9		
	<b>Total</b>	81	100.0	100.0	

Observing the responses, the Underground is marked as the most preferred travel mode, followed by walking, bus, and train. These preferences may be influenced by the location of the respondents' residence. For example, considering the majority of the participants were students at Brunel University, tram is not an easily accessible mode for them, thus it is the least preferred mode apart from other.

Table 4.4 Transport mode preferences

	<b>Bus</b>	<b>Tram</b>	<b>Under-ground</b>	<b>Walk-ing</b>	<b>Over-ground</b>	<b>Cycl-ing</b>	<b>Cab</b>	<b>Pri-vate</b>	<b>Train</b>	<b>Other</b>
<b>Yes</b>	54	5	66	60	39	18	11	34	52	2
<b>No</b>	27	76	15	21	42	63	70	47	29	79
<b>Total</b>	81	81	81	81	81	81	81	81	81	81

Note: Responses from multiple choice question

The highest portion of the respondents tends to use the service for leisure purpose, followed by work, shopping, and visiting family and friends purposes.

Table 4.5 Purposes of use the Underground

	<b>Shopping</b>	<b>Medical</b>	<b>Family and friends</b>	<b>Work</b>	<b>Leisure</b>	<b>Other</b>
<b>Yes</b>	18	3	17	27	47	7
<b>No</b>	63	78	64	54	34	74
<b>Total</b>	81	81	81	81	81	81

Note: Responses from multiple choice question

#### 4.2.6.2. General opinions about the service

Personal safety in PT is one of the significant components of service quality which service providers pay attention to (Too and Earl, 2010; Awasthi et al.,



2011; Prasad and Shekhar, 2010; Fellesson and Friman, 2008; Sumaedi et al., 2012; Joewono and Kubota, 2007; Thompson and Schofield, 2007; Redman et al., 2013; Hensher and Prioni, 2002; Pérez et al., 2007; Maruvada and Bellamkonda, 2012). 65.4% of the respondents rated that they strongly agree or agree with that the London Underground systems are safe. Only 9.9% of the participants responded that they disagree or strongly disagree that the environment is safe.

Table 4.6 Opinions about safety

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	15	18.5	18.5	18.5
	<b>Agree</b>	38	46.9	46.9	65.4
	<b>Neutral</b>	20	24.7	24.7	90.1
	<b>Disagree</b>	6	7.4	7.4	97.5
	<b>Strongly disagree</b>	2	2.5	2.5	100.0
	<b>Total</b>	81	100.0	100.0	

Satisfaction with public transport service is considered as a significant factor because it is associated with behavioural intention to use the service, or customer retention (Lai and Chen, 2010; Imam, 2014). 58% of the participants responded that they strongly agreed or agreed with that they are satisfied with the London Underground services. 11.1% of the respondents disagreed or strongly disagreed that they were satisfied with the service.

Table 4.7 Opinions on satisfaction

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	9	11.1	11.1	11.1
	<b>Agree</b>	38	46.9	46.9	58.0
	<b>Neutral</b>	25	30.9	30.9	88.9
	<b>Disagree</b>	8	9.9	9.9	98.8
	<b>Strongly disagree</b>	1	1.2	1.2	100.0
	<b>Total</b>	81	100.0	100.0	

Reliability is discussed as one of the influential elements to be considered in the dimension of rail service quality (Prasad and Shekhar, 2010), or public transport service (Pérez et al., 2007). 66.7% of the respondents measured that they strongly agree or agree with that the London Underground systems

are reliable. Only 11.1% of the respondents rated that they disagreed or strongly disagreed that the service is reliable.

Table 4.8 Opinions on reliability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	11	13.6	13.6	13.6
	<b>Agree</b>	43	53.1	53.1	66.7
	<b>Neutral</b>	18	22.2	22.2	88.9
	<b>Disagree</b>	7	8.6	8.6	97.5
	<b>Strongly disagree</b>	2	2.5	2.5	100.0
	<b>Total</b>	81	100.0	100.0	

Comfort has been mentioned as a desired quality of public transport service (dell’Olio, 2011), or one of the factors relating to customer satisfaction of the service (Fellesson and Friman; 2008). Only 27.2% of the respondents marked that they strongly agree or agree that the service is the Underground journey is comfortable. A high proportion of the respondents (45.7%) selected neutral. Relatively higher rate of tendency of strong disagreement and disagreement was found (27.2%).

Table 4.9 Opinions on comfort

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	6	7.4	7.4	7.4
	<b>Agree</b>	16	19.8	19.8	27.2
	<b>Neutral</b>	37	45.7	45.7	72.8
	<b>Disagree</b>	19	23.5	23.5	96.3
	<b>Strongly disagree</b>	3	3.7	3.7	100.0
	<b>Total</b>	81	100.0	100.0	

32.1% of the participants responded that they strongly agree or agree with the statement, the environments of the Underground are clean. 37% of them marked neutral, and 30.8% of them answered that they disagree or strongly disagree with the statement. As cleanness of environments is one of the significant aspects of public transport service quality desired by users, or one of the determinants of the service quality (dell’Olio, 2011; Eboli and Mazzulla, 2012), therefore, enhancement of cleanness seems to be needed.

Table 4.10 Opinions on cleanness

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	3	3.7	3.7	3.7
	<b>Agree</b>	23	28.4	28.4	32.1
	<b>Neutral</b>	30	37.0	37.0	69.1
	<b>Disagree</b>	13	16.0	16.0	85.2
	<b>Strongly disagree</b>	12	14.8	14.8	100.0
	<b>Total</b>	81	100.0	100.0	

The item was attempted to measure how the respondents thought about the easiness of gaining assistance from staff whenever they wanted to, since staff behaviour is mentioned as one of the factors of perceived service quality (Jain et al., 2014). Also, staff assistance is proposed as one of the factors of service convenience (Wagner, 2012). The respondents tended to agree with the easiness of getting staff assistance (42% of the responses including strongly agree and agree answers), however, 34.5% of them presented negative responses with it (including disagree and strongly disagree responses).

Table 4.11 Opinions on easiness of getting assistance from staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	9	11.1	11.1	11.1
	<b>Agree</b>	25	30.9	30.9	42.0
	<b>Neutral</b>	19	23.5	23.5	65.4
	<b>Disagree</b>	18	22.2	22.2	87.7
	<b>Strongly disagree</b>	10	12.3	12.3	100.0
	<b>Total</b>	81	100.0	100.0	

This item was intended to discover if negative experiences had strong influences on the participants and, if they played a role as a physical barrier. Since, anxiety may develop avoidance behaviour (American Psychiatric Association, 2013). Only one participant strongly agreed that he or she does not want to use the service because of a prior negative experience. Additionally, one participant strongly disagreed to the statement, and three participants agreed to the statement. The majority of them (85.2%) disagreed or strongly disagreed with it. Although, the degree of the agreement was low, further investigation on the negative experiences of

users who tended to avoid using it and why might provide useful information on the barriers to intention to use of the service.

Table 4.12 Unwantedness of the Underground use due to previous negative experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<b>Strongly agree</b>	1	1.2	1.2	1.2
	<b>Agree</b>	3	3.7	3.7	4.9
	<b>Neutral</b>	8	9.9	9.9	14.8
	<b>Disagree</b>	29	35.8	35.8	50.6
	<b>Strongly disagree</b>	40	49.4	49.4	100.0
	<b>Total</b>	81	100.0	100.0	

#### 4.2.6.3. Main triggers of anxiety

Table 4.13 demonstrates users' level of anxiety about each negative situation, listing the mean values from the lowest to the highest. The lower the means, the greater their anxieties are, since 'strongly agree' responses were coded 1, and 'strongly disagree' responses were coded 5. The neutral responses were coded 3, therefore means scored below 3 are likely to be triggers of anxiety. The findings have presented the situations which arouse anxiety amongst the respondents. State anxiety is understood as an emotional response experienced when the situation is interpreted as threatening (Spielberger, 1979). In other words, it might also be considered that potential risks which are subjectively appraised as dangerous are inherent in the anxiety inducing situations. The situations whose means were rated below 3.0, which is neutral response, are seen they tend to trigger the respondents' anxiety. However, items whose means are higher than that also need to be reviewed, because they did not seem to induce anxiety as much as the higher ranked anxiety-triggers amongst the participants, and this could be interpreted that the situations are not seen as threatening as the higher ranked anxiety-inducing situations. The top four anxiety triggers are seen as the situations which might worry the participants most, because in the respondents' minds, the situations might lead to incidents which could potentially be interpreted as situations in which their personal security may be threatened. Anti-social behaviour on public transport has been mentioned as a serious problem which needs to be tackled (Moore, 2011). Overcrowding has been extensively discussed as a barrier as well as a stressor in public transport environments (Cox et al.,

2006; Uittenbogaard et al., 2014; Blainey and Preston, 2012). The participants' perception of crowding as an anxiety trigger supports the view that passengers are worried about likelihood of incidents occurrence when experiencing overcrowding (House of Commons Transport Committee, 2003). Noise has been mentioned a stressor amongst PT users (Stradling et al., 2007; Gatersleben and Uzzell, 2007). The responses from this questionnaire survey show that noise also could be a trigger of anxiety. Feeling unsafe during late-night travel has been discussed in the relevant literature (Stradling et al., 2007; Smith and Clarke, 2000), and similar responses were found in the present study, which was ranked as the fourth anxiety inducing situation. In terms of likelihood of accident occurrence, 67.9% of the participants (except neutral responses) responded that they strongly agree or agree that they are concerned about it, this means the probability of accidents itself tend not to significantly concern the respondents, but it is seen that when they are encountering negative situations, higher anxious arousal is elicited.

Table 4.13 Mean values of responses of anxiety about negative situations

	<b>Negative situations</b>	<b>Mean</b>	<b>N</b>	<b>Std. Deviation</b>
<b>1</b>	Anti-social behaviour	2.04	81	0.872
<b>2</b>	Overcrowding	2.25	81	0.874
<b>3</b>	Too much noise	2.40	81	0.918
<b>4</b>	Late night travel	2.44	81	1.225
<b>5</b>	Long-waits	2.52	81	1.026
<b>6</b>	Disruptions	2.53	81	1.141
<b>7</b>	Missing train announcements	2.59	81	1.191
<b>8</b>	Missing platform announcements	2.60	81	1.114
<b>9</b>	No toilet access	2.63	81	1.05
<b>10</b>	Can't find information from signs	2.69	81	1.056
<b>11</b>	Can't find exits	3.02	81	1.118
<b>12</b>	Long walks	3.14	81	1.222
<b>13</b>	Platform gaps	3.14	81	1.262
<b>14</b>	Unfamiliar journey	3.15	81	1.13
<b>15</b>	Staircases	3.17	81	1.223
<b>16</b>	Missing stops	3.37	81	1.134
<b>17</b>	Can't get seats	3.38	81	1.032
<b>18</b>	Transfer	3.44	81	1.049
<b>19</b>	Quick doors	3.49	81	0.955
<b>20</b>	Victim of crime	3.56	81	1.151
<b>21</b>	When I'm moving slow	3.59	81	1.087
<b>22</b>	Likelihood of accident occurrence	3.74	81	1.127
<b>23</b>	Fear of getting lost	3.84	81	1.03
<b>24</b>	Travelling alone	3.95	81	0.934

Note: Coded (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree)

#### 4.2.6.4. Comparisons between genders

In terms of differences between the responses from the male and female participants, it seems reasonable to address that the female respondents tend to feel more anxious about almost all the situations because the mean values of female users' responses are rated lower than those of males, apart from the items, disruptions and no toilet access. Particularly, the females' responses present a tendency of higher level of anxiety than those of males about some physical environmental occurrences, for instance, big platform gaps, long staircases, and long walks, which seem to be less of a concern to the males in the survey results. Late-night travel is the second most anxiety inducing situation amongst the female respondents, and this demonstrates a big difference between genders. It supports female passengers' security needs on public transport which is extensively discussed in the relevant literature (Smith, 2008). The Table 4.14 presents the means of female users' and male users' responses calculated separately to see the differences.

Table 4.14 Means of female users' responses and those of male users

	<b>Negative situations</b>	<b>Mean-Female</b>	<b>N</b>	<b>Mean-Male</b>	<b>N</b>
<b>1</b>	Anti-social behaviour	1.84	43	2.26	38
<b>2</b>	Overcrowding	2.12	43	2.39	38
<b>3</b>	Too much noise	2.37	43	2.42	38
<b>4</b>	Late night travel	1.98	43	2.97	38
<b>5</b>	Long-waits	2.42	43	2.63	38
<b>6</b>	Disruptions	2.56	43	2.5	38
<b>7</b>	Missing train announcements	2.35	43	2.87	38
<b>8</b>	Missing platform	2.44	43	2.79	38
<b>9</b>	No toilets access	2.65	43	2.61	38
<b>10</b>	Can't find Information from	2.49	43	2.92	38
<b>11</b>	Can't find exits	2.77	43	3.32	38
<b>12</b>	Long walks	2.84	43	3.47	38
<b>13</b>	Platform gaps	2.65	43	3.68	38
<b>14</b>	Unfamiliar journey	2.91	43	3.42	38
<b>15</b>	Staircases	2.88	43	3.5	38
<b>16</b>	Missing stops	3.28	43	3.47	38
<b>17</b>	Can't get seats	3.28	43	3.5	38
<b>18</b>	Transfer	3.3	43	3.61	38
<b>19</b>	Quick doors	3.24	43	3.76	38
<b>20</b>	Victim of crime	3.3	43	3.84	38

<b>21</b>	When I'm moving slow	3.57	43	3.61	38
<b>22</b>	Likelihood of accident	3.58	43	3.92	38
<b>23</b>	Fear of getting lost	3.6	43	4.11	38
<b>24</b>	Travelling alone	3.72	43	4.21	38

Note: Coded (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree)

### 4.3. Expert group interview

The meeting was held in a meeting room on the 20th of October, 2015 in Transport for London office, Palestra, London. The participants were one user experience (UX) consultant, two customer strategy managers. The meeting was initiated by a presentation introducing the aim and objectives of this study about passengers' anxiety associate with the London Underground travel, with delivering the key findings from the questionnaire survey. The primary purpose of the meeting was to identify what measures and activities are taken to ensure passengers' personal safety especially in the potential anxiety-inducing situations, such as anti-social behaviour, in particular. In addition, what types of human and physical resources are equipped to be harnessed in the Underground environment for passengers was the matter of concern.

Regarding the relevant measures, campaigns and events, such as, Meet the manager event held by the BTP occasionally was discussed. In the event, police officers introduce what their duties are, and what activities are conducted, at certain stations selected by the BTP, and users can come to talk with the police. Also, an event was held in order to advertise help points at stations to inform passengers about them. At the Underground stations, they started playing classical music to reduce anti-social behaviour, and it is thought that a calming effect is expected.

With regard to safety facilities, CCTV cameras, help points, passenger alarms, and staffed stations were mentioned. CCTV cameras are installed at all stations, and in a significant number of trains. They do not advertise the locations of CCTV cameras, since it might have a reverse effect, for example, the information might be abused by offenders. Help points can be used for asking for help or reporting issues. All the stations are staffed, therefore, passengers can get assistance from staff at the station when needed, for instance, when passengers feel unwell. Passenger alarms are installed in trains, passengers can activate them when feeling unsafe,

however, there is not much the driver can do immediately to deal with the situation, but continue to the next station. Once they get to the station, they can ask for help from station staff.

## **4.4. Photography**

### **4.5.1. London Underground environment**

According to the questionnaire responses, the most worrying negative events were thought as the situations in which the users felt concerned about their personal safety. Hence, this section will present safety facilities and information provided by the service provider for passengers which may be needed in potential negative events. They will be displayed in three main different sections, safety facilities and information provided at station, in trains, and on the websites. The researched websites of the authorities are that of Transport for London, and the British of Transport Police.

- **At stations**

There are a number of methods for passengers to use when they need to deal with emergency situations, or when need to get assistance from staff or communicate with them for passengers' safety. They are help points, passenger alarms, fire alarms, signage. Also, CCTV cameras are installed to monitor for security surveillance (Department for Transport, 2012). Fire alarms and extinguishers are installed to be used in case of fire. Emergency stop buttons are equipped to stop trains only in emergency at platforms. Further, signage for wayfinding including emergency exit, and signage indicating safety facilities are provided. Also, posters which encourage passengers to report safety issues during their journey are presented.

- **Help Point**

Help points are installed at stations can be used in case of fire (1. Fire alarm), in case of emergency (2. Emergency button), when passengers need to contact a member of for assistance (3. Information button). In all the three cases, users can directly talk to staff, in the first and second cases, users are requested to follow instructions from staff. They are available on most platforms (Transport for London, 2017a).



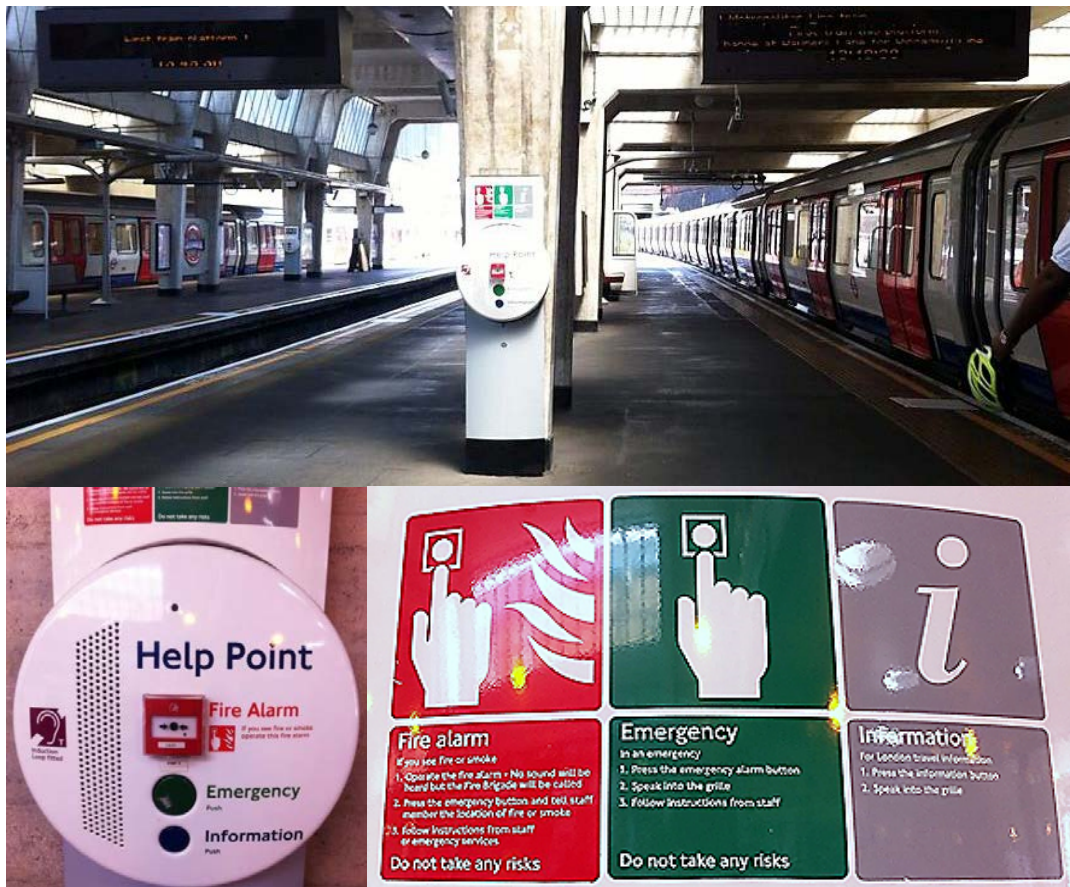


Figure 4.1 Help point at Uxbridge station



Figure 4.2 Help point at Oxford Circus station

Although help points allow passengers to use them whenever necessary, when considering the frequency of being used of the buttons, the layout of

the buttons does not seem to be well designed. It means that information button would be more frequently used than the others, such as fire alarm and emergency, and it is the function which cannot easily be found elsewhere on platforms, unlike fire alarm and emergency button, however it is located at the bottom, and its size is smaller, thus it is less visible and it does not seem to facilitate its use effectively. Also, in some cases, help points are installed without the instructions as shown in the Figure 4.2, in that case, non-English speaking users would not be able to understand how and when to use it properly because it does not provide graphic symbols for help point itself, emergency and information buttons.

- **Emergency train stop button at platform**



Figure 4.3 Emergency train stop button at platform at Oxford Circus station

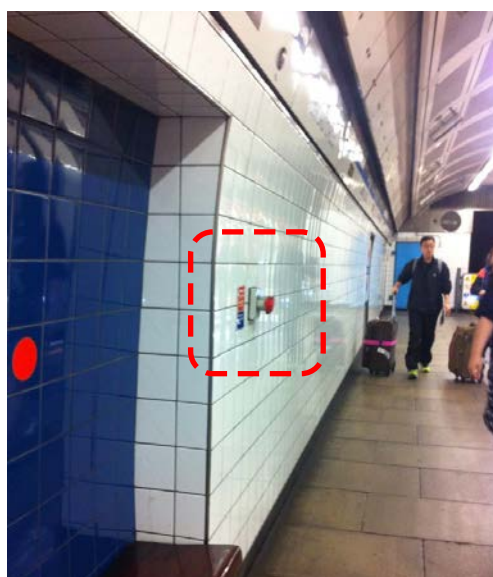


Figure 4.4 Location of the emergency train stop button at platform at Oxford Circus station



Although misuse of emergency train stop button may cause serious consequence for operation of the service, it can hardly be visible, and found.



Figure 4.5 CCTV cameras installed at Uxbridge station ticket hall



Figure 4.6 Signage for CCTV at Uxbridge station

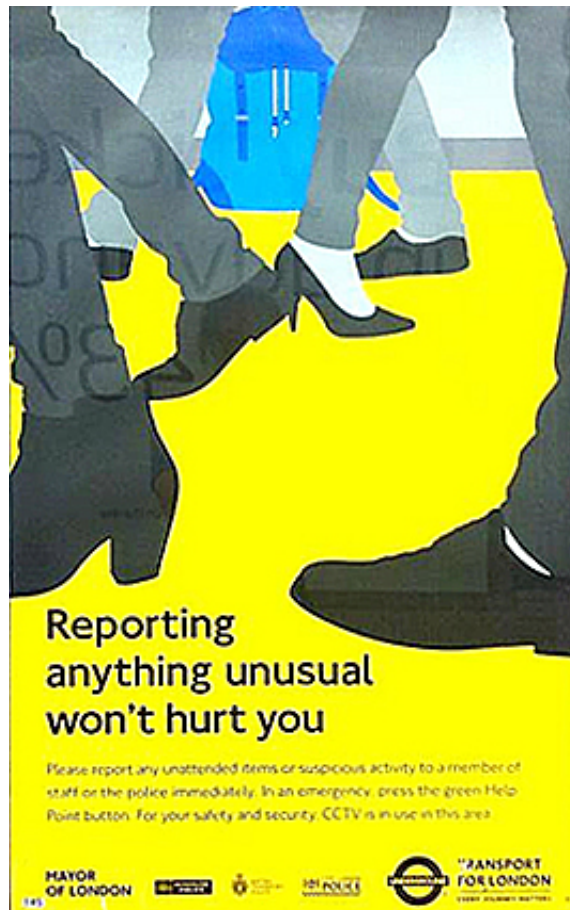


Figure 4.7 Poster encouraging passengers to report anything unusual at Baker Street station

It is important to show the service providers' intention to listen to passengers' voice (Bradford and Jackson, 2010), however it seems that messages need to be conveyed concerning the service providers' willingness to effectively solve passengers' problems which may threaten their personal safety, and also to present how to secure their safety.

- **In trains**

There are a number of facilities equipped for passengers' safety in trains, they are passenger emergency alarms, CCTV cameras, and video cameras. Emergency alarms can only be used in emergency by pressing the button to alert the driver. In emergency, passengers are advised to stay on the train, and to follow further instructions provided by staff or emergency services.

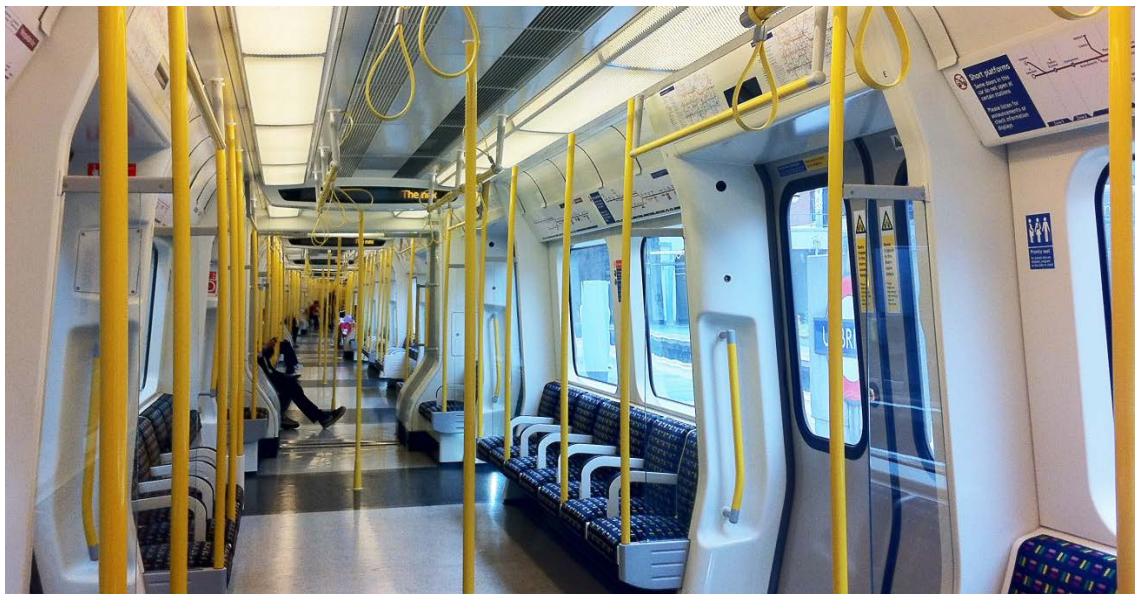


Figure 4.8 Inside of the Metropolitan train



Figure 4.9 Inside of the Metropolitan train



Figure 4.10 Signage on doors





Figure 4.11 (Left) Emergency alarm at doorway in the Victoria line train

Figure 4.12 (Right) Emergency alarm in the Metropolitan line train

It seems that necessary safety information regarding emergency and personal security is offered, however, the locations where information is presented, and its contents depend on the physical structure of the train, and the spaces allowed. Nevertheless, it is felt that the messages, formats, and locations that the relevant information are given should be consistent. As it is seen in the Figure 4.14, the signs for 'No smoking', 'CCTV cameras in operation', and 'In an emergency' deliver essential information for safe use of the service, however, somewhat different contents of the messages are combined together in a sign, especially the 'No smoking sign' from the others.



Figure 4.13 (Left) Emergency alarm in the Metropolitan line train

Figure 4.14 (Right) Signage for no smoking, CCTV, and emergency instructions in the Metropolitan line train



Figure 4.15 (Left) Assistance from staff in the Piccadilly line train

Figure 4.16 (Right) Signage for video cameras in the Victoria line train

- **On the websites (Transport for London, and the British Transport Police websites)**

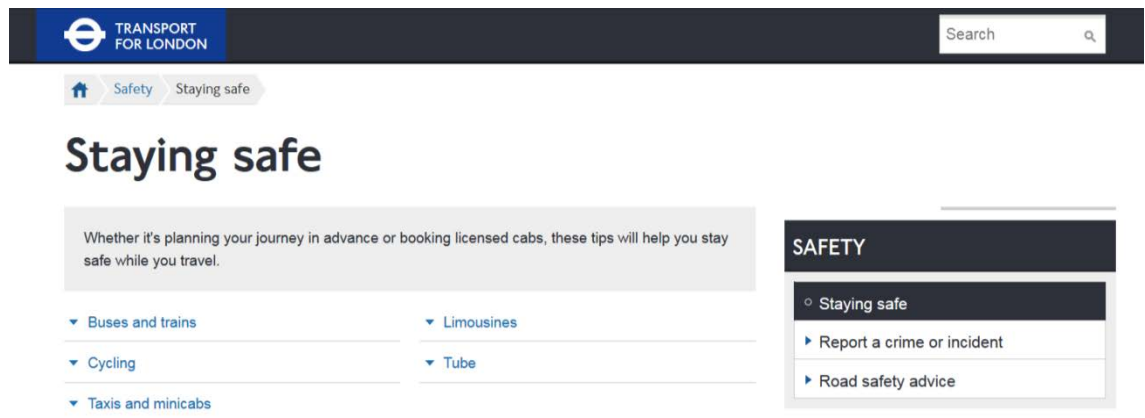
Advice on safe trips for passengers on the Underground are offered on the TfL, and the BTP web pages. On the TfL website, there are two main routes to reach the relevant information, the one is under the Safety category, and the other one is under the Transport accessibility category. Overall, advice on how to get staff assistance, and contact the driver, or how and when to use safety facilities, such as, help points or passenger alarms are offered. Moreover, caution about travelling after drinking, and suggestions on travelling when feeling unwell are described. Contacting the driver is not recommended when the situation is not an emergency. When feeling unsafe due to experience of crime or anti-social behaviour, passengers are advised to talk to staff or the police. It is highlighted that CCTV cameras are extensively used across stations, and a large number of trains (Transport for London, 2017a; 2017b).

Furthermore, the BTP website also offers information about personal safety for passengers. It suggests passengers to be prepared by planning their journey prior to travel, and to carry a mobile phone for contacting someone when needed during the travel. Additionally, it encourages passengers to be aware of the surroundings, and avoid dark areas. It suggests users to stay near CCTV cameras, or to stay close to other passengers, and to avoid listening to personal stereo in case that passengers cannot be aware of what is going on around them. Also, when passengers are on the train, they are advised to protect their privacy, to note where emergency alarms are located (British Transport Police, 2017).

However, from a user's point of view, the content of the information provided on the two different websites and the web pages would seem similar. It may be beneficial if information is given on a certain and suitable location on the website, it would seem more coherent, and be able to be found more easily. In the Figure 4.17, the information provided on the web page seems to be useful for passengers to travel safely on the network, however, when seeing the structure of the information from the viewer's perspective, the way it is delivered does not seem to effectively facilitate their understanding. In is mentioned that structuring information is considerable to assist viewers to understand the information effectively (Wurman, 2000). However, on the web page, all the items are weighted equally, consequently, it seems hard to identify what is more important than others. Also, some related items of the information are provided separately, such as the last two sentences.



Furthermore, it does not provide any graphic aids which help the viewer understand more easily (Reinking, 1986).



## Tube

- Be especially careful if you are travelling after drinking. Many injuries are alcohol related
- If you drop anything onto a train track don't try to pick it up, just ask a member of staff or use the Help Point
- Don't board a train if you feel unwell. If you're already on the Tube and start to feel unwell, ask someone to open the end car windows or operate the slide mechanism above the seats to increase ventilation
- Don't use the passenger alarm between stops unless it's a real emergency (eg if someone collapses). Staff can assist you more quickly at the station
- If the passenger alarm has been activated, move away from any immediate danger. Remain calm, open windows for ventilation and wait for instructions from a member of staff or the emergency services
- If any part of the train is at the platform, the train will stop. If the train is between stations, the driver will continue to the next station where assistance will be available
- It is safer to remain on the train unless instructed to leave by staff or emergency services. Emergency lighting is provided on all trains but it may be useful to use your mobile as an additional source of light
- If you are carrying luggage, use the lift instead of the escalators where possible
- If you have to use the escalators to carry luggage, place it securely on the step and hold on to your luggage and the handrail

Figure 4.17 The Underground travel safety tips provided on the TfL website

TRANSPORT FOR LONDON

Search

Transport accessibility Features on board

## Features on board

Our vehicles have a range of features designed to make it easier to travel.

- Priority seating and wheelchair spaces
- Audio/visual information
- Low-floor access
- Safety and security

TRANSPORT ACCESSIBILITY

- Plan your journey
- Learn to use public transport

## Safety and security

Your safety is of prime importance to us and crime is at its lowest ever levels on London's transport network.

CCTV is used extensively across stations, piers, all buses and many trains.

[Find out how we use CCTV.](#)

Passenger alarms on trains can be used to contact the driver and are found next to doors and wheelchair spaces.

Help points available on most platforms can be used to contact staff in an emergency, to request assistance or ask for information.

If you feel unsafe or experience any incidents of crime (including hate crime) or antisocial behaviour please talk to our staff or the police.



Figure 4.18 Travel safety tips provided on the TfL website

The screenshot shows the British Transport Police website. At the top left is the logo for the British Transport Police. To the right of the logo is a navigation menu with links: Latest news, About us, Local NPT teams, Advice and info, Publications, Careers at BTP, and Contact us. Below the navigation menu is a sidebar on the left with a 'Personal safety' heading and a list of links: Support, Rail Pastors, FAQs, Stop and search, Misconduct hearings, Justice department, Travel advice, Night Tube, Network Incident Response Team, Rail enthusiasts, Tackling crime, Victims of crime, Scrutiny panel, and Social media. The main content area features a 'Personal safety' section with the text: 'Rail is the safest form of travel in Britain. We want to help you prepare for your journey and empower you to stay safe while you travel.' Below this text is a photograph of a police officer in a high-visibility vest talking to passengers on a train. Underneath the photo is a 'Be prepared' section with a list of tips: 'Plan your journey before you travel.', 'Make sure someone knows when and where you are travelling. Carry a mobile phone in case you need to contact them.', 'If you have restricted movement, check beforehand that each station can provide you the access you need.', and 'When travelling in a group, arrange a meeting point in case you get separated and supply everyone with the same contact number.' To the right of the main content area is a 'My local team' section with a link 'Click here to add a local team'. Below that is a red 'Contact Us' box with the text: 'To report a crime or incident, call 0800 40 50 40 or text 61016. In an emergency call 999'. Further down are sections for 'Lost property', 'Complaints and feedback', and 'What's going on in your area?'.

Figure 4.19 Travel safety tips provided on the BTP website

## 4.5. Problems of the current information environments

Overall, the Underground service environment has been investigated through a variety of methods, such as photography, focus group meeting, and web-based research. The main purpose of the investigations was to identify what types of facilities are prepared for the users, and what measures and activities are taken to support the users in anxiety-inducing situations. There are a wide range of facilities and systems are set up for passengers' safety, such as help points, passenger alarms, emergency stop buttons, CCTV cameras, and video cameras. Furthermore, campaigns and events are conducted to increase awareness of personal safety, and to facilitate communication between the authorities and the users. However, observing the current situations through the users' perspective, it is seen that the current information environments regarding passengers' safety have not been designed to prioritise its potential buffering effects against anxiety, which might be effective when passengers are vigilant for potential risks. For example, passengers are allowed to use safety resources, such as passenger emergency alarms, and buttons to speak to drivers in carriages only in case of emergency when accidents actually occur, such as fire. Also,

according to the one of the interviewees, service providers are reluctant to inform their locations and usage, since they are concerned about misuse. Moreover, the information environments seem to lack guidance on coping process, such as step-by-step information delivering processes to follow conveyed through understandable forms, and presentation of holistic information about locations and usage of safety facilities located in stations and trains. In addition, useful but partial information is provided through various channels, such as at stations, in trains, or on the website. This might make users feel that it is difficult to reach the necessary information. Exposure to difficult situations may lead to occurrence of information needs, which are met by obtaining information, however, people hardly recognise the needs, and hardly know what information might be useful (Nicholas and Herman, 2009). Therefore customers' knowledge on coping with aversive events and on proper use of safety facilities might have not been accumulated properly. In other words, passengers might find the situations less controllable than actually they are. In addition, if they are less aware of coping procedures with harnessing physical and human safety resources, as well as a method to communicate with service providers to report problems and ask for help, they would potentially experience a sense of helplessness which is connected to arousal of anxiety (Barlow, 2002). Currently, data which is available on how effective information provision should be designed seems to lack.

#### **4.6. Chapter summary**

This chapter discusses the background research which was conducted to develop theoretical backgrounds for re-designing information environments in order to help reduce passengers' anxiety on the London Underground. This set of the preliminary studies was initiated as an exploratory phase, since passengers' anxiety, as a negative emotional state in the London Underground environment has rarely been investigated. First, an exploratory questionnaire was conducted in order to see if the respondents experience anxiety, and to identify the main anxiety-inducing situations, also if there are differences between genders. Second, a Transport for London expert group interview was convened in order to identify what measures and activities are made to support passengers in potential anxiety-inducing situations. Third, photography was carried out to confirm the addressed resources from the interview, and to gain general overview about the current information

environments pertaining to passengers' personal safety. The findings will contribute to further investigation of the anxiety-inducing situations, for example, the major anxiety trigger will be used as a stressor in a conceptual model which will be formulated in the subsequent chapter. As the female participants reported a greater level of anxiety about seeing other passengers' anti-social behaviour, the effect of gender will be further investigated. Moreover, the suggested resources, such as help point, and emergency alarm, will be included as one of the determinants of anxiety in the model.

## **Chapter5. Research model**

### **5.1. Introduction**

This chapter discusses a research model and hypotheses formulated based on the theoretical support synthesised from the reviewed relevant literature on anxiety, and the data achieved from the pilot study. The research model will be generated on the basis of the psychological model (the Spielberger's state-trait conception of anxiety), which explains important components of anxiety and their interrelations in a process as a sequence, implying probabilities of occurrence of iterations in some parts or of the entire process (reappraisal). This process is initiated from a stressor, which leads to somatic, psychological and behavioural responses, when it is interpreted to be dangerous (Spielberger, 1966; 1972). The theoretical grounds of the interpretation of the stressor which determines the level of arousal are found from the Lazarus's (Lazarus, 1966; Lazarus and Folkman, 1984) cognitive theory of stress and appraisal (Spielberger, 1966; 1972). Thus, the research model embraces possible factors which are potentially considered in the cognitive threat appraisal process, whose outcome determines the level of anxious arousal. Additionally, the effect of perceived control, will be hypothesised to be intervened between the cognitive appraisal and anxious arousal. The rationale behind this assumption is that it is mentioned as the products of the person's assessment of "the demands of the situation", or the individual's resources and options for coping and capability to execute the coping strategies which are needed in the situation (Folkman, 1984). Hypotheses will be generated accordingly, to enable the model to be testable, and then will be examined to confirm the proposed relationships, ultimately to provide theoretical evidence for selection of significant factors for designing information platforms, which will possibly be effective to buffer anxious arousal. Five factors will be proposed which might be related to cognitive appraisal, which are past victimisation experiences, perceived physical ability to defend, confidence in the relevant authorities, beliefs in informal social control from other passengers, and safety knowledge. Also, perceived uncontrollability will be hypothesised to be intervened between the factors and anxious arousal. Additionally, the effect of gender is supposed as a factor which moderates the relationship between perceived physical

ability to defend and perceived uncontrollability which leads to anxious arousal.

## **5.2. Key findings from the pilot study and the theoretical background**

### **5.2.1. Key findings from the pilot study**

#### **5.2.1.1. Anti-social behaviour as a stimulus**

The results generated from the pilot questionnaire analysis, eleven negative situations have been identified as potential anxiety-inducing situations, since the mean values of the items were rated below 3. Although the results were not statistically verified, it could be interpreted that they might be worthy to look at as situations which involve potential risks. In the present chapter, however, the first four ranked stressors will be further investigated. They are identified as, first, other people's anti-social behaviour, second, overcrowdedness, too much noise, and late-night travel on the London Underground. As the purpose of this study is to examine the effects among hypothesised influencing factors and anxiety, by observing the situation through the relevant theories, and accordingly, make basis for the development of effective anxiety mitigation strategy, it was judged that there should be only one dominant stressor in the hypothetical situation for testing. Since, the theory which will provide a basis for the process explains that the level of stress results from the appraisals of a situation which includes a threat. Therefore, the highest-ranked situation was selected as a potential risk for the further investigation. Also, the decision was made because anti-social behaviour arouses citizens' anxiety (Burney, 2009), and it is mentioned as one of the major problems in public transport environments (Moore, 2011). Anti-social behaviour issues are considered as crime-related topics (Sian et al., 2007), which are tackled in conjunction with crimes (Upson, 2006; Lynch and Atkins, 1988). Therefore, in order to identify more relevant factors which might be involved in the cognitive appraisal with regard to anti-social behaviour, the selection of the coping resources will be guided by the Killias's "an analytical framework of different dimensions of vulnerability" (Killias, 1990). In the framework, the concept of vulnerability which is associated with fear of crime is introduced.

### **5.2.1.2. Gender difference and the effect of gender**

The female respondents reported higher level of anxiety in the situation, therefore it is hypothesised that the intensity of female passengers' anxiety will be higher than that of male passengers' in the situation. For further investigation on the difference, it will further be explored where the difference might arise, and then will be supposed that the difference results from their lower level of perceived physical ability to defend themselves, later in this chapter.

## **5.2.2. Theoretical background**

### **5.2.2.1. Cognitive appraisal of threat**

Briefly summarising the previously reviewed literature on psychological stress analysis, the cognitive appraisal is differentiated from other types of stress assessment in the sense that threat, which is anticipated harm that has not been inflicted yet, is intervened in the process. Once situations are seen as harmful, unlike situations perceived benign or beneficial (they are identified as irrelevant, benign-positive, and stressful later in Lazarus and Folkman, 1984), consequently, subsequent appraisal of the threat is set in motion, which is called coping. The appraisals are differentiated into two types of appraisal, primary appraisal and secondary appraisal. With respect to primary appraisal, there are "two classes of antecedents", which are appraisals based on constructs inhering in the stimuli, and those innate in the individuals' "psychological structure". Elements concerning secondary appraisal which are related to coping are activities and efforts to reduce anticipated future harm which are based on cognitive function (Lazarus and Opton, 1966).

### **5.2.2.2. Relevant theories and models of anxiety and their characteristics**

- **The Spielberger's state-trait conception of anxiety and the Lazarus's cognitive theory of stress and coping**

'The state-trait conception of anxiety' by Spielberger (1966; 1972) (Figure 5.1) has been referred to for developing the research model and hypotheses. Additionally, its theoretical background of the cognitive



appraisal stage in the Spielberger's model is based on the Lazarus's theory of psychological stress (Lazarus, 1966).

The Spielberger's model enables understanding the components of anxiety which need to be considered in research on anxiety by organising significant constructs and representing relations among them. It highlights the role of cognitive appraisal, whose theoretical foundation is rooted in Lazarus's (Lazarus, 1966) cognitive appraisal process in the 'Transactional Model of Stress and Coping'. The uniqueness of the Spielberger's model is its separation of anxiety as a transitory state, and anxiety as personal proneness to perceive various stimuli threatening (Spielberger, 1972). State anxiety is characterised by "subjective, consciously perceived feeling of apprehension and tension, accompanied by or associated with activation or arousal of the autonomic nervous system", distinguished from trait anxiety as a dispositional characteristic which "predisposes an individual to perceive a wide range of objectively non-dangerous circumstances as "threatening". State anxiety will be intensified when an "objectively painful stimulus" is anticipated in a circumstance, regardless of trait anxiety (Spielberger, 1966). In this sense, it seems that state anxiety has its greater importance in cognitive appraisal of an objective threat, thus state anxiety will be assessed among passengers as a response to potential threat, which is seeing other passengers' anti-social behaviour, as an external stimulus in this study.

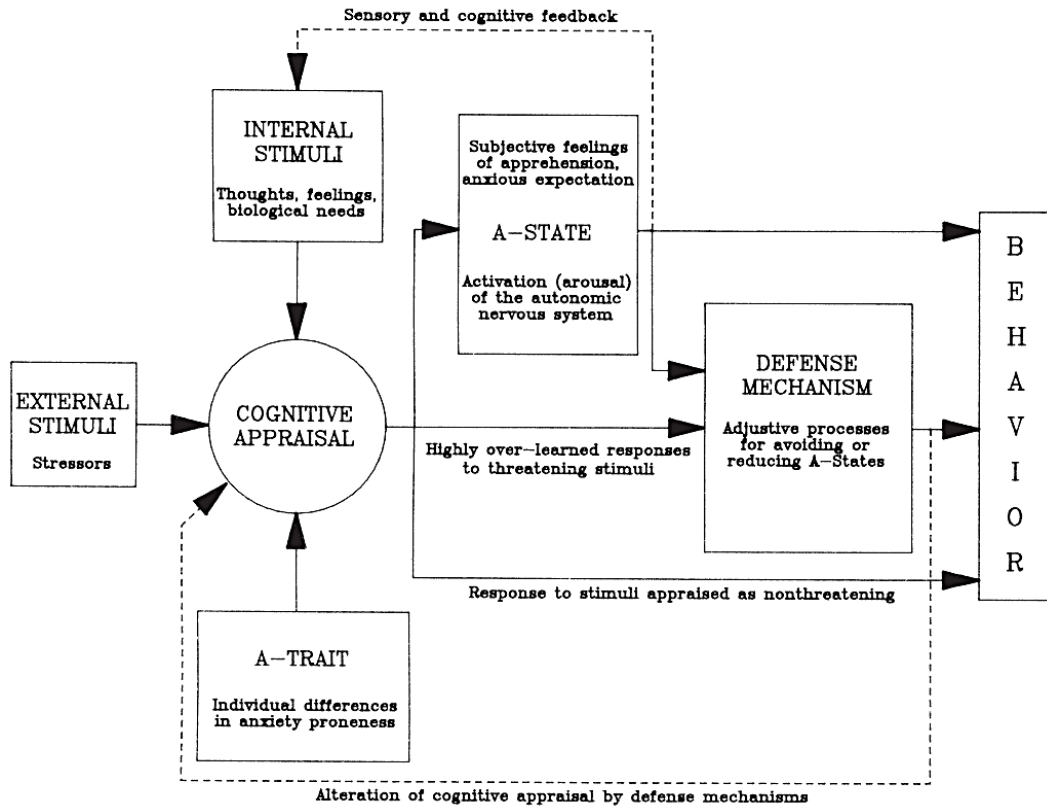


Figure 5.1 A trait-state conception of anxiety  
(Spielberger, 1972 cited in Barlow, 2002)

- **The Barlow's process of anxious apprehension**

Additionally, as one of the secondary appraisals, the importance of perceived control has drawn attention since its deficiency predicts anxiety in a large number of studies (Feldner and Hekmat, 2001; Rapee, 1997; Tetrick and LaRocco, 1987; Cloitre et al., 1992). Furthermore, as its theoretical basis of perceived uncontrollability as a factor which predicts anxious apprehension, the model of 'The process of anxious apprehension' by Barlow (2002) (Figure 5.2) demonstrates its likelihood. The model suggests important components of anxiety initiated from "evocation of anxious propositions (situation context, unexplained arousal or other cues)", highlighting the negative effects of perceived uncontrollability, "focused largely on possible future threat, danger, or other potentially negative events" which result in somatic or behavioural responses.

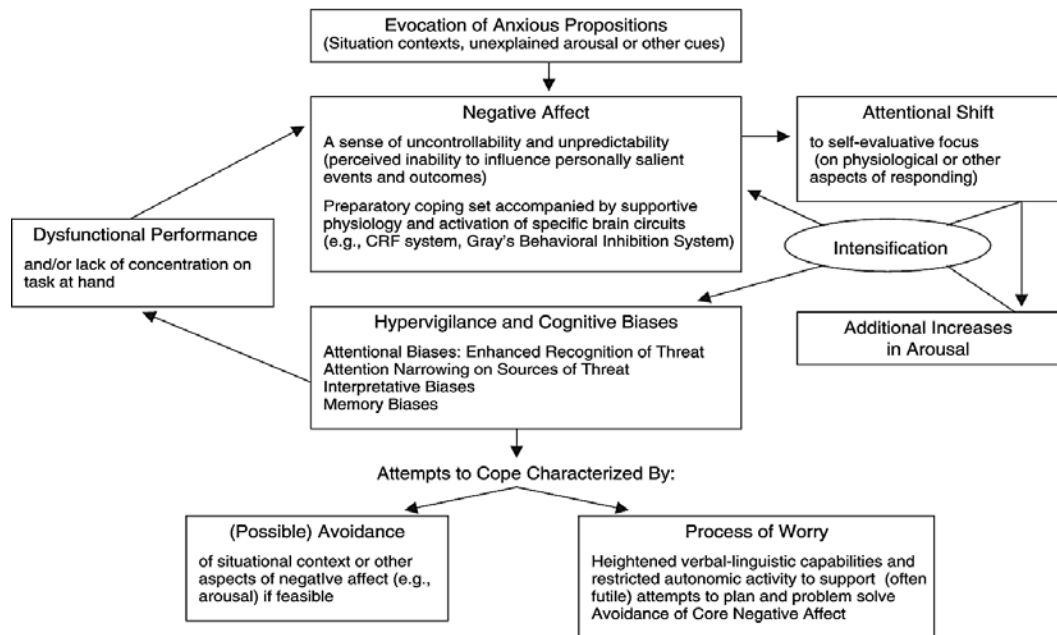


Figure 5.2 The process of anxious apprehension

(Barlow, 2002)

To sum up, the Spielberger's model provides the grounds of the process which reaches state anxiety initiated from stimuli with the involvement of cognitive appraisal, which is explained by Lazarus's theory of psychological stress that offers the factors which are engaged in the stage, whose outcomes result in state anxiety when a situation is appraised threatening. Additionally, on account of the significance of perceived uncontrollability which has been confirmed as a factor that explains anxiety as verified in numerous empirical studies, as well as its likelihood which can be identified in the Barlow's model, its influence will be tested along with the aforementioned other factors related to cognitive appraisal process. Therefore, in this study, the hypothesised model will embrace three stages which are cognitive appraisal, negative effect, and anxious arousal.

- **The Killias's analytical framework of different dimensions of vulnerability**

As an early concept of perceived vulnerability to victimisation is regarded as a component embracing cognitive and affective aspects construed based on the synthesis of previous concepts of perception of vulnerability. As a cognitive factor, it is indicated as "a belief that one is susceptible to future

negative outcomes and unprotected from danger or misfortune” which is associated with emotional responses, such as anxiety and fear. Also, the concept of invulnerability is suggested which is individuals’ perception that they are less vulnerable on the premise of lower likelihood of occurrence of aversive events to them, and lesser susceptibility of encounter to the events (Perloff, 1983). Later the concept of vulnerability associated with fear of crime is more specified by Killias that it has three aspects, which are “physical, social, and situational components” which are then related to the three defined dimensions of vulnerability, which are perceived “exposure to non-negligible risk, loss of control (lack of effective defense, protective measures and/or possibilities of escape), and anticipation of serious consequences”. It is postulated that when the influences of the three dimensions exceed a certain level, fear will be triggered. Lack of control is one of the suggested dimensions of vulnerability, it can be influenced by the three factors (Killias, 1990). Thus, the three factors will provide grounds for the selection of the potential factors which hypothetically lead to loss of control, and anxiety in this study. For instance, as physical factors, perceived physical ability will be considered, as social factors, trust in other passengers, and as situational factors, passengers’ safety knowledge and their confidence in the relevant authorities will be taken into account.

<b>Dimensions of Vulnerability</b>	<b>Exposure to risk (higher in the case of...)</b>	<b>Seriousness of consequences (more serious in the case of...)</b>	<b>Loss of control (in case of an attack by a young man, not much can be done by...)</b>
<b>Physical factors</b>	<ul style="list-style-type: none"> <li>- Women (in connection with sexual attacks)</li> </ul>	<ul style="list-style-type: none"> <li>- Women (rape produces serious long-term consequences; rape victims often injured)</li> <li>- Elderly and people in bad health (consequences more serious and lasting)</li> </ul>	<ul style="list-style-type: none"> <li>- Women</li> <li>- Elderly</li> <li>- Physically vulnerable person</li> </ul>
<b>Social factors</b>	<ul style="list-style-type: none"> <li>- "Risky" jobs: taxi drivers, bank employees, jobs with late closing hours, prostitutes, etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Victims without network of social support and/or adequate resources</li> </ul>	<ul style="list-style-type: none"> <li>- Lonely victim, especially when more than one offender</li> <li>- Victim of dubious reputation</li> </ul>
<b>Situational factors</b>	<ul style="list-style-type: none"> <li>- Residence in high-crime area (or with signs of inclivity/ disorder)</li> </ul>	<ul style="list-style-type: none"> <li>- Victimization (injury) in deserted area (where no help is available within reasonable time)</li> </ul>	<ul style="list-style-type: none"> <li>- Victim in deserted area (especially after dark)</li> <li>- Victim in area without formal or natural surveillance</li> <li>- Victim exposed to high risk without adequate (technical) protection</li> </ul>

Figure 5.3 An analytical framework of different dimensions of vulnerability (In connection with fear of crime)

(Killias, 1990)

### **5.3. Research model and hypotheses**

#### **5.3.1. Research model formulation**

On the basis of previously reviewed theoretical background of anxiety as a negative emotional state with the interrelations among the components of anxiety, and the data from pilot study, a research model will be generated. It is composed of potential influencing factors of anxiety and perceived uncontrollability. They are considered to be evaluated as primary and secondary appraisals of threat, since “secondary appraisals of coping options and primary appraisals of what is at stake interact with each other in shaping the degree of stress and the strength and quality of the emotional reaction” (Lazarus and Folkman, 1984, p.35), and their influences potentially result in perception of uncontrollability which will lead to anxious arousal.

With respect to primary appraisal, ‘perceived invulnerability’ in relation to past victimisation experience will be proposed as factors which lead to anxiety through ‘perceived uncontrollability’ in the appraisal. With regard to secondary appraisal, elements associated with coping resources and strategies, such as ‘perceived physical ability’, ‘confidence in the authorities’, ‘trust in other passengers’, and ‘safety knowledge’ will be suggested as factors which lead to anxiety through ‘perceived uncontrollability’. Lastly, a moderating effect of gender in the relationship between ‘perceived physical ability to defend’ and ‘perceived uncontrollability’ which results in anxious arousal will be hypothesised.

#### **5.3.2. Factors relating to primary appraisal**

When it comes to primary appraisal, evaluating future conditions as “harmful, benign or beneficial” is contingent upon stimuli whether they produce “threat or nonthreat” responses. In harmful conditions, assessment of threat is associated with evaluation of the stimuli, which is a process involving two types of determinants. “One consists of factors in the stimulus configuration”, they are for example, the power of noxious stimuli and the persons’ resources to counteract the harm, as well as imminence, and the

level of ambiguity of stimuli. The second determinative components are factors embedded in individuals' psychological structure, such as "motive strength, general beliefs, intellectual resources, education and knowledge". Through the appraisal, if a situation is evaluated as threatening, individuals' efforts to minimise the threat will be initiated (Lazarus and Opton, 1966). In this study, individuals' general beliefs about "transactions with the environment" will be investigated. "The individual must, of course, learn the personal significance of particular cues from past experience. But general beliefs about the environment and his capacity to deal with it guide every specific interpretation. For example, beliefs about one's own general helplessness imply the corresponding potency of the environment for weal or for woe. Conversely, beliefs about one's own masterfulness limit expectations that one is at the mercy of potential dangers." (Lazarus, 1966) In this present study, as a primary appraisal, 'Illusions of invulnerability' which are mentioned that they are associated with a sense of control, and they are significantly lost as a result of actual experience of victimisation will be hypothesised as factors related to primary appraisal.

#### **5.3.2.1. Perceived invulnerability**

"Cognitions arising from the immediate situation as interpreted by past experience provide a framework within which one understands and labels his feelings. It is the cognition which determines whether the state of physiological arousal will be labelled "anger", "joy," or whatever." (Schachter and Singer, 1962) Previous victimisation has been treated as one of the individual factors of primary appraisal (Wright and Fitzgerald, 2007). In Amerio and Roccato's study on psychological responses to crime, it is confirmed that individuals' victimisation experiences predict fear of crime. Especially ones who have experiences of direct victimisation in the last three years tend to fear seven times more than the ones who do not have them during the same years (Amerio and Roccato, 2005). Furthermore, Kanan and Pruitt's investigation on fear of crime verifies the influence of experiences of being victimised on the level of fear of crime (Kanan and Pruitt, 2002). A sense of invulnerability is shattered by experiences of victimisation, and helplessness might have been experienced during the negative events which were seen uncontrollable (Peterson and Seligman, 1983; Janoff-Bulman and Frieze, 1983). Perloff mentions that individuals' perceived vulnerability is intensified after experiencing traumatic events, with their perception of invulnerability being shattered, and with psychological

stress induced. In this sense, it is suggested that “illusions of unique invulnerability” which have a buffering effect against anxiety and an improving effect of perceived control might be adaptive (Perloff, 1983). Non-victims’ illusions of invulnerability are described that downward comparison is likely to be involved when appraising risks, which are their views that their lower likelihood of falling victim to negative events than others’. This comparison leads non-victims to have beliefs that they are less susceptible, and they can cope with negative events better than others (Perloff, 1987).

Referentially, susceptibility is accounted as a component related to primary appraisal in the Glanz et al.’s (2008) ‘Transactional model of stress and coping’ (see Figure 5.4), proposing that the consequences of the primary appraisal will lead to coping effort and then to individuals’ adaptation. For instance, aversive and intrusive thoughts as well as psychological stress are experienced more amongst females who have family history of ovarian cancer, perceiving greater susceptibility (Schwartz et al., 1995). Also, in Taylor et al.’s (Taylor et al., 1992) study reveals that males who are seropositive HIV has “beliefs of invulnerability” which are related to better sense of control, and reduced level of stress (Glanz and Schwartz, 2008).

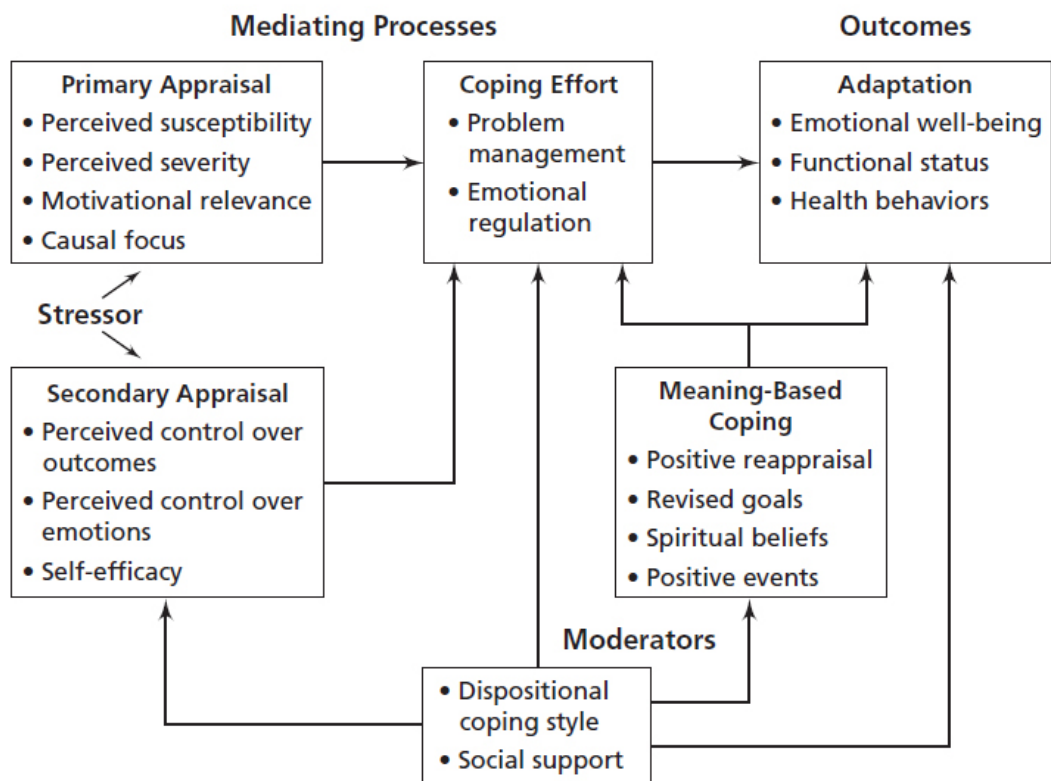


Figure 5.4 Transactional model of coping and stress

(Glanz et al., 2008)

Barlow states that psychological vulnerability which has been formed resulting from past behavioural experiences and “a learned inability to cope with” stressors in uncontrollable and unpredictable situations (Barlow, 1988). He also claims that perceived uncontrollability as a state which individuals experience helplessness resulting from the perception that negative events are not predictable and controllable, and that desired consequences are not achievable (Barlow, 2002). Catterson and Hunter’s investigation on cognitive mediators of the relationship between peer victimisation effect and sense of loneliness present that only control perception mediated the relationship but blame or threat did not (Catterson and Hunter, 2010). In public transport environments, it is identified that passengers who have been, seen or felt threatened perceive the environments less safe (Currie et al., 2013). Therefore it will be hypothesised as follows.

**H1. Perceived invulnerability will negatively predict anxiety through perceived uncontrollability**

### **5.3.3. Factors relating to secondary appraisal**

“Secondary appraisal is more than a mere intellectual exercise in spotting all the things that might be done. It is a complex evaluative process that takes into account with coping options are available, the likelihood that a given coping option will accomplish what it is supposed to, and the likelihood that one can apply a particular strategy or set of strategies effectively.” (Lazarus and Folkman, 1984, p.35) In this section, two main constructs will be discussed as secondary appraisals, which are coping resources and perceived control. Its theoretical basis which helps clarify the potential interrelations among the potential factors related to coping and control will be provided followed by empirical study results from the relevant literature. Generally, it is postulated that knowledge on coping resources and options will supply a basis of positive beliefs about individuals’ control over aversive situation, and ultimately their anxious arousal will be relieved.

#### **5.3.3.1. Theoretical background of coping resources, control and stress**



- **Coping resources**

In secondary appraisal of threat, possible resources and options for coping are evaluated. Coping is defined that individuals' "cognitive and behavioural efforts to manage specific external and/or internal demands" in stressful situations. It is described as a process which individuals deploy, for instance, "defensive strategies, and problem-solving strategies" depending on situations (Lazarus and Folkman, 1984). In terms of the coping resources, which are considered in the appraisal contain "physical, social, psychological, and material assets". Individuals' health conditions and energy can be classified as physical resources, and person's "social network and support system" which can be performed as sources of "information, tangible assistance, and emotional support" can be categorised as social resources. Plus, relevant skills for solution to problems, "self-esteem, and morale" can be regarded as psychological resources, and money, instruments can be accounted for material resources (Folkman, 1984).

- **Control as a secondary appraisal**

Situational evaluation of control is also considered as one of the components of secondary appraisal (Glanz et al., 2008; Folkman, 1984). Folkman describes control as "the person's judgement or belief about the possibilities for control in a specific encounter" (Folkman, 1984). Thompson defines control as "belief that one has at one's disposal a response that can influence the aversiveness of an event". It is also mentioned that it is not necessary to be real or to be exercised to be effective, if it is perceived, then it is believed to be in effect (Thompson, 1981). Further, Chorpita and Barlow define control as "the ability to personally influence events and outcomes in one's environment, principally those related to positive or negative reinforcement". They suppose that vulnerability to anxiety could be accounted for by a lack of control experienced in the early stage which might give rise to a likelihood of interpretation of subsequent situations as uncontrollable (Chorpita and Barlow, 1998). Averill's suggests three major types of control which has an effect on stress reduction. They are behavioural, cognitive and decisional control. Specifically, behavioural control is mentioned as "the availability of response which may directly influence or modify the objective characteristics of a threatening even", cognitive control is addressed as "the way in which an event is interpreted,

appraised, or incorporated into a cognitive plan, and decisional control is described as “the opportunity to choose among various courses of action” (Averill, 1973). Folkman further elaborates control using Bandura’s conception, outcome and efficacy expectancy. The former refers to “outcome expectancy” which is individuals’ belief that a given strategy will produce a certain outcome based on individuals’ judgement, and the latter is accounted “efficacy expectancy” which is one’s confidence in their ability for generation of outcome through implementing the strategy effectively. Two main constructs which perform in the assessment of control are, first, one’s judgement of the demands occur in the situation, second, one’s assessment of the resources and options for coping, and capability of implementation of necessary coping strategies. Appraisals of control can be affected as a consequence of newly provided information by the environment, and the outcomes of coping efforts (Folkman, 1984). Perceived control has been verified as a significant factor which predicts anxiety or stress in a number of studies (Feldner and Hekmat, 2001; Rapee, 1997; Tetrick and LaRocco, 1987; Cloitre et al., 1992). For example, Lang and McNeil’s study regarding stress and adaptation amongst patients hospitalised for a short term uncovers patients having a lack of perceived control tend to experience higher degrees of anxiety, depression, and lower perceived quality of life, and higher negative pressure accompanied by hospitalisation (Lang and McNeil, 2006).

- **Coping resources, control and stress**

Litt suggests perceived control and self-efficacy as constructs which buffer experiences of stress in aversive situations. He clarifies the possible interactions of the two constructs when encountering to stressful stimuli. Enhanced behavioural outcomes can be expected when individuals perceive that the situation seems under control, and therefore, feel confident (high-efficacy) in exerting their ability to control. He further explains the interactions with experience of stress using Bandura’s (Bandura, 1977) words, lower level of psychological distress is experienced when individuals have high level of efficacy (Litt, 1988a).

### **5.3.3.2. ‘Perceived physical ability**

Killias’s study co-conducted with Clerici regarding assessment of vulnerability based on Killias’s (Killias, 1990) argument which is formation of

fear of crime is significantly attributed to vulnerability, distinguishing it into two components. First, “personal, social and situational aspects”, such as gender, and characteristics of neighbourhood (which will be discussed as one of potential coping resources and a type of social support linked to trust in people in the next section), second, “dimensions of threats”, such as likelihood of crime, the magnitude of severity of consequences, and a sense of uncontrollability over the probability and anticipated outcomes. In their study, amongst various factors of perceived vulnerability, the most influencing variable which explains the arousal of fear was self-evaluated physical vulnerability. It was assessed through a self-report measure asking the subjects’ mode of defence against a hypothetical attack (evaluation on “their chances in the event of an assault on a lonely street by a young, unarmed man, i.e. whether they felt able to flee or to defend themselves, or whether they expected to succumb under such circumstances”) (Killias and Clerici, 2000).

Later in Jackson’s study (Jackson, 2009), he further clarifies the relationships among the variables of vulnerability, pointing out that in Killias and Clerici’s study (Killias and Clerici, 2000), perceived control was not taken into account in the assessment although it was proposed as one of the important factors of perceived vulnerability in his previous study (see Killias, 1990), and the factor determined as the strongest predictor of fear of crime which was self-evaluated vulnerability might have been related to perception of control and consequence, and therefore arousal of fear was predicted by it, however independency among the factors may have not been sufficiently achieved. Jackson, thus, suggests the factors of vulnerability as, perceived likelihood of victimisation, control and consequence and clarifies the relationships among them. Additionally, it is proposed that worry about crime might be rooted in personal evaluation of the factors along with perceived physical ability to defence. The test results reveal that the relationships among the factors in the structural models present that perceived physical defence capabilities predicted the sense of control over personal crime which predicted worry about crime mediated by the perception of probability of personal crime, consequently clarifying the relations of the factors which constitute the concept of vulnerability (Jackson, 2009). However, in his subsequent study on risk sensitivity in the fear of crime, perceived physical defence capabilities were treated as one of the factors comprising perceived control (Jackson, 2011). However, it seems that it is required to define more clearly the notion of the physical capabilities being exclusive of the concept of control. Therefore, in this study, perceived

physical ability to the exclusion of the concept of control will be taken into account, and the effect of perceived physical ability on control will be measured. Another study regarding physical ability, control, and anxiety, higher level of self-esteem, internal locus of control, and lower degree of social anxiety were shown among the participants who perceived that their physical skills were excellent in Ryckman et al.'s study (Ryckman et al., 1982).

In terms of the effect of gender, it is demonstrated that the sense of control directly predicted worry about crime of females but not that of males, it might be reasonable to infer that a need for further investigation of the function of gender as a moderating effect when explaining the disparity between the two restricted models, the one with a significant path ("perceived control over personal crime" which is found in females' model) and the other one without the path. In public transport settings, in terms of females' vulnerability, it is addressed they are more vulnerable because of their physical size and their perceived lack of ability to protect themselves. It is also mentioned that the majority of females are not regarded as threat to offenders as much as males (Loukaitou-Sideris and Fink, 2008). Therefore, it seems reasonable to hypothesise that lack of perceived physical defence capabilities will predict anxiety through perceived uncontrollability. In terms of the effect of gender, it seems sensible to suppose that gender will moderate the relationship between the perceived physical ability to defend and perceived uncontrollability which will lead to anxious arousal.

## **H2. Perceived physical ability will negatively predict anxious arousal through perceived uncontrollability**

### **H2a. Gender will moderate the relationship between the perceived physical ability and perceived uncontrollability**

#### **5.3.3.3. Trust in other passengers (informal social control), and confidence in the relevant authorities**

Trust in other passengers and confidence in authorities are considered as constructs associated with secondary appraisal, as resources of social support, and coping and control, in the sense that perceived positive likelihood that difficult situations will be resolved with the help of them might be performed as a ground for individuals to sustain their hope in stressful situations during their journey. Hope is one of the types of psychological coping resources which are taken into consideration for "situational

appraisals of control” elicited from positive beliefs when encountered with aversive situations (Folkman, 1984). It can be boosted by the thought that “outcomes are controllable”, and by one’s positive beliefs about a person’s ability (such as, doctor) about the effectiveness of programs or treatment, and about justice (Lazarus and Folkman, 1984, p.159). These positive beliefs might be derived from passengers’ trust in other passengers, and confidence in the relevant authorities, such as, Transport for London and British Transport Police that they would provide assistance in stressful situations, therefore they might have buffering effects against potential threat.

- **Social support**

Terry states that social support is regarded as coping resources, relating to problem-focused coping, which helps boost individuals’ problem management strategies that can be achieved from social network (Terry, 1991). Cohen and Mckay considers social support might influence individuals’ coping ability, for example, effective strategies for coping provided from support systems, or recommendation for facilitating desirable behaviours, or tangible aid for managing stressful stimuli (Cohen and Mckay, 1984). Cohen and Wills’s model (Figure 5.5) displays the points at which social support might be intervened in the sequence from stressors to illness or illness behaviour. The two possible points are ‘appraisal process’, and “emotionally linked physiological response or behavioural adaptation”. Also, their buffering hypothesis explains that social support will have positive effects on well-being and adjustment (Coen and Wills, 1985).

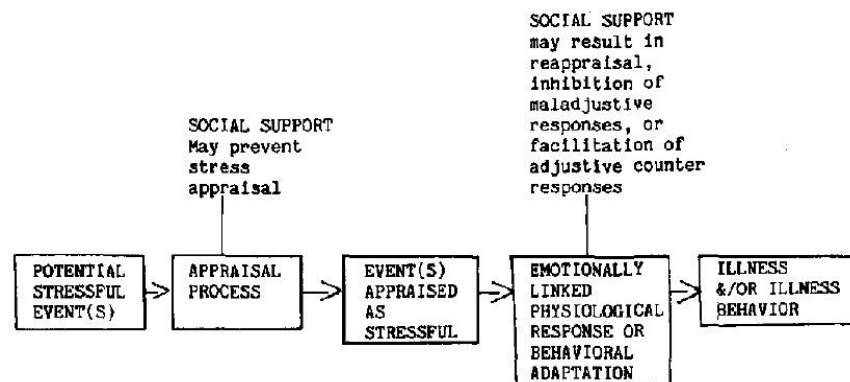


Figure 1. Two points at which social support may interfere with the hypothesized casual link between stressful events and illness.

Figure 5.5 Two points at which social support may interfere with the hypothesized causal link between stressful events and illness

(Cohen and Wills, 1985)

In terms of buffering effects of social support against stressful stimuli, Christian and Stoney's results demonstrate that subjects receiving social support (attendance of non-evaluative companion) showed less vascular responding, which was a reaction to stress measured in the study (Christian and Stoney, 2006). Cohen and McKay assert that social support as resources, which one can be offered from their interpersonal relationships, and its necessity might occur from its effectiveness in buffering stress in stressful environment in consideration of buffering process. They suggest three types of support, distinguishing psychological and non-psychological support. First, appraisal and emotional support which are relevant to information provision as psychological support, second, tangible support which is concerned with material provision are proposed as social support. Appraisal support, which presumably, can be influential on appraisal of threat and that of one's ability to cope, is suggested that it would be effective when provision of information which reassures them that there are available responses to the negative situation. Also, referring to similar others emotional reactions and comparing could be helpful in the sense that the resources and manners enable individuals to reappraise the threat, and to perceive it less threatening. Emotional support is delineated that emotional loss, which is lack of feeling loved and cared, might negatively influence individuals' physical and psychological health. Lastly, tangible support can be information on relationship between individuals and a support network, or assistance provision, money or care. This leads people to perceive that "others are behind you", although practical assistance might not be operative (Cohen and McKay, 1984). Krause suggests four types of social support. First, emotional support is described as attributes from providers "including empathy, caring, love and trust". Second, integration is the level of embeddedness in one's network and a sense of belonging. Third, tangible support is referred to financial assistance, material contribution, or relief supplied through practical actions. Lastly, informational support is provision of knowledge for problem-solving which can be utilised when encountering stressful events. The results from the study conducted to investigate the effectiveness of social support as stress buffering agent in stressful situations among older adults, reveal that certain types of social support show buffering effects against stressful events, such as "bereavement, crime and social network crises" (Krause, 1986). Langford et al. render

examples of consequences of social support are “personal competence, health maintenance behaviours, effective coping behaviours, perceived control, sense of stability, recognition of self-worth, positive affect, psychological well-being, and decreased anxiety and depression”. It is described that there are four qualities of social support, which are emotional (providing affective support, such as caring, empathy and trust), instrumental (providing tangible support, such as goods, services and aids), informational (providing information to others experiencing stress for problem solving), and appraisal support (communicating information relevant to self-evaluation of stressful events) (Langford et al., 1997). Cohen and Wills classify four different types of social resources as buffers of stress. They include, first, esteem support which is related to emotional support, second, informational support which provides assist in “defining, understanding, and coping with problematic events”. Third, social companionship which is help in enhancement of a sense of belonging, and lastly, instrumental support which is aid in material resources and services, which is also referred to “material support and tangible support” are included. Provision of suitable coping resources falls into the category of information support that might countervail perceived uncontrollability (Cohen and Wills, 1985).

The significance of social help regarded as coping resources which might be performed as buffering agents in stressful situations is substantiation of its potentiality of its role as a stimulator of sense of control. Barlow proposes that social support might have buffering effect against anxiety through enhancement of perceived control, amongst individuals with biological vulnerability, or individuals who have undergone previous behavioural experiences which resulted in psychological vulnerability in unpredictable and uncontrollable situations (Barlow, 1998). Caplan’s study results demonstrate that concrete assistance in facilitation of problem handling as social support help enhance the subjects’ sense of control with presenting that buffering effects of social support against psychological and physical illness. The provided support was executed by supporting in evaluation of stressful situations, formulation and implementation of plans, and provision of feedback (Caplan, 1981 cited in Krause, 1986). In addition, Langford and Bowsher’s unpublished study identifies that social support has an influence on “perceived situational expectancy of control”, also the result obtained through a different analysis applied on the same data show that psychological well-being is affected by “perceived situational expectance of control” (Langford and Bowsher, 1995, cited in Langford et al. 1997). In the

study conducted by Terry, its results demonstrate that resources for coping have buffering effects against negative impacts of threat, for example “high stress, low situational control, low self-efficacy”. The significant interactions between coping resources and threat reveal that individuals experiencing greater stress, with a low degree of social support use more emotion-focused coping (1991), which is a strategy which tends to be applied when situations are evaluated as uncontrollable, distinguished from problem-focused coping (Forsythe and Compas, 1987). In Krohne and Slangen’s study concerning social support for patients undergoing surgery and their adaptation, its results reveal that patients who perceive that they received higher emotional and information support, experience less anxiety than those who did that they gained lower support. Informational support influences more on alleviation of anxiety, and it is construed that individuals’ sense of control might be enhanced by the informational support, and their preoperative stress could be reduced (Krohne and Slangen, 2005). In Schulz and Decker’s study on well-being of individuals with disability due to injuries, respondents who receive better family support, which is considered as social support, perceive high degree of control (Schulz and Decker, 1985).

In this study, it is regarded that there are two main potential types of social support for passengers which might be at hand in the London Underground transport environments, which are support from other passengers, and support from the relevant authorities, such as, Transport for London and British Transport Police, when encountering to aversive events.

- **Trust in other passengers (informal social control)**

Firstly, in relation to expectations of trust in other passengers, which might be interpreted as a type of social support that helps passengers sustain a hope as a coping resource, which may be an analogous construct to neighbourhood cohesion which has been mentioned as a one of the significant predictors of fear of crime in a number of studies. Amerio and Roccato’s study results uncover that distrust in others predicts fear of crime (Amerio and Roccato, 2005). Findings from Gray et al.’s study reveal that individuals who experience higher level of fear of crime include ones who hold negative views on their community cohesion, which were measured by three items asking about the levels of their agreement on their neighbours’ willingness to help each other, intimacy, and trustworthiness (Gray et al., 2011). Box investigates the relationship between neighbourhood cohesion



and fear of crime by verifying the postulation formulated on the basis that people who do not have friends will fear more, since they have a thought that they might not be able to cope with potential crimes. Nevertheless, “a strong sense of neighbourhood cohesion and community” would substitute their expectation of possible assistance from their friends. The results confirm that neighbourhood cohesion has an effect on decrease in fear of crime (Box et al., 1988). Jackson’s study results describing influencing factors of worry about crime demonstrate that perceived probability of being victimised, which has a direct effect on the level of worry about crime, is partly explained by social cohesion (Jackson, 2004). Amongst several dimensions of community cohesion, informal social control needs to be paid more attention to, for the reason that passengers in public transport environments are more likely to be strangers unlike neighbours which are objects in studies on fear of crime. Ross and Jang’s study also confirms that informal social connections have buffering effect against fear of crime (Ross and Jang, 2000). In Jackson’s worry about crime model, issues about cohesion which embrace informal social control and trust in others are presented as significant factors which may account for worry about crime (Jackson, 2006). His study regarding validating new scales for assessing fear of crime suggests that worry about crime would be predicted by perceived community cohesion, including informal social control through perception about control of crime (Jackson, 2005). Also, in terms of public transport environments, Delbosc and Currie’s study results present that feeling safe on public transport is influenced by “trust in people and feeling safe in one’s home and street”, and a sense of community in their neighbourhood is a strong contributor to explain the variables (Delbosc and Currie, 2012). However, their study investigates general safety perception on public transport, therefore it seems that the range of people needs to be more narrowed when examining its influence on anxiety about a situation-specific stressor with a cue of anxiety involved. In Currie et al.’s study regarding passengers’ public transport personal safety perception, feeling comfortable with strangers on public transport is confirmed as a significant factor influences their perception (Currie et al., 2013). Therefore, it seems appropriate to hypothesise that trust in other passengers which can be considered as social support as a form of informal social control, which assists passengers to maintain a hope will play a role as a facilitator of passengers’ control perception and will ultimately play a role as buffers of anxious arousal.

### **H3. Trust in other passengers (informal social control) will negatively predict anxious arousal through perceived uncontrollability**

- **Confidence in the relevant authorities**

Secondly, regarding confidence in authorities, confidence in police is summarised as “a motive-based trust” which is “rooted in social alignment between the police and the community”. Trust in this context is mentioned as “we believe you have the right intentions toward us and that you are competent to do what we trust you to do” (Hardin, 2006 cited in Jackson and Bradford, 2010). This might be a potential source of hope for a resolution of negative situations in the environment. Public evaluation of the police’s capability is protecting public respect and realising community value as a “civic guardian” (Loader and Mulcahy, 2003 cited in Jackson and Bradford, 2010). It is described that there are three features of performance in policing, which are effectiveness (the level of competence in tackling crimes), fairness (procedural justice), and community engagement (understanding community concerns). The influences of these factors on confidence in police are confirmed (Jackson and Bradford, 2010). Additionally, an aspect of communication between the police and citizen is claimed as a significant component that has a connection to confidence in police (Hohl et al., 2010). In their study, communication (through a leaflet as a medium) is confirmed as an element accounts for public confidence in policing, thus communication factor could be seen as an antecedent of confidence. In Box’s study, citizens tend to fear less about crime when police are seen effective in elimination of crimes and apprehension of criminals (Box et al., 1988). “Perceived risk of crime refers to people recognizing the crime around them and estimating the probability of their becoming a crime victim.” Hraba et al.’s study results disclose that trust in government predicts “perceived increased risk of crime” (Hraba et al., 1998). When it comes to public transport environments described in Rundmo et al.’s study, the group of users who use public transport more than private transport shows higher trust in relative organisations’ risk handling ability than the groups of users who utilise private transport more often than public transport with presenting a significant difference (Rundmo et al., 2011). Therefore, it seems appropriate to hypothesise that confidence in the relevant authorities which can be interpreted as a type of social support which helps passengers sustain a hope will perform as a boost of

passengers' sense of control and will ultimately play a role as a buffer of anxious arousal.

#### **H4. Confidence in the relevant authorities will negatively predict anxious arousal through perceived uncontrollability**

##### **5.3.3.4. Safety knowledge**

Safety knowledge has its significance in the sense that it might be used as coping resources and options in the stressful situation. It seems reasonable to state that the level of awareness of possible coping resources and options, which are regarded as safety knowledge, such as information about what can be done in the situation, is likely to be related to Averill's behavioural and decisional control. The reason is that that the knowledge might be helpful to directly modify or at least, to believe that they are able to influence the situation, and to be aware of the possible actions to take (Averill, 1973). According to Miller's typology of control, as one of the four types of behavioural control (institutional control, self-delivery, actual and potential control), institutional control is identified as an ability to make a response that modifies the aversive event (Miller, 1979, cited in Tompson, 1981), might be exerted by applying the safety knowledge. In Peterson and Shigetomi's study about hospitalised children's, the subjects who received information on coping techniques regarding relaxation and imagery, plus modelling techniques including delineation of processes from hospitalization to recovery experienced less distress. It is mentioned that providing the relevant information (i.e. hospitalization experience), and modelling processes have been aimed to improve children, and their parents' coping ability, and to boost control over emotions, and ultimately, to relieve their anxiety (Peterson and Shigetomi, 1981).

In Litt's study on mediating effects of self-efficacy and sense of control, the results present that the subjects' manipulated stronger perceived control led to higher level of self-efficacy, and it resulted in higher tolerance of cold-pressor than that the group of subjects whose control was manipulated to be limited. The subjects who showed higher tolerance were provided with instrumental control, which was a choice of cessation of the cold-pressor test (Litt, 1988b). In this study, safety information in the London Underground environments will include knowledge on locations, correct activation and usage of physical resources, such as, help point at stations, emergency alarms, buttons to alert driver, and also, human resources, such

as, staff, as well as safety procedure can be followed when negative situations are anticipated (Culling et al., 2015). Therefore, it seems adequate to surmise that passengers' deficiency of knowledge on safety resources and implementation process which can be employed in anxiety inducing situations as coping resources will lead to a heightened perception of uncontrollability and then results in anxious arousal.

**H5. Safety knowledge will negatively predict anxious arousal through perceived uncontrollability**

## Chapter 6. Results

### 6.1. Introduction

This chapter describes the overall procedures engaged in the analysis of the empirical data gathered through the survey questionnaire for testing the research model and hypothesis. It encompasses three sections, from, first, the information about the questionnaire development, second, data collection, third, to the model and hypothesis testing results.

#### 6.1.1. Research model of anxiety

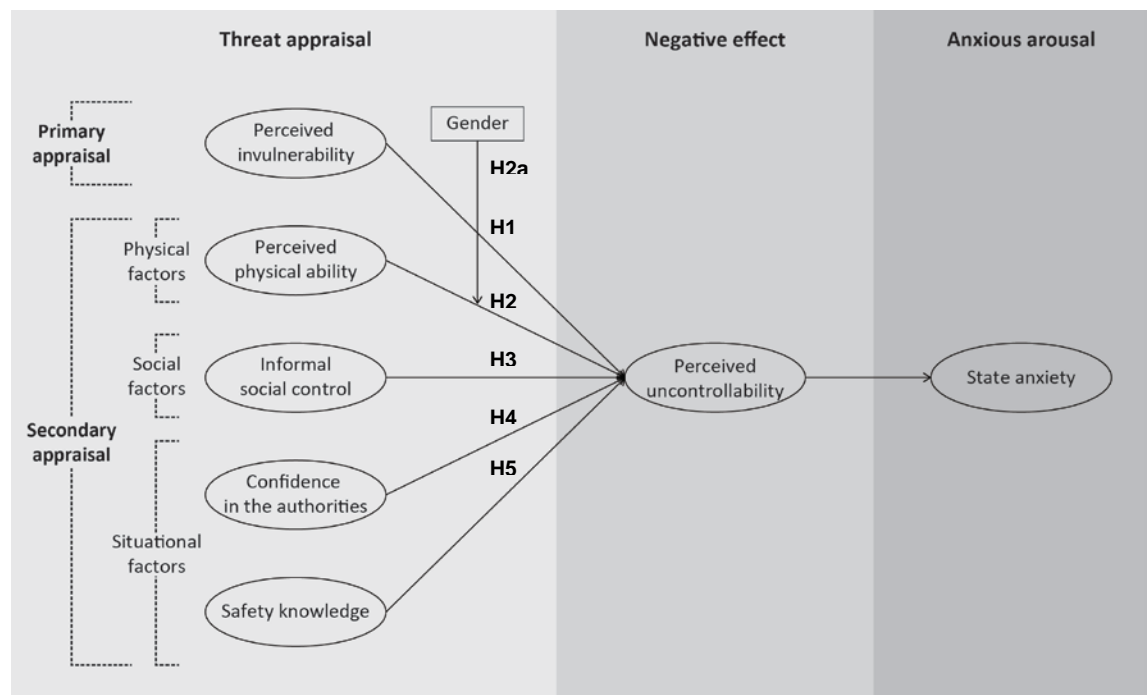


Figure 6.1 Research model: Factors influencing anxious arousal through perceived uncontrollability

#### 6.1.2. Hypotheses

- **Hypothesis 1**

Perceived invulnerability will negatively predict anxiety through perceived uncontrollability

- **Hypothesis 2**

Perceived physical ability will negatively predict anxious arousal through perceived uncontrollability

- **Hypothesis 2a**

Gender will moderate the relationship between the perceived physical ability and perceived uncontrollability

- **Hypothesis 3**

Trust in other passengers (informal social control) will negatively predict anxious arousal through perceived uncontrollability

- **Hypothesis 4**

Confidence in the relevant authorities will negatively predict anxious arousal through perceived uncontrollability

- **Hypothesis 5**

Safety knowledge will negatively predict anxious arousal through perceived uncontrollability

## **6.2. Questionnaire development and administration**

### **6.2.1. Questionnaire development**

The purpose of conducting a questionnaire survey is to examine the hypothesised relationships among perceived invulnerability, coping resources, and anxious arousal through perceived uncontrollability. Confirmed relationships among the constructs and anxiety are expected to function as anxiety buffers when the relationships are confirmed to be negatively associated with anxiety in the hypothetical anxiety-triggering situation, which is when passengers are seeing other passengers' anti-social behaviour. A definition of anti-social behaviour was given to participants as follows: 'Anti-social behaviour is a wide range of selfish and unacceptable activity, any aggressive and intimidating behaviour that lowers the quality of life. It includes rowdy, noisy or drunken behaviour, offensive or threatening language, littering and vandalism, and a menacing group'.

## **6.2.2. Structure of the questionnaire**

The questionnaire consists of three different sections. In the first part, it asks participants demographic information, and general opinions on the London Underground service environments. In the second part, it includes inquiries for testing the hypotheses, categorised into seven sub-sections which correspond to each construct hypothesised in the previous section. They are 'Safety Knowledge' (SK), 'perceived Physical Ability' (PA), 'Confidence in the authorities' (CA), 'informal Social Control' (SC), 'Perceived Invulnerability' (PI), and 'Perceived Uncontrollability' (PU). In the last part, questions are provided for measuring the degree of anxiety about the situation when they are seeing other anxiety-inducing situations. Directions are given before questions in the each section are presented. They will be further described in the following sections.

### **6.2.2.1. Questions for demographic information and general opinions**

In order to achieve basic understanding on the various aspects of anxiety of the London Underground passengers, questions were presented to obtain details of participants, such as gender, residence, ethnicity, age, frequency and years of use. In addition, it enquires whether they have been attacked, harassed or threatened by anti-social behaviour in general, and on the London Underground before. Further, inquiries about general opinions are included, for instance, perceived safety and worry about crime in the environment, and perceived clarity about their understanding on the current safety information.

### **6.2.2.2. Questions for hypothesis testing**

They are presented as follows; perceived safety knowledge, perceived physical ability, confidence in the relevant authorities (Transport for London, and the British Transport Police), perceived informal social control, perceived invulnerability, perceived uncontrollability, and state anxiety. The development of the questionnaire items and wording will be delineated below.

- **Perceived invulnerability (PI)**

In order to evaluate perceived invulnerability, the study conducted regarding “experienced-based analysis” in hazardous work environments (Mbaye and Kouabenen, 2013) was reviewed. The primary rationales behind this decision were perceived invulnerability which tended to remain intact due to absence of actual victimisation experiences on a specific risk factor was aimed to be investigated. Additionally, the invulnerability was expected to be assessed with minimised influence resulted from downward comparison which stood for the tendency to judge their likelihood of getting damaged or victimised in negative events to be lower than that of others (Perloff and Fetzer, 1986). For these reasons, questions inquiring perceived diminished likelihood of being a victim, such as, the items presented in Morrison’s study (Morrison, 2009) did not seem to be apt items for this study. Also, the questionnaire, Adolescent Invulnerability Scale, was not seen as well suited for this objective, because some items are age-related, or too general, rather than being focused to examine the issue about a specific matter (Lapsley and Duggan, 2001). Therefore, in order that responses elicited through the items could reflect respondent’s perception of invulnerability that tends to remain intact in the situation involving anti-social behaviour as a threat potential, 4 items modified from the Mbayea and Kouabenan’s study were contained (Mbayea and Kouabenan, 2013). The 4 original items represent: 1) “Nothing serious can happen to me”, 2) “I’ve never had a problem so far, so I don’t see why I’d have one in the future” 3) “I seldom think about accidents that could happen to me at work” 4) “I rarely tell myself that something serious might happen to me at work”. The 4 modified items are: 1) I believe nothing serious can happen to me as a result of anti-social behaviour. 2) I’ve never had a problem related to anti-social behaviour so far, so I don’t see why I’d have one now. 3) I seldom think about incidents caused by anti-social behaviour that could happen to me. 4) I rarely think that something serious will happen to me as a result of anti-social behaviour. The 5-point Likert scale was utilised for measuring the construct from ‘strongly disagree’ to ‘strongly disagree’.

- **Perceived physical ability (PA)**

The original scale is developed by Ryckman et al.’s named as Physical Self-Efficacy Scale (Ryckman et al., 1982). The items in the measurement fall into two categories, perceived physical ability and physical self-presentation. For evaluating perception of physical ability, the former subscale was



selected. It consists of ten questions, however, due to the limit of the space of the questionnaire developed for the present study, five items were chosen to be included. The evidence of the selection of the five items is described in Bortoli and Robazza's study. The exploratory factor analysis results utilising varimax rotation, and principal component extraction, the items assessing whether respondents feel they can react quickly, they are physically strong, they have a quick movement, a good movement control, and they have difficult skills to perform (Bortoli and Robazza's, 1997). Thus, in this study, the 5 items appraising perceived physical ability were selected and modified to suit the context of the study as follows: 1) I think I can react quickly. 2) I think I'm physically strong, so I feel that I can physically defend myself. 3) I think I'm slow with my movements, so I feel that I can't physically defend myself. 4) I think I have poor control of my physical movements. 5) I think I can perform physical self-defence techniques. The five-point Likert scales, ranging from strongly agree to strongly disagree were included.

- **Confidence in the relevant authorities (CA)**

Transport for London and British Transport Police are the main government organisations responsible for dealing with anti-social behaviour issues in the London Underground environment (Transport for London, 2017c). With the purpose of assessing respondents' confidence in the relevant authorities regarding anti-social behaviour issues, the related items were selected from Jackson and Bradford's study on public confidence in the police. In the study, the results from the Metropolitan Police Public Attitudes Survey (PAS) 2008/9 were used. From their study, the constructs police fairness and engagement, which account for overall confidence in the police were chosen to be tested (Jackson and Bradford, 2010; Bradford and Jackson, 2010). Relevant items are "the police in this area" understand communicate issues, they deal with the things that matter, they treat you with respect, they are friendly and approachable. Additionally, it is considered to be important to keep citizens informed in respect of "police-public contact" (Myhill and Quinton, 2010) which is connected to overall confidence in the police. Thus, measures contributing to evaluating the "police-public contact" have been reviewed. Amongst them, the Metropolitan Police Public Attitude Survey (PAS) 2012 form was selected. Two items regarding seeking views from the public and informing them in a dimension of communication between the police and citizens were opted for. Therefore, seven questions were developed based on the studies as follows: 1) They are effectively tackling

anti-social behaviour that matters to your Underground journey. 2) They are dealing with anti-social behaviour that matters to your Underground journey. 3) They understand anti-social behaviour issues that affect your Underground journey. 4) They seek passengers' views on anti-social behaviour issues that matter to your Underground journey. 5) They have informed you about what they've been doing to tackle anti-social behaviour issues that matter to your Underground journey, over the last 12 months. 6) They would treat you fairly and respectfully, if you had contact with them regarding anti-social behaviour issues. 7) They would be friendly and approachable to talk about anti-social behaviour issues. The 5-point Likert scale was used from 'strongly disagree' to 'strongly agree' to ask 7 questions included for assessing the construct.

- **Trust in other passengers (Informal social control) (SC)**

The items attempted to gauge the level of perceived informal social control, which signifies the intensity of other passengers' willingness to take responsibility to mediate situations in which negative events occur as a result of anti-social behaviours were devised (Wikström and Dolmén, 2001). They were concerning the perceptions about the likelihood of other passengers' contacting the police, telling people behaving anti-socially, and offering spontaneous assistance (Jackson, 2011; Gibson et al., 2002). For the present study, three questions were created on the basis of the items as follows: 1) If there are people behaving anti-socially, other passengers will not tell them off. 2) If a frightening event occurs due to anti-social behaviour, other passengers can be relied upon to contact TfL or the police. 3) If I sensed trouble as a result of anti-social behaviour, I could not get the attention of other passengers for help. Accordingly, the 3 items were asked to be rated in the 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'.

- **Perceived safety knowledge (SK)**

The purpose for examining the perceived level of safety knowledge is to measure how well the respondents are aware of the coping resources which are connected to behavioural control. Based on the interview data, two main types of resources have been identified, first, they are physical resources, such as, emergency alarms, and help points. Second, they are human resources, such as, assistance from the staff. Lastly, the level of knowledge

on the ability to apply the resources as a process is asked. The structure of the questions is on the basis of Rundmo et al.'s study which investigates risk perception in transport mode use, asking the extent of knowledge on safety, and on travelling safely (Rundmo et al., 2011). Hence, in this study, 3 items assessing perceived safety knowledge on the physical, human resources, and the process were asked. The questions were worded as follows: 1) I think I have a good knowledge about where to find the nearest staff, or how to contact them. 2) I think I have a good knowledge about what and where the emergency alarm, and help point are located, and how and when I can activate and use them. 3) I think I have a good knowledge about what to do if there's an emergency. The five-point Likert scales were used to be rated from strongly disagree to strongly agree.

- **Perceived uncontrollability (PU)**

The Anxiety Control Questionnaire (ACQ) was developed with the object of measuring perceived uncontrollability in anxiety-related situations, with highlighting the lack of specific measurements specifically invented for the purpose. The initial questionnaire has 30 items, assessing individuals' sense of control over external threats, and internal emotional responses using the 6-point Likert scale (Rapee et al., 1996). Later, it has been disclosed that it is a three-factor structure through exploratory and confirmatory factor analysis, with items remaining in the scale, named the Revised Anxiety Control Questionnaire (ACQ-R). Its constructs are, emotion, threat, stress control (Brown et al., 2004). For this present study attempting to investigate passengers' anxious response to anti-social behaviour as a potential threat in the environment, it seems reasonable to employ the threat sub-scale. As the subscale suggests, 6 items in the threat sub-scale were questioned. The original 6 items are: 1) "When I am frightened by something, there is generally nothing I can do", 2) "Whether I can successfully escape a frightening situation is always a matter of chance with me", 3) "There is little I can do to change frightening events", 4) "The extent to which a difficult situation resolves itself has nothing to do with my actions", 5) "If something is going to hurt me, it will happen no matter what I do", 6) "Most events that make me anxious are outside my control". 6 questions revised from the original scale for the context of this study are: 1) When I'm frightened by anti-social behaviour, there is generally nothing I can do. 2) Whether I can successfully escape from the frightening situation is a matter of chance. 3) There is little I can do to change frightening events created by anti-social

behaviour. 4) The extent to which the situation resolves itself has nothing to do with my actions. 5) If something is going to hurt me, it will happen no matter what I do in the situation. 6) Situations created by anti-social behaviour on the Underground are outside my control. The 6-point Likert scales were adopted, from 'strongly disagree' to 'strongly agree'.

- **State anxiety (SA)**

The original scale was devised by Spielberger et al., referred to as the State-Trait Anxiety Inventory (Spielberger et al., 1983). Since the form-Y has been developed it has been extensively used for assessing anxiety. The inventory is composed of two sub-scales, state and trait anxiety inventory, composed of twenty items respectively, forty questions in total. The former form evaluates anxiety as an emotional state, experienced "right now" at the point of administration, and the latter one measures anxiety as a personal trait, experienced in general (Spielberger, 2010). The State Anxiety subscale is seen as a more appropriate tool to investigate respondents' state of anxiety perceived in the hypothetical situation when seeing other passengers' anxiety. For these reasons, the state anxiety subscale has been settled on. However, as mentioned, the form includes twenty items, which have been reported that the length could be a barrier (Marteau and Bekker, 1992), the need of abbreviating the form arose accordingly. Although the full STAI form is recommended to be used, in the case when time matters, the State-Anxiety subscale in the State-Trait Personality Inventory written by the same authors could be singled out (Spielberger 1979 cited in Marteau and Bekker, 1992). It has been stated that the anxiety scores of the STPI highly correlate with the STAI (Spielberger and Rickman, 1990 cited in Monk et al., 2000). The subscale comprises ten items, six anxiety-present, and four anxiety-absent items. Hence, for this present study, 10-item state anxiety subscale was opted for to attempt to have an understanding about the respondents' anxiety as an emotional state, however, in the structural equation model, the six anxiety-present items were taken into consideration. The items are: 1) "I feel calm", 2) "I am tense", 3) "I feel upset", 4) "I am relaxed", 5) "I feel content", 6) "I am worried". The 4-point Likert scale was adopted to be ranked, out of the alternatives suggested 'not at all', 'somewhat', 'moderately so', and 'very much so' in the same manner as the referenced scale. However, the six items were selected after drafting the second questionnaire draft. The detailed information about the selection process of the items are described in the section 6.2.3.2.

### **6.2.3. Piloting the questionnaire**

#### **6.2.3.1. The first draft**

The purpose for piloting the first draft of the questionnaire was to detect any ambiguities, inaccuracies and to examine appropriateness of selected questions. Besides, length of the form, and organisations of instructions for answering questions needed to be checked (Gray, 2014). It was an iterative process, and feedback from three volunteers who were users of the London Underground service, and one academic from the Design department of Brunel University London, and one highly experienced researcher working for an NGO based in Reading was reflected in the process. The forms were amended accordingly, and repeatedly. In the reviewing process, the reviewers helped check the time required for completing the form, and read the questions carefully in order to review the questions were modified properly based on the questions selected from the original scales to suit the context and purpose of the present study. Additionally, questionnaire wording was reviewed in a careful manner to see if all the items in the forms were understood and interpreted clearly without causing any ambiguity. This process was particularly important because the chosen questions have been employed in the pre-existing studies but they have not been employed particularly in the context of anxiety about the Underground use.

#### **6.2.3.2. The second draft (piloted and analysed for shortening the State-Anxiety subscale)**

After reviewing the first draft, the sets of questions for measuring each construct were determined, however selection of questions from the State-Anxiety subscale of the State-Trait Anxiety Inventory (STAI) (Spielberger et al., 1983) was still undecided. Since shortening the scale seemed necessary for the present study because the length of the full State-Anxiety subscale containing twenty questions has been mentioned as a potential drawback when administration is constrained by time (Marteau and Bekker, 1992). It was also because missing responses were observed in the two piloted forms out of the twenty two collected forms in total. This may have resulted from the length of the scale containing 20 questions. Accordingly, for both reasons, it seemed necessary to shorten the scale for the present study to help avoid missing responses and help lower participants' burden. The two

forms that included the missing responses were excluded from the analysis. In this context, this section will be allocated to seek possibility to shorten the State-Anxiety subscale in the State-Trait Anxiety Inventory (STAI).

- **Selection criterion of items in the State-Anxiety subscale**

Using the completed twenty forms with no missing responses, responses gauged by the full State-Anxiety subscale from the STAI were examined. It was aimed to shorten the form by testing the results produced from the responses elicited by sets of items excerpted from the full version (see the Table 6.1 demonstrating five different sets of items including the full State Anxiety subscale in the STAI). Assessed internal consistency of the chosen sets was referred to as a selection criterion. Internal consistency stands for the degree that the items included in a scale measure the same construct (Tavakol and Dennick, 2011), in this present study, the construct is state anxiety in particular. This means higher internal consistency represents that items in a scale are more likely to better contribute to measuring one single construct consistently, for example, assessing anxiety by measuring how nervous, tense, or worried a respondent is, with avoiding asking irrelevant questions.

- **Selection of a set of items using published shortened versions of the State-Anxiety subscales**

In order to obtain useful guidance for selecting an optimal set of items from the STAI State-Anxiety subscale, published shortened versions of the full scale have been reviewed. In the published shortened forms, excerpts and selection criteria of questions from the full scale vary across studies and their samples recruited. Three different shortened forms of the STAI State-Anxiety subscale have been opted for. They are, the State-Anxiety subscale in the State-Trait Personality Inventory including 10 questions, developed by Spielberger et al. (1995) (STPI: Shortened version 1); the brief STAI consisting of 6 questions, written by Marteau and Bekker (1992) (Shortened version 2); and the simplified STAI including 6 questions, invented by Knippenberg et al. (1990) (Shortened version 3) (see the Table 6.1).

- **Anxiety present and absent items in the State-Anxiety subscales**

Additionally, the STAI State-Anxiety subscale includes both anxiety-present and anxiety-absent items (Spielberger et al., 1983). As this study aims to build a causal model of passengers' anxiety, and test causal relationships among the chosen factors using structural equation modelling techniques, it needs to be verified that each indicator (e.g. feeling tense, worrying, being

nervous) contributes to measuring one single construct (e.g. state anxiety) in a consistent manner in order to meet required acceptable validity of constructs (e.g. how well the indicators help explain the level of respondents' anxiety in a consistent manner) that is connected to validity of the model (e.g. how well the established model comprised of several factors help account for anxiety) (Hair, 2010). Given that the STAI State-Anxiety scale has two types of items including anxiety present and absent questions, it is likely that the two different sets of items would represent two different constructs in the analysis stage using structural equation modelling. Consequently, a related study was reviewed to see if the anxiety present and absent items are verified as one construct when analysed through structural equation modelling techniques. According to the Wetherell et al.'s study using the State-Anxiety subscale of the STAI comprised of 10 items presents confirmatory factor analysis results about depressive and anxiety symptom data. The gathered data was best fitted to a measurement model (which is used for analysis in initial stage of structural equation modelling process (Hair, 2010)), when anxiety-present items (6 questions) and anxiety-absent items (4 questions) were treated separately as distinguished constructs (Wetherell et al., 2001). This implies that when the indicators of the two different categories (anxiety present and absent items) are treated as one construct, model fit would not be as good as when they are handled as two separate constructs. Therefore, for this present study that particularly concerns passengers' anxiety, items directly measure anxious arousal (the 6 anxiety-present items) will be used for further analysis using structural equation modelling in the following chapter.

The list of the full and shortened scales and the results of the reliability statistics analysis are presented below in the Table 6.1. For reference, information about the items in the full STAI State-Anxiety subscale (Full scale), and its reliability statistics are also included in the first column in the table.

Table 6.1 List of scales and their reliability statistics (N=20)

<b>Types</b>	<b>Full scale</b>	<b>Shortened version 1</b>	<b>Shortened version 1A</b>	<b>Shortened version 2</b>	<b>Shortened version 3</b>
<b>Scales</b>	The State-Anxiety subscale in the STAI Full scale	The State-Anxiety subscale in the STPI	The State-Anxiety subscale in the STPI (Anxiety-present items)	Shortened STAI (Pregnant women)	Shortened STAI (Ill patients)

<b>Authors</b>	Spielberger et al., 1983	Spielberger et al., 1995	Wetherell et al., 2001	Marteau and Bekker, 1992	Knippenberg et al., 1990
<b>1</b>	Calm	Calm	Calm	Calm	Calm
<b>2</b>	Secure	Secure	Secure	Secure	Secure
<b>3</b>	Tense	Tense	Tense	Tense	Tense
<b>4</b>	Strained	Strained	Strained	Strained	Strained
<b>5</b>	At ease	At ease	At ease	At ease	At ease
<b>6</b>	Upset	Upset	Upset	Upset	Upset
<b>7</b>	Worrying	Worrying	Worrying	Worrying	Worrying
<b>8</b>	Satisfied	Satisfied	Satisfied	Satisfied	Satisfied
<b>9</b>	Frightened	Frightened	Frightened	Frightened	Frightened
<b>10</b>	Comfortable	Comfortable	Comfortable	Comfortable	Comfortable
<b>11</b>	Self-confident	Self-confident	Self-confident	Self-confident	Self-confident
<b>12</b>	Nervous	Nervous	Nervous	Nervous	Nervous
<b>13</b>	Jittery	Jittery	Jittery	Jittery	Jittery
<b>14</b>	Indecisive	Indecisive	Indecisive	Indecisive	Indecisive
<b>15</b>	Relaxed	Relaxed	Relaxed	Relaxed	Relaxed
<b>16</b>	Content	Content	Content	Content	Content
<b>17</b>	Worried	Worried	Worried	Worried	Worried
<b>18</b>	Confused	Confused	Confused	Confused	Confused
<b>19</b>	Steady	Steady	Steady	Steady	Steady
<b>20</b>	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
<b>N of items</b>	20	10	6	6	6
<b>Alpha</b>	.873	<b>.792</b>	<b>.788</b>	.642	.720
<b>Decision</b>	Not appropriate	<b>Selected</b>	<b>Selected</b>	Not appropriate	Not appropriate
<b>Reason for exclusion</b>	Too many items			Lower alpha coefficient	Lower alpha coefficient

Selected items in each scale for internal consistency statistics analysis

As illustrated above, the two scales presenting the second and third-highest Cronbach's alpha coefficients were selected. Since, Cronbach's alpha enables to assess internal consistency of a scale, which is represented as a number falls between 0 and 1. Internal consistency stands for the degree that the items included in a scale measure the same construct, such as anxiety for the present study (Tavakol and Dennick, 2011). The selected scales are the STPI State-Anxiety subscale (shortened version 1, 10 items), and anxiety-present items in the STPI State-Anxiety subscale (shortened version 1A, 6 items). Comparatively lower alpha coefficients may have been



generated in the shortened version 2 (6 items), and 2 (6 items) because they included both anxiety present and absent items. On the basis of the lower coefficients, the two scales were exempted from consideration for further analysis.

The rationales for selecting the two scales need to be described. First, the STPI State-Anxiety subscale (the shortened version 1) was selected because scores calculated through its own scoring system with little modification best demonstrate how anxious the subject feel at the point when their level of state anxiety is evaluated (Spielberger, 1983).

Subsequently, to best understand participants' anxiety examined through the scale will be used for evaluating respondents' level of anxiety and also used for descriptive statistics, and comparisons among the levels of anxiety of groups of participants. However, as the results from Wetherell et al.'s study, the ten items in the STPI State-Anxiety subscale would be divided into the two separate constructs, anxiety-present items and anxiety-absent items (Wetherell et al., 2001) in the process of confirmatory factor analysis, which is a part of structural equation modelling. For this reason, the shortened scale only comprised of the six anxiety-present items in the STPI State-Anxiety subscale (the shortened version 2) was chosen for structural equation modelling in order to achieve acceptable validity of tested models.

#### **6.2.4. Ethical approval**

Two questionnaire forms have been reviewed and approved by the Brunel University Research Ethics Committee. They are, the second draft, which was designed for the piloting whose results are presented above, and the final draft which was developed for hypothesis testing. The approval letters can be found in the Appendix C.2 and C.3.

##### **6.2.4.1. The second draft**

The piloted second draft was reviewed and approved by the committee on 14th of December, 2015. Following the guidelines provided by the committee, Participant information sheet was offered to deliver necessary information on confidentiality, treatment of data, and also brief descriptions of the study. Furthermore, respondents were requested to sign on the sheet if they understood the given details, and they agreed to participate in the study.

The questionnaire form and the informed consent form, for the second draft can be found in the Appendix A.2, and B.2.

#### **6.2.4.2. The final draft**

The final draft of the questionnaire was reviewed and approved by the Committee on the 5th of September, 2016. Information for participants and agreement form was designed in the same manner as the second draft.

The questionnaire form and the informed consent form, for the final draft can be found in the Appendix A.3, and B.3.

#### **6.2.5. Data collection**

##### **6.2.5.1. The second draft for piloting**

Data was collected from the 14th of December, 2015 to the 17th of December, 2015. Two styles of questionnaire were used, paper-and-pencil, and electronic version of questionnaire. 15 forms were administrated through the former mode, 5 forms were through the latter mode. However, 2 forms were excluded from the analysis, due to missing responses in the anxiety screening section.

##### **6.2.5.2. The final draft**

The data collection was conducted from the 5th of September to the 9th of September, 2016 to 17th of October, 2016. Two types of administration were exploited. They were paper-and-pencil, and online questionnaire administration. 17 completed forms were collected through paper-and-pencil administration, and 298 forms were gathered online. The recruited participants were users of the London Underground living in and around London, however over 90 per cent of them responded that they live in London. In total, 315 forms were collected. 210 out of the 298 participants, who participated in the online survey, got paid £1.00 as a reward for completion of the form. The online questionnaire was developed on the SurveyMonkey online questionnaire website, which is mentioned as one of the more prominent services that can be used by researchers (Wright, 2005).

The 17 respondents participated using paper-and-pencil administration were invited to the questionnaire survey by being personally asked by the researcher. Since they were the London Underground users and their age was in the targeted bracket. When recruiting them, a brief introduction about the researcher and the study including its purpose, and expected time required to complete the questionnaire survey were provided. Once the participants agreed to participate, the printed questionnaire form was provided, and then collected after a few hours, or days when the forms were filled.

The unpaid 71 respondents participated using online method were invited to the survey through SNS such as Facebook, and also recruited by being requested by the researcher in person or via email. A significant portion of the 88 respondents were students at Brunel University London and their acquaintances who were encouraged to be take part in the study. Thus, in order to reach a wider range of participants who are not Brunel University students living in London, and using the London Underground frequently, the online platform Prolific was used. The platform helps researchers find suitable respondents using screening system, and assists researchers to reach the respondents to encourage their participation. The paid 210 participants were invited to take part in the questionnaire on Prolific the online participant recruitment service.

### **6.3. Data analysis**

This section will discuss process and result of analysis of the collected data. The purpose of the study is to provide theoretical grounds for designing information by generating insights based on interpretations created through testing a hypothesised causal model of state anxiety applying structural equation modelling techniques. Prior to application of the techniques, several analytical processes will be conducted in order to gain broad understanding about the sample from the collected data. The process is comprised of four main phases. First, in data screening process, incomplete forms including missing responses will be handled (see the section 6.3.1.1). Furthermore, process of detection and deletion of multivariate outliers will be described (see the section 6.3.1.2). This process is necessary when using structural equation modelling techniques since the outliers might have a negative influence on model fit which is related to validity (Byrne, 2016).

Second, descriptive statistics will be conducted on all the collected forms with exclusion of incomplete forms that contained missing responses. The phase embraces data coding, and analysis of descriptive statistics, such as frequencies, group differences (see the sections from 6.3.1.3 to 6.3.1.5). Third, exploratory factor analysis will be carried out to identify underlying factors of identified constructs in the proposed model (see the model presented in the section 6.1.1). It was decided to apply this statistical method specifically to clarify factor structure of the construct 'confidence in the relevant authorities' whose underlying structure has not been defined clearly in the pre-existing relevant literature (see the section 6.3.1.7). Fourth, structural equation modelling techniques will be applied for data analysis. The generated outcome will provide evidence about validity of selected measures and scales (e.g. the State-Trait Anxiety subscale, the Anxiety Control Questionnaire), and strength and significance of causal effects of determinants (e.g. perceived physical ability, safety knowledge) on state anxiety. This phase consists of two sub procedures, assessment of initially hypothesised (a priori) model presented in the Figure 6.1, and modified measurement models (confirmatory factor analysis-CFA), and assessment of structural equation model for testing and confirming causal relationships among the identified constructs. The latter process embraces evaluation of the initially hypothesised structural model, and a re-hypothesised model. Moreover, examination of a moderating effect gender in the relationship between perceived physical ability and perceived uncontrollability will be provided.

### **6.3.1. Data screening and coding**

This section will describe the process involved in data screening and coding.

#### **6.3.1.1. Incompleteness and missing responses**

The collected forms were inspected thoroughly to detect incomplete forms that needed to be excluded from analysis. 34 unfinished forms were found, overall, the questions in the last section were not answered. The possible reason is that the online survey respondents were not allowed to proceed to the next page if there were unanswered questions, thus, the pages before the last page were filled properly, and then the survey was ended with some

of or all the questions in the last page unanswered. Consequently, 281 completed forms with no missing responses were used for data analysis.

### **6.3.1.2. Multivariate outliers**

After leaving incomplete forms out, multivariate outliers were detected and considered to be removed from further analyses. Outliers are defined as scores of cases which present substantial deviation from the rest of the scores in a data set (Byrne, 2016). When it comes to a multivariate outlier, it has “extreme scores on two or more variables, or its pattern of scores is atypical” (Kline, 2010). Prior to the deletion, multivariate normality needed to be examined. Since, when data presents serious multivariate non-normality, this may lead to inflated  $\chi^2$  value, and then additional modifications need to be applied to fit the data. Also, model fit tends to be affected by it, for example, comparative fit indices, such as TLI or CFI may be underestimated (Byrne, 2016). As suggested, testing univariate normality is a prerequisite for multivariate normality, therefore, univariate kurtosis was examined first, because it may significantly influence assessment of covariances (Byrne, 2016). The result revealed that the values were all rated below 7.0 (West et al., 1995), therefore, it seemed that no concern was raised on univariate normality, and the condition for testing multivariate normality was established (Byrne, 2016). Multivariate non-normality can be evaluated by Mardia’s coefficient (Mardia, 1970), when the value is larger than 3.0 (Ullman, 2006), or greater than 5.0 or 6.0 (Bentler, 2006, p.110), it is judged that the data is non-normally distributed. According to the test result, the value was calculated as 25.096, indicating deviation from multivariate normality. Therefore, in order to reduce the level of multivariate non-normality, a widely adopted method which includes detection and deletion of multivariate outliers was used (Han et al., 2009; Cook et al., 2006; Schaufeli et al., 2002). The Mahalanobis distance is considered as one of the criteria for multivariate outlier detection, generated by evaluation of distances between the centroid of the mean of all observations and each observation (Ullman 2006; Hair et al., 2010). Conservative  $p$ -value below 0.001 has been proposed for its detection (Tabachnick and Fidell, 2014; Hair et al., 2010; Kline, 2010). Thus, the observations whose  $p$ -value were rated less than 0.001 were removed one at a time starting from the one farthest from the centroid until there was no observation showing significant  $p$ -value (Lobel et al., 2008). Consequently, 12 forms were excluded through this process.

### 6.3.1.3. Data coding

- **Responses for demographic information**

First of all, regarding gender, male was coded as 1, female was coded as 2. Second, in terms of residence, “In London” was coded as 1, “Outside London” was coded as 2. Third, ethnic groups were coded as follows, “Asian/Asian British” as 1, “Black/African/Caribbean/Black British” as 2, “Other ethnic group” as 3, “White” as 4, “Mixed/multiple ethnic groups” as 5, “Prefer not to answer”, as 6. Fourth, with regard to age, “19-24” as 1, “25-34” as 2, “35-44” as “3”, “45-54” as 4, “55-64” as 5, 65-74 as 6, “75-84” as 7, “85 or over” as 8, and “Prefer not to answer” as 9. Fifth, regarding the frequencies of use the Underground, they were coded as follows “Very rarely” as 1, “Rarely” as 2, “Occasionally” as 3, “Frequently” as 4, “Very frequently” as 5, and “Other” as 6. Sixth, lengths of use were coded as, from 1 to 15 representing each year bracket increasing at intervals of 1, for example, from “0-1” to “14-15”, and ‘15 years or longer’ was coded as ‘16’. Seventh, in regard to prior experience of getting victimised by anti-social behaviour in general, and on the London Underground, the absence of the relevant experience was coded as 1, and the presence of the experience was coded as 2.

Table 6.2 Codes of items for demographic questions

	<b>Items</b>	<b>Codes</b>
<b>Gender</b>	Male	1
	Female	2
<b>Residence</b>	In London	1
	Outside London	2
<b>Ethnicity</b>	Asian/Asian British	1
	Black/African/Caribbean/Black British	2
	Other ethnic group	3
	White	4
	Mixed/multiple ethnic groups	5
	Prefer not to answer	6
<b>Age</b>	19-24	1
	25-34	2
	35-44	3
	45-54	4
	55-64	5
	65-74	6
	75-84	7
	85+	8
<b>Frequency of use</b>	Very rarely (1time a month or less)	1

	Rarely (2-3 times a month)	2
	Occasionally (1 time a week)	3
	Frequently (2-3 times a week)	4
	Very frequently (4 times a week or more)	5
	Other	6
<b>Length of use</b>	0-1 year	1
	1-2 years	2
	2-3 years	3
	3-4 years	4
	4-5 years	5
	5-6 years	6
	6-7 years	7
	7-8 years	8
	8-9 years	9
	9-10 years	10
	10-11 years	11
	11-12 years	12
	12-13 years	13
	13-14 years	14
	14-15 years	15
15+ years	16	
<b>Prior victimisation</b>	No	1
	Yes	2

- **Responses for general opinions and measuring constructs**

Although the three different points of Likert scales were included depending on the structures of the original scales, or questions, they were used to measure the extent of respondents' agreement the items from strong disagreement to strong agreement. Consequently, the strongest disagreement responses were coded as '1', and the strongest agreement responses were coded as '4' for the 4-point Likert scales, '5' for the 5-point Likert scales, or '6' for the 6-point-Likert scales. The points located in-between the two extreme ends, were numbered started from 2, with gradual increase with 1 being added. Thus, the greater the numbers are, the stronger the respondents' perceptions are.

#### **6.3.1.4. Statistical analysis**

The results from data analysis will be organised into three sections, first, results from descriptive statistics with statistical difference and correlation tests when needed, second, those from exploratory factor analysis, third, those from structural equation modelling including a measurement model testing outcomes. Structural equation modelling was utilised to conduct

confirmatory factor analysis, and evaluate the magnitudes and significances of the relationships among the constructs. Through the technique, tests for mediation through examining indirect effects and for moderation effect were also enabled. IBM SPSS statistics 20, and IBM AMOS 20 were used for data analysis.

### **6.3.1.5. Descriptive statistics**

Descriptive statistics are displays of summarised data collected from samples, or population, extensively assisted by the use of graphic presentations (Gray, 2014). In this study, gaining a better understanding about the sample will be facilitated by means of descriptive statistics, particularly, demonstrating frequencies, mean values of variables through using charts and graphs.

- **About the sample**

The total number of the respondents was 269, after deleting the forms including the detected multivariate outliers. The respondents are the London Underground users living in and around London, however, the majority of them live in London. An almost identical proportion of males and females was expected, in order to analyse the hypothesised moderating effect of gender in the relationship between perceived physical ability and perceived uncontrollability. Finally, 135 males and 134 females participated in the study.

- **Demographic information**

- **Gender**

In total, 269 forms were used for the data analysis, 135 forms were collected from males, and 134 forms were collected from females, with no missing responses. In order to compare between genders, the numbers of male and female respondents needed to be almost the same.

- **Residence**

In the sample, the majority of the participant responded that they live in London. There were 243 participants living in London, and 26 respondents



living outside London. The former group made up approximately 90.3 percent, and the latter group formed approximately 9.7 percent of the sample.

### Ethnicity

Ethnicity of the respondents is distributed as presented below in the Table 6.3. The largest ethnic group in the sample was white, and the second largest ethnic group was Asian/Asian British. 2 missing responses were found.

Table 6.3 Ethnicity of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asian/Asian British	61	22.7	22.8	22.8
	Black/African/Caribbean/Black British	19	7.1	7.1	30.0
	Other ethnic group (Arab/ Any other ethnic group)	6	2.2	2.2	32.2
	White	168	62.5	62.9	95.1
	Mixed/multiple ethnic groups	13	4.8	4.9	100.0
	<b>Total</b>	<b>267</b>	<b>99.3</b>	<b>100.0</b>	
Missing	Prefer not to answer	2	0.7		
<b>Total</b>		<b>269</b>	<b>100.0</b>		

N=267, 2 missing responses

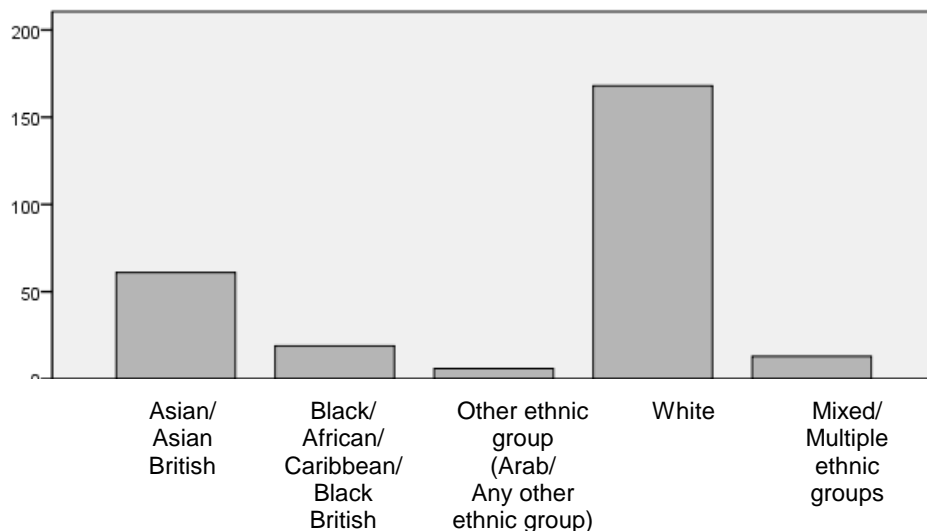


Figure 6.2 Ethnicity of the respondents

**Age**

Age groups were distributed as demonstrated below in the Table 6.4. The largest portion of the respondents was located between 25 and 34, followed by those aged between 19 and 24. 82.5 percent of the respondents were aged between 19 and 44. It seems to be meaningful to pay more attention to responses from individuals in these age groups about their fear about crime related issues. Since, it has widely been reported that younger people's worry about crime tends to be higher than that of older people. Although, there are studies that demonstrate the effect of age is negligible or non-existent, or dependent upon living alone and low wage (Mesch, 2000; Janson and Ryder, 1983), there also are studies that present the negative effect of age on fear. For example, a number of studies have stated the fear paradox which represents older people's fear is less than young people unlike what is commonly believed that the aged fear more (Ferraro and LaGrange, 1992; LaGrange and Ferraro, 1987, 1989; Chadee and Ditton, 2003). More specifically, amongst the related studies regarding the association between age and worry that support the paradox, Ziegler and Mitchell confirm that older participants were more. In addition, Ditton et al.'s study reveals that a group of older people aged over 60 tend to fear much less than younger participants (Ditton et al., 1999). Also, in Jackson's study, a negative influence of age that shows statistical significance on fear of personal and property crime including anti-social behaviour related matter is demonstrated (Jackson, 2009). Accordingly, although this present study would not attempt to produce statistical evidence on the negative effect of age on worry, this study puts emphasis on the negative influence of age. Hence, it is expected that older people would tend to fear less about anti-social behaviour issues on the London Underground (see the Figure 6.13).

Table 6.4 Age distribution

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Valid</b>	<b>19-24</b>	75	27.9	27.9	27.9
	<b>25-34</b>	96	35.7	35.7	63.6
	<b>35-44</b>	51	19.0	19.0	82.5
	<b>45-54</b>	26	9.7	9.7	92.2
	<b>55-64</b>	13	4.8	4.8	97.0
	<b>65-74</b>	5	1.9	1.9	98.9
	<b>75-84</b>	3	1.1	1.1	100.0

	<b>Total</b>	269	100.0	100.0
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N=269, No missing responses

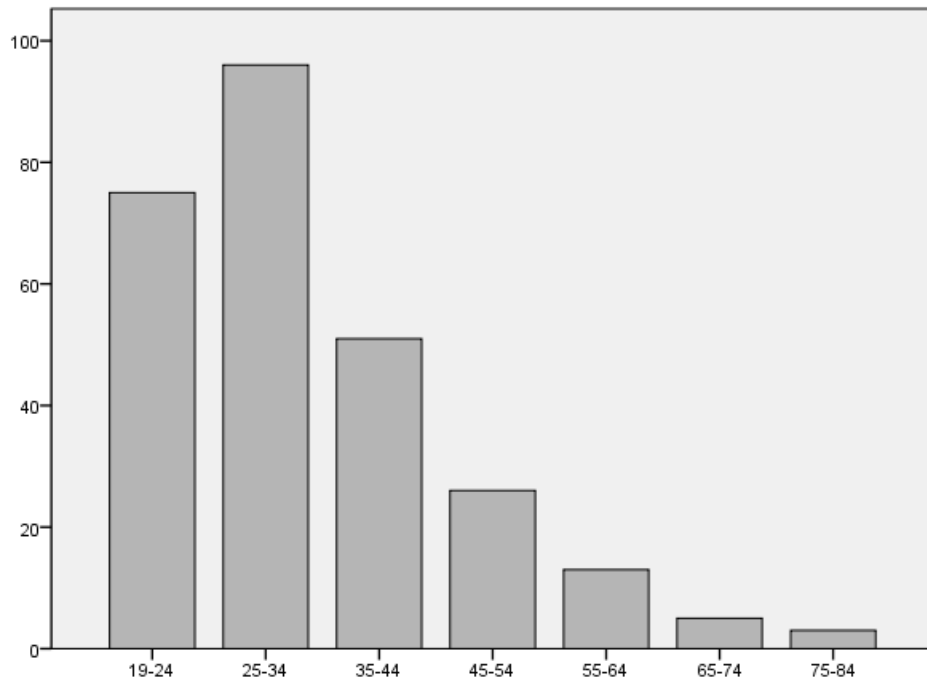


Figure 6.3 Age distribution

**Frequency of use**

The biggest portion of the respondents was passengers who use the Underground very frequently, as often as 4 times or more per week, followed by the group of respondents who take the Underground frequently, as often as 2 to 3 times per week. 16.9 percent of the participants rated that they use it rarely, as often as 2 to 3 times per month, and 14.3 percent of them marked that they get the Underground occasionally, as often as 1 time per week, followed by those of who use it very rarely, as often as 1 time per month or less. 3 missing responses were observed.

Table 6.5 Frequency of use

		<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Valid</b>	<b>Very rarely</b>	30	11.2	11.3	11.3
	<b>Rarely</b>	45	16.7	16.9	28.2
	<b>Occasionally</b>	38	14.1	14.3	42.5
	<b>Frequently</b>	66	24.5	24.8	67.3
	<b>Very frequently</b>	87	32.3	32.7	100.0

	<b>Total</b>	266	98.9	100.0	
<b>Missing</b>	<b>Other</b>	3	1.1		
<b>Total</b>		269	100.0		

N=266, 3 missing responses

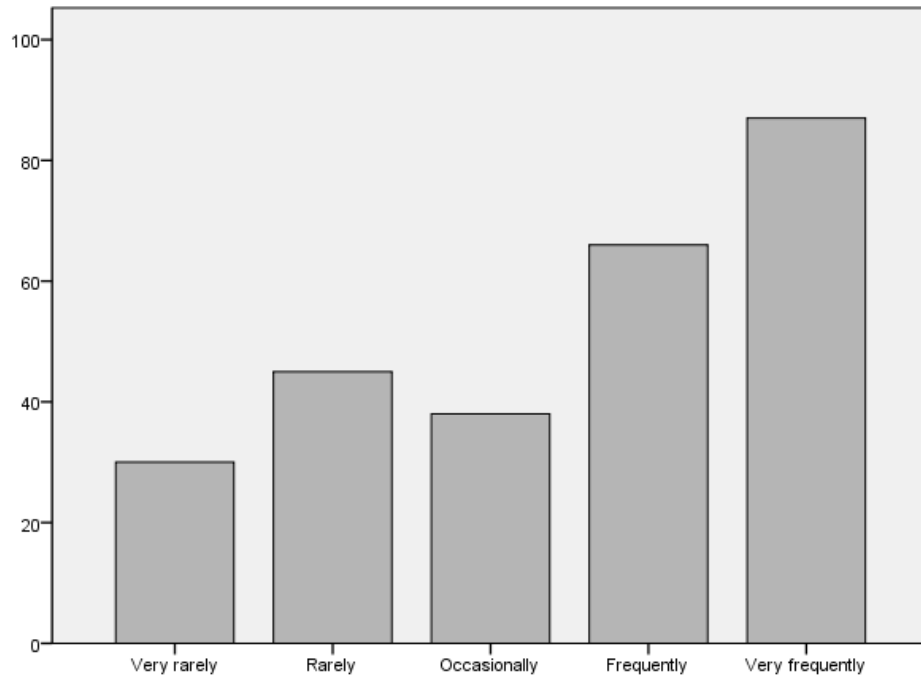


Figure 6.4 Frequency of use

### Years of use

The users who have used the Underground for longer than 15 years formed the largest part of the sample. The next largest group was the participants who have utilised it for between 1 and 2 years. The distributions of the years of their use are illustrated below.

Table 6.6 Years of use

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<b>0-1</b>	7	2.6	2.6	2.6
	<b>1-2</b>	27	10.0	10.0	12.6
	<b>2-3</b>	19	7.1	7.1	19.7
	<b>3-4</b>	22	8.2	8.2	27.9
	<b>4-5</b>	17	6.3	6.3	34.2
	<b>5-6</b>	14	5.2	5.2	39.4
	<b>6-7</b>	14	5.2	5.2	44.6

	<b>7-8</b>	12	4.5	4.5	49.1
	<b>8-9</b>	5	1.9	1.9	50.9
	<b>9-10</b>	13	4.8	4.8	55.8
	<b>10-11</b>	7	2.6	2.6	58.4
	<b>11-12</b>	5	1.9	1.9	60.2
	<b>12-13</b>	2	0.7	0.7	61.0
	<b>13-14</b>	4	1.5	1.5	62.5
	<b>14-15</b>	5	1.9	1.9	64.3
	<b>15+</b>	96	35.7	35.7	100.0
	<b>Total</b>	269	100.0	100.0	

N=269, No missing responses

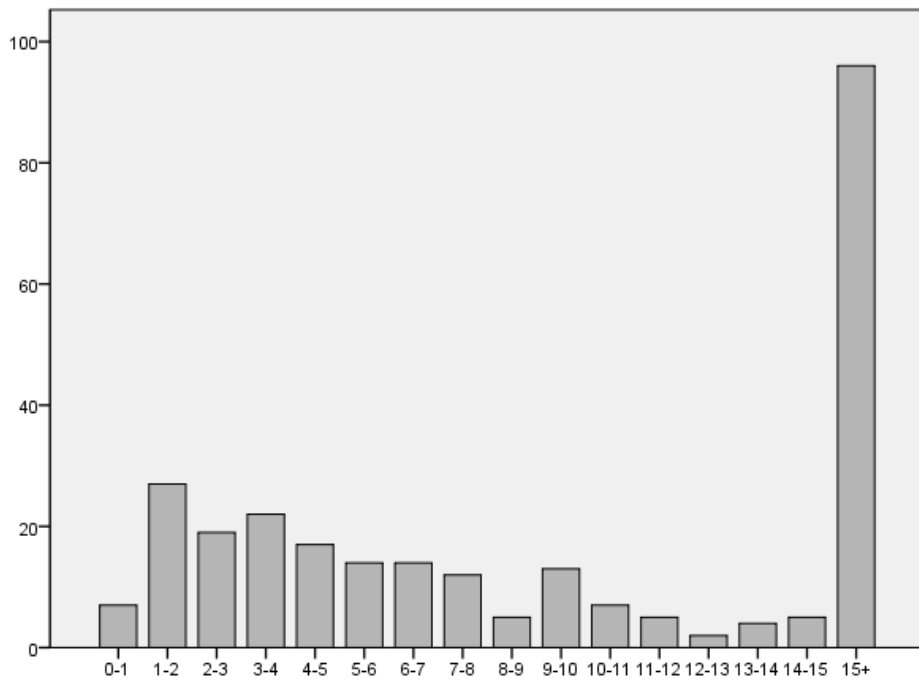


Figure 6.5 Years of use

**Prior victimisation experience**

Slightly more than a half of the respondents have got attacked, harassed or threatened by anti-social behaviour before.

Table 6.7 Prior victimisation experience

		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<b>Yes</b>	138	51.3	51.3	51.3
	<b>No</b>	131	48.7	48.7	100.0
	<b>Total</b>	269	100.0	100.0	

N=269, No missing responses

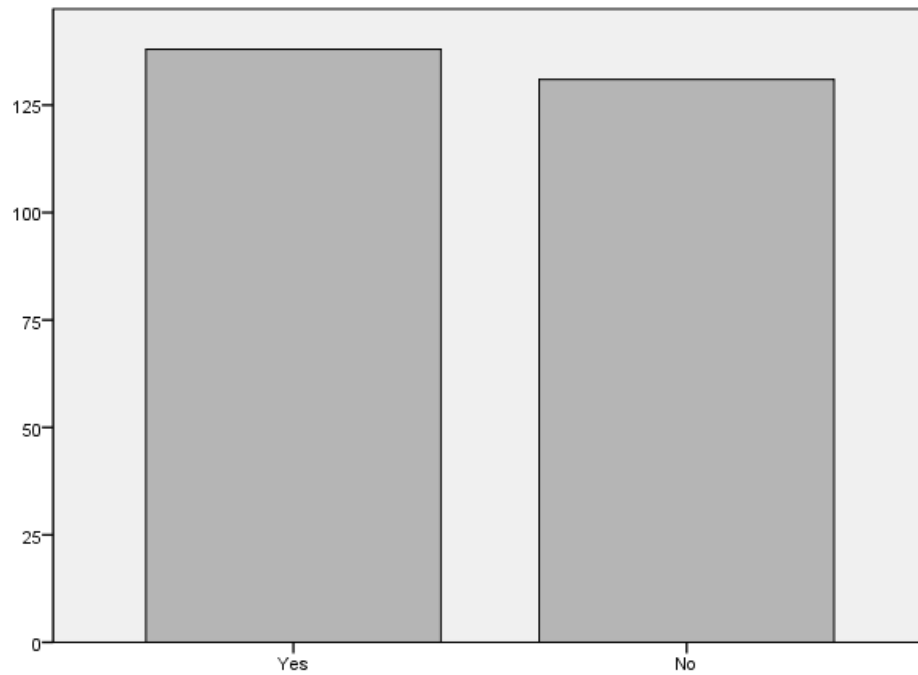


Figure.6.6. Prior victimisation experience

**Prior victimisation experience on the London Underground**

21.2 percent of the respondents answered that they have got attacked, harassed or threatened by anti-social behaviour in the London Underground environment before.

Table 6.8 Prior victimisation experience on the Underground

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	57	21.2	21.2	21.2
	No	212	78.8	78.8	100.0
	Total	269	100.0	100.0	

N=269, No missing responses

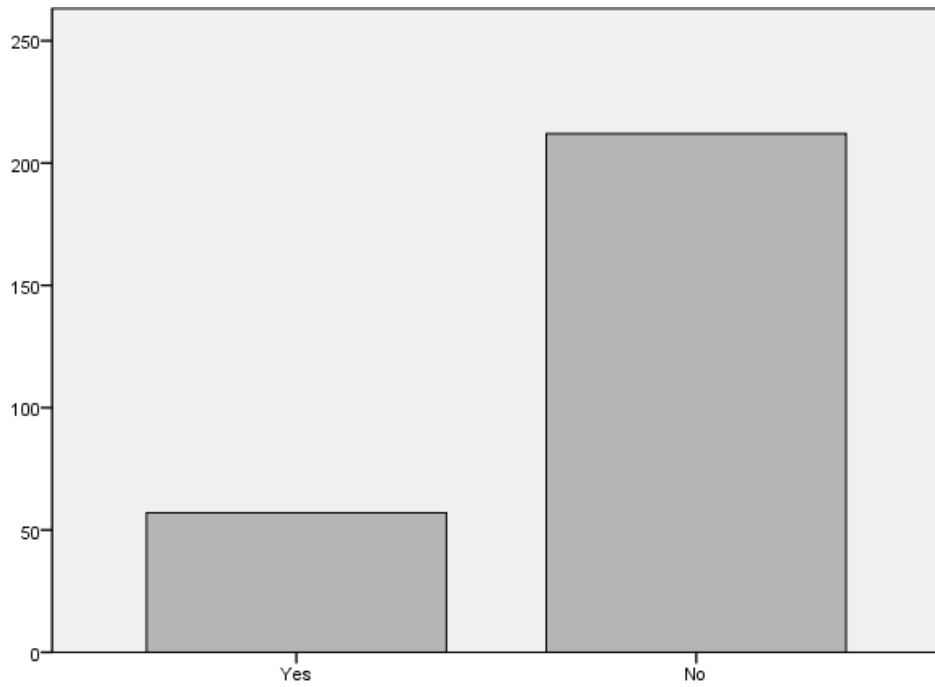


Figure 6.7 Prior victimisation experience on the Underground

**Prior victimisation experience and gender**

The number of the female respondents who have been attacked, harassed or threatened by anti-social behaviour was larger than that of male respondents who had the experiences. There was no missing response.

Table 6.9 Prior victimisation experience and gender

		Attacked		Total
		Yes	No	
Gender	Male	66	69	135
	Female	72	62	134
Total		138	131	269

N=269, No missing responses

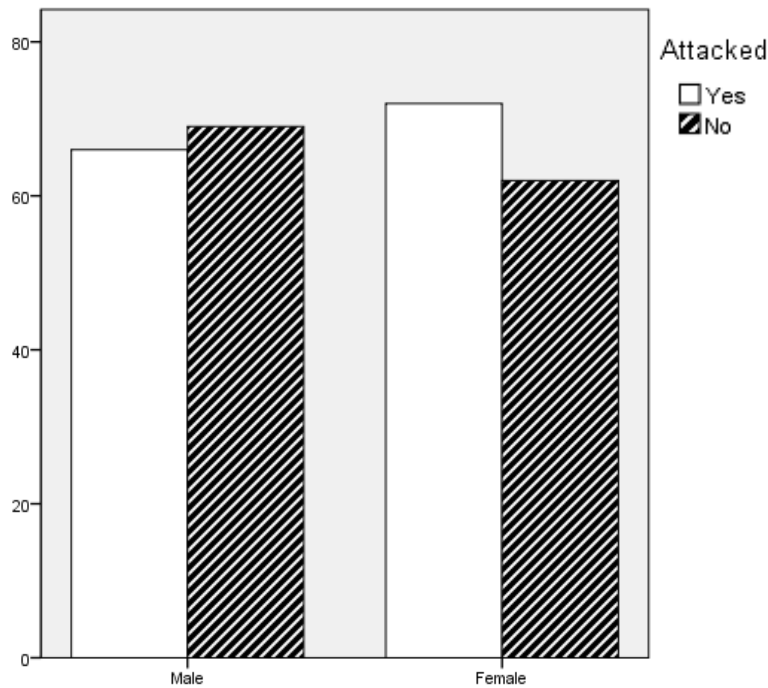


Figure 6.8 Prior victimisation experience and gender

**Prior victimisation experience, gender, and the levels of anxiety**

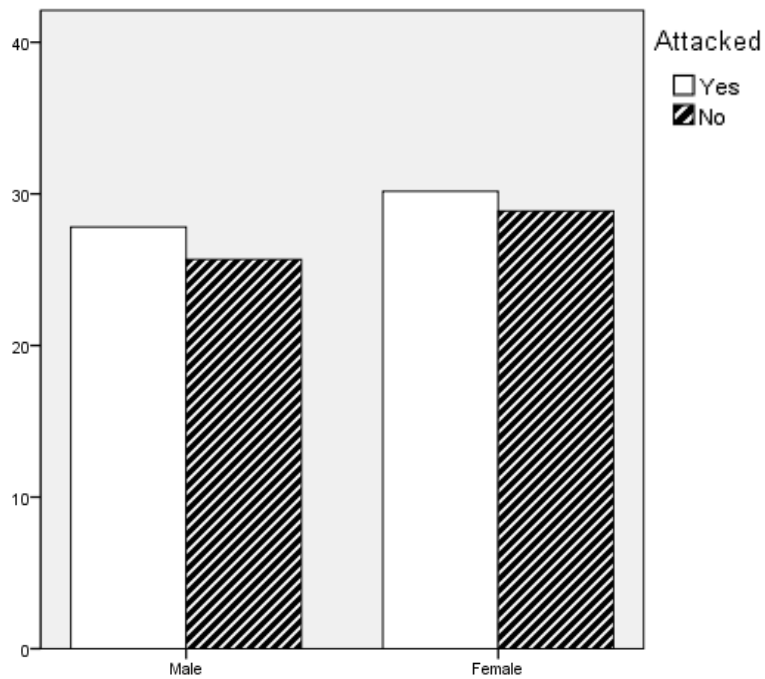
In general, the level of female respondents' anxiety was reported to be higher than that of male respondents. Additionally, the intensity of anxiety of the respondents who got victimised was rated to be greater than that of the respondents who had not been victimised before. Considering both genders and their prior experiences, the victimised female participants scored the highest level of anxiety, followed by the non-victim female participants. Then, the victimised male participants scored the third highest level, followed by the non-victim male participants. By observing the reported mean values, it can be reasoned that the victimised female respondents are more vulnerable than other groups.

Table 6.10 Prior victimisation experience, gender, and the levels of anxiety

Attacked		Mean	N	Std. Deviation
Yes (Victims)	Male	27.82	66	5.844
	Female	30.17	72	6.885
	Total	29.04	138	6.493
No (Non-victims)	Male	25.68	69	6.163
	Female	28.87	62	6.357
	Total	27.19	131	6.433
Total	Male	26.73	135	6.082
	Female	29.57	134	6.653



	<b>Total</b>	28.14	269	6.518
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Y axis: The mean scores of State Anxiety subscale in the STPI

Figure 6.9 Prior victimisation experiences, gender, and the levels of anxiety

**Prior victimisation experience and ethnicity**

Table 6.11 Prior victimisation experience and ethnicity

	<b>Asian/ Asian British</b>	<b>Black/ African/ Caribbean/ Black British</b>	<b>Other ethnic group</b>	<b>White</b>	<b>Mixed/ Multiple ethnic groups</b>
<b>Yes</b>	26 (43%)	10 (53%)	1	94 (56%)	6 (46%)
<b>No</b>	35	9	5	74	7
<b>Total</b>	61	19	6	168	13

N=269, 2 missing responses

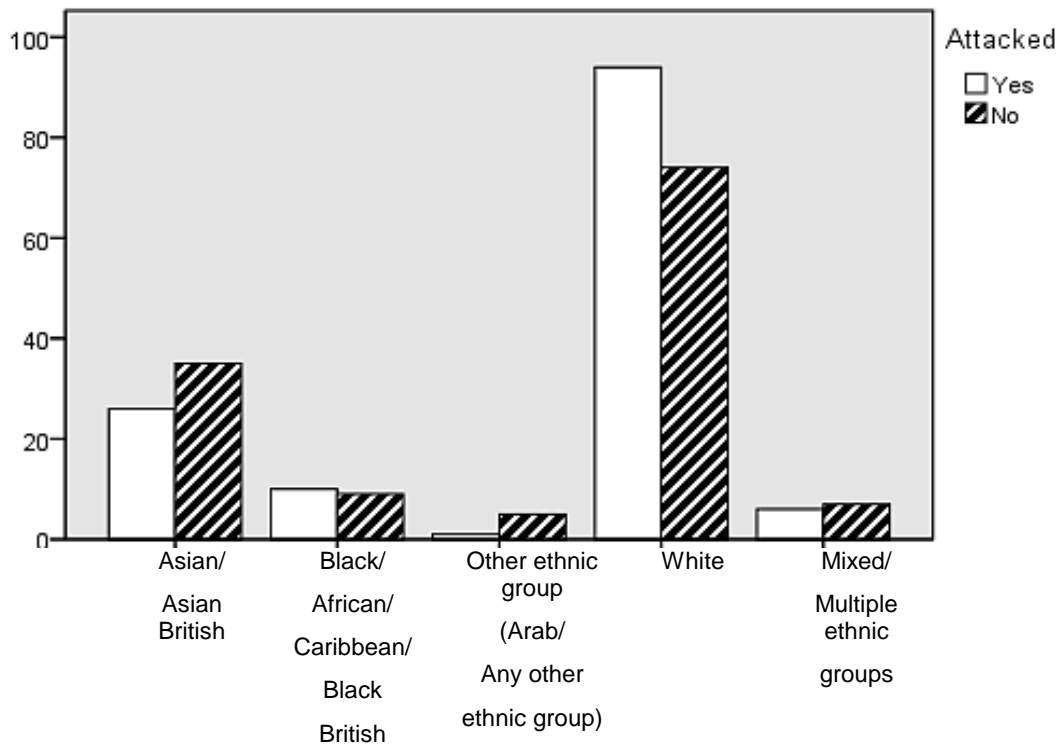


Figure 6.10 Prior victimisation experience and ethnicity

### 6.3.1.6. Comparisons among groups

#### Comparison of the levels of anxiety between genders

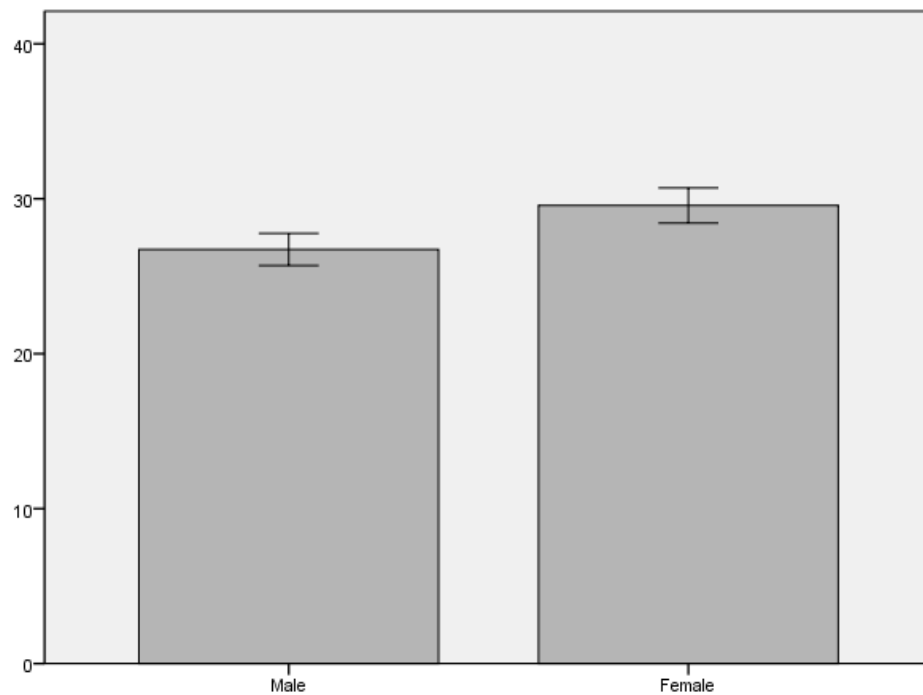
The hypothesis formulated based on the results from the exploratory questionnaire in the explorative study was 'there will be a significant difference between genders in the levels of anxiety about seeing other passengers' anti-social behaviour'. Inferential statistics will be applied to determine whether the significant difference will be confirmed or not. They are commonly used for hypothesis testing, that enable to infer generalizable knowledge from information gathered from observed samples to the entire population (Gray, 2014). In order to test the difference, independent samples t-test was executed. The test is used to verify the difference between mean values achieved from two different groups is statistically significant or not (Pallant, 2016). The assumptions of the test are, homogeneity of variance, and normal distribution of the data sets. According to the central limit theorem, when the sample size is sufficient, so to speak, larger than 30, the sample will tend to exhibit normal distribution. The sample sizes of the two groups are 135, and 134 respectively, it is regarded that the data sets are normally distributed. In terms of homogeneity of variance, the non-significant Levene's test result, 0.246 reveals that the

variances are homogeneous (Field, 2009). The mean difference was confirmed to be significant, with the  $p$ -value of 0.000 (2-tailed), displaying the mean difference of -2.841 with the  $t = -3.656$ ,  $df = 267$ .

Table 6.12 Comparison of the levels of anxiety between genders

Gender	Mean	N	Std. Deviation
Male	26.73	135	6.082
Female	29.75	134	6.653

N=269, No missing response



Y axis: The mean scores of State Anxiety subscale in the STPI

Error bars: 95% confidence interval

Figure 6.11 Comparison of the levels of anxiety between genders

- **Comparison of the levels of anxiety among ethnic groups**

Although the uneven distributions of the sample sizes, observing the tendencies appeared in the data, the White group demonstrated the highest mean score, followed by the Mixed/Multiple ethnic groups, and Asian/Asian British group. The lowest mean value was rated by the Black/African/Caribbean British group.

Table 6.13 The levels of anxiety among ethnic groups

<b>Ethnic group</b>	<b>Mean</b>	<b>N</b>	<b>Std. Deviation</b>
<b>Asian/Asian British</b>	27.67	61	6.147
<b>Black/African/Caribbean British</b>	26.47	19	6.372
<b>Other ethnic group (Arab/ Any other ethnic group)</b>	27.83	6	4.167
<b>White</b>	28.54	168	6.765
<b>Mixed/Multiple ethnic groups</b>	28.38	13	6.305
<b>Total</b>	28.17	267	6.518

N=267, 2 missing responses

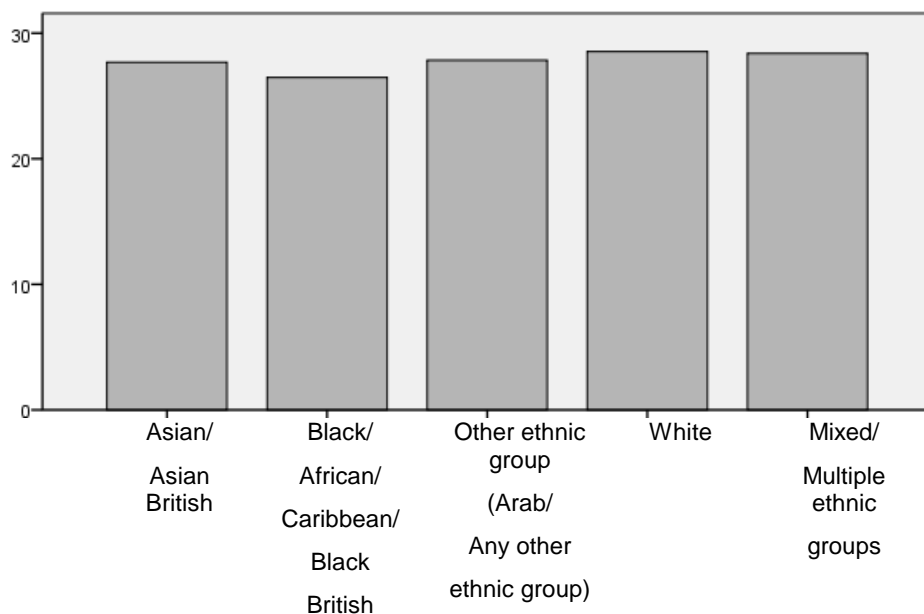


Figure 6.12 The levels of anxiety among ethnic groups

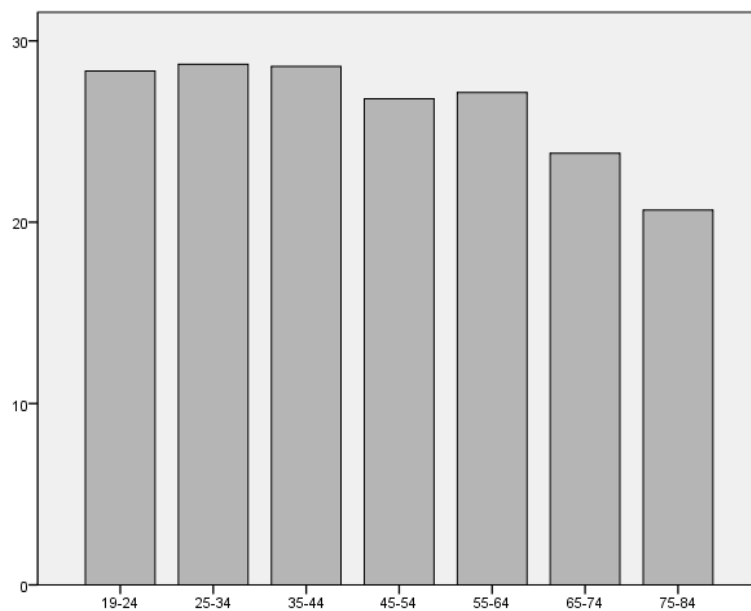
- **Comparison of the levels of anxiety among the age groups**

It has been identified that the age group of which the respondents who rated the highest scores of state anxiety was the bracket 25-34. The next highest-rated group was the bracket 35-44, followed by 19-24, and 55-64. Although the sample sizes were small, the degrees of anxiety amongst the rest of the age groups were seen to gradually decrease.

Table 6.14 The levels of anxiety among the age groups

Age	Mean	N	Std. Deviation
19-24	28.33	75	6.374
25-34	28.71	96	6.492
35-44	28.59	51	6.447
45-54	26.81	26	6.986
55-64	27.15	13	6.568
65-74	23.80	5	5.167
75-84	20.67	3	6.658
Total	28.14	269	6.518

N=269, No missing responses



Y axis: The mean scores of State Anxiety subscale in the STPI

Figure 6.13 The levels of anxiety among age groups

- **Comparison between the levels of anxiety and the frequencies of use of the Underground**

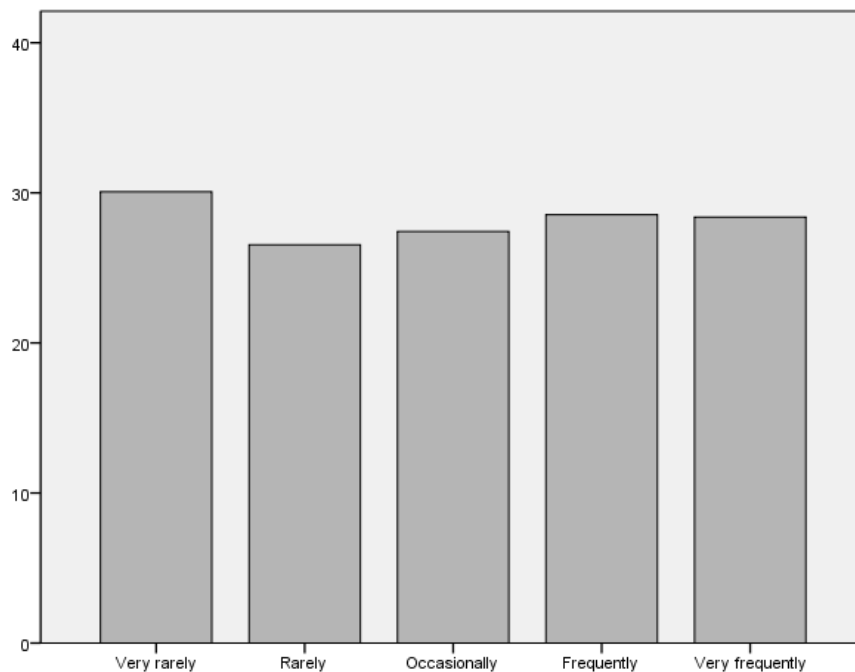
The levels of anxiety were explored by the frequency of use on the service. The group of the respondents using the Underground very rarely rated the greatest level of anxiety, on the contrary, the group of the participants using the service rarely, scored the lowest degree of anxiety. The scores gained by the occasional, frequent and very frequent users were positioned between the very rare and rare users of the service. Based on these

patterns observed, it might not be reasonable to argue that the level of anxiety has much to do with the frequency of use.

Table 6.15 The levels of anxiety among the frequencies of use of the Underground

Frequency	Mean	N	Std. Deviation
Very rarely	30.07	30	5.546
Rarely	26.53	45	5.872
Occasionally	27.42	38	6.442
Frequently	28.55	66	6.655
Very frequently	28.38	87	6.995
<b>Total</b>	<b>28.16</b>	<b>266</b>	<b>6.528</b>

N=269, 3 missing responses



Y axis: The mean scores of State Anxiety subscale in the STPI

Figure 6.14 The levels of anxiety among frequencies of use of the Underground

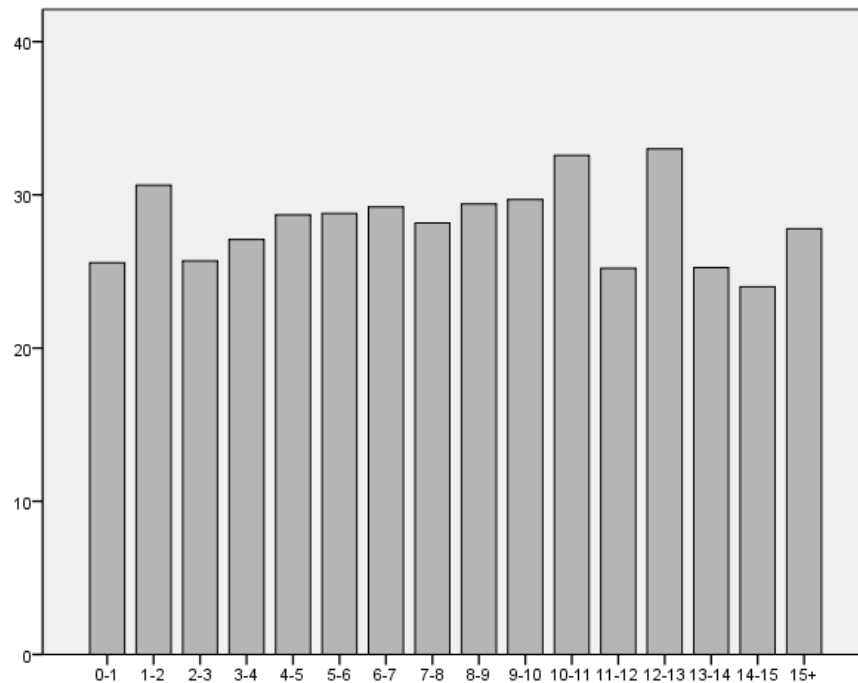
- **Comparison between the levels of anxiety and years of use**

Table 6.16 The levels of anxiety among years of use

Years	Mean	N	Std. Deviation
0-1	25.57	7	5.255
1-2	30.63	27	7.121
2-3	25.68	19	5.628

<b>3-4</b>	27.09	22	4.985
<b>4-5</b>	28.71	17	5.676
<b>5-6</b>	28.79	14	7.485
<b>6-7</b>	29.21	14	5.236
<b>7-8</b>	28.17	12	5.524
<b>8-9</b>	29.40	5	6.877
<b>9-10</b>	29.69	13	6.762
<b>10-11</b>	32.57	7	4.392
<b>11-12</b>	25.20	5	6.723
<b>12-13</b>	33.00	2	1.414
<b>13-14</b>	25.25	4	4.787
<b>14-15</b>	24.00	5	6.285
<b>15+</b>	27.79	96	7.133
<b>Total</b>	28.14	269	6.518

N=269, No missing responses



Y axis: The mean scores of State Anxiety subscale in the STPI

Figure 6.15 The levels of anxiety among years of use

- **Comparison of the levels of anxiety between victims and non-victims of anti-social behaviour**

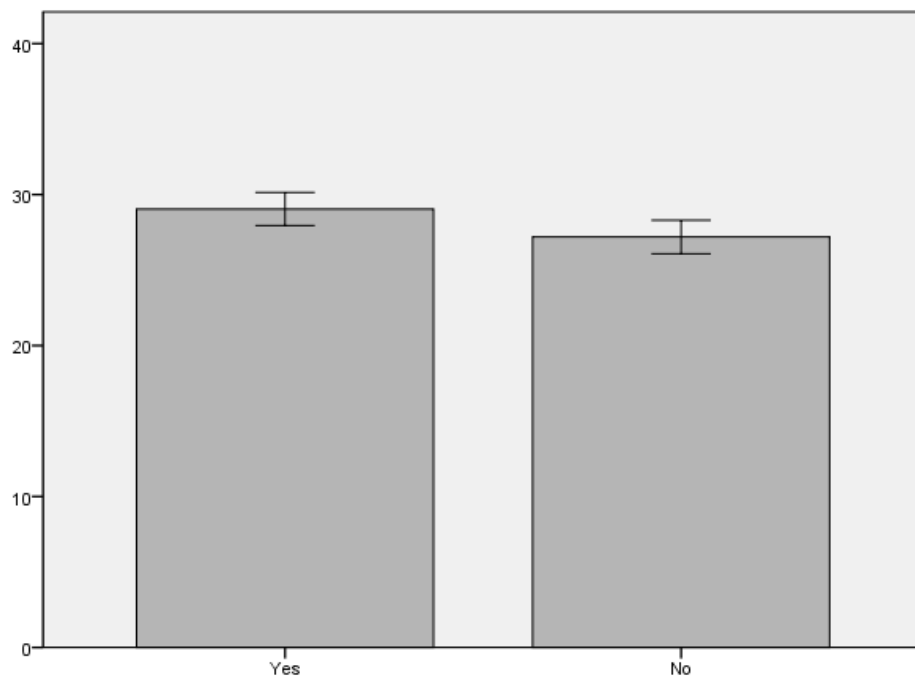
According to the responses from victims, and non-victims of anti-social behaviour, the mean score of the victims was rated higher than that of non-victims. It is hypothesised that victims feel more anxious about other passengers' anti-social behaviour on the London Underground because of

the similar past experiences. The reason is anxiety might have been experienced because it was “labelled” by past experiences. Cognitions which occur in the current situation as construed by prior experiences shape “a framework within which one understands and labels his feelings” (Schachter and Singer, 1962). Also, passengers who had been threatened or attacked, had seen someone threatened or attacked, or had felt threatened felt less safe on public transport (Currie et al., 2013). In order to examine the difference, independent sample t-test was applied. It was verified that the difference was statistically significant with the significance level of 0.02 ( $t = 2.350$ ,  $df = 267$ ), presenting the non-significant  $p$ -value of 0.523 from the Levene’s test result. Therefore, it can be judged that the group of the respondents, who had the prior experience of getting attacked, harassed or threatened by anti-social behaviour rated significantly higher level of anxiety.

Table 6.17 The levels of anxiety between victims and non-victims

<b>Attacked</b>	<b>Mean</b>	<b>N</b>	<b>Std. Deviation</b>
<b>Yes</b>	29.04	138	6.493
<b>No</b>	27.19	131	6.433
<b>Total</b>	28.14	269	6.518

N=269, No missing responses



Y axis: The mean scores of State Anxiety subscale in the STPI

Error bars: 95% confidence interval



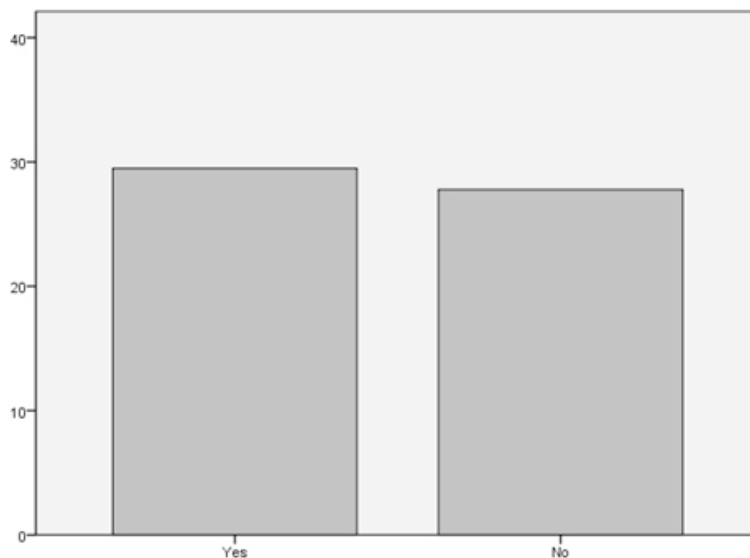
Figure 6.16 The levels of anxiety between victims and non-victims of anti-social behaviour

- **Comparison of the levels of anxiety between victims and non-victims of anti-social behaviour on the London Underground**

Table 6.18 The levels of anxiety between victims and non-victims on the Underground

<b>Attacked</b>	<b>Mean</b>	<b>N</b>	<b>Std. Deviation</b>
<b>Yes</b>	29.47	57	6.509
<b>No</b>	27.78	212	6.490
<b>Total</b>	28.14	269	6.518

N=269, No missing responses



Y axis: The mean scores of State Anxiety subscale in the STPI

Figure 6.17 The levels of anxiety between victims and non-victims of anti-social behaviour on the Underground

- **General opinions about anti-social behaviour on the London Underground**

In regards to the question asking if anti-social behaviour issues are problematic in the environment, 43.5 percent of the respondents answered that they strongly agree (7.1%) or agree (36.4%), 28.3 percent of them indicated that they neither disagree nor agree with it, and 28.2 percent of them stated that they disagree (26%) or strongly disagree (2.2%) with it. A

larger portion of the responses represented that the participants tended to agree with it.

Regarding the question inquiring if they were harmed as a result of anti-social behaviour, it would seriously affect their well-being, 71 percent of the respondents strongly agree (17.1%) or agree (53.9%) to the statement, 19.7 percent of them indicated that they neither disagree nor agree with it, and only 9.3 percent of them answered that they disagree (8.2%) or strongly disagree (1.1%) with it. Based on their responses, they tended to think the potential harm would affect their well-being.

Table 6.19 The responses on the statement ASB is problematic in the environment

	Frequency	Percent	Valid Percent	Cumulative Percent
<b>Strongly disagree</b>	6	2.2	2.2	2.2
<b>Disagree</b>	70	26.0	26.0	28.3
<b>Neither disagree or agree</b>	76	28.3	28.3	56.5
<b>Agree</b>	98	36.4	36.4	92.9
<b>Strongly agree</b>	19	7.1	7.1	100.0
<b>Total</b>	269	100.0	100.0	

Table 6.20 The responses on the statement harm results from ASB would affect their well-being

	Frequency	Percent	Valid Percent	Cumulative Percent
<b>Strongly disagree</b>	3	1.1	1.1	1.1
<b>Disagree</b>	22	8.2	8.2	9.3
<b>Neither disagree or agree</b>	53	19.7	19.7	29.0
<b>Agree</b>	145	53.9	53.9	82.9
<b>Strongly agree</b>	46	17.1	17.1	100.0
<b>Total</b>	269	100.0	100.0	

### 6.3.1.7. Exploratory factor analysis (EFA)

Exploratory factor analysis was conducted because some of the selected factors constituting the construct 'confidence in the relevant authorities' have not been tested before in structural equation modelling as one construct. Specifically, they were the factors relating to communication between people and the authorities, such as, seeking view, having been informed. For better judgement, three different types of criteria for factor extraction were

reviewed. First, it was considered the mode that accepting factors whose eigenvalues rate greater than 1.0, the default setting in statistical software tools in general, but this could result in inaccurate outcomes (Velicer and Jackson, 1990). Alternatively, the scree test was taken into consideration as an option. In the scree plot, the number of the factors before the bend could provide the evidence of the components retain in models (Beavers et al., 2013). However, this method might not be clear “if there are data points clustered together near the bend”. Therefore in this present study, the method that is designating the predicted number of the factors on the basis of the reviewed literature, if it is not equivalent to the number presented in the scree plot, figures around the number could be appointed for factor extractions. Using four different figures for gaining the optimised number of extracted factors is recommended. (Osborne and Costello, 2009).

- **Extraction based on designated number of factors**

For the analysis, principal axis factoring (PAF) was chosen for extraction, and a Promax with Kaiser Normalization was applied for rotation. With regard to extraction, the rationale for adopting PAF are, as addressed in Simpson et al.'s paper, unlike PAF, principal component analysis (PCA) is based on the assumption that all variables are scaled with no errors. Also, higher replicability and stability of results generated from PAF could be expected than PCA (Simpson et al, 1992). In terms of rotation, one of the oblique rotation methods was applied, since, in studies engaging humans, the factors reflecting their perceptions could hardly be uncorrelated perfectly (Field, 2009), in addition to that, as a theoretical background, it has been reported that a sense of uncontrollability is a significant component which contributes to genesis of anxiety (Brown et al., 2004). Furthermore, as Lang and Hallman's study tells, orthogonal rotations are more widely utilised, however, uncorrelatedness among the factors in their data could barely be substantiated theoretically, or empirically. Therefore, in their study, a Promax rotation was selected, with PAF, as well as other studies regarding human perception used them (Hughes et al., 2008; Kardash and Wallace, 2001; Tan et al., 2005; Tan et al., 2004; Lang and Hallman, 2005; Appleton et al., 2006; Korpela et al., 2010; Rosenbaum, 2006; Liew et al, 2010; Klonsky and Glenn, 2009; Haviland et al., 2000; Simpson et al., 1992). In sum, there are the seven constructs need to be evaluated, however, in terms of the construct 'confidence in the authorities', there are the two newly included items selected from the Metropolitan Police Public Attitudes Survey

for this present study, which have not been tested in the previous studies. In this sense, the phase can be called exploratory. Therefore, the construct will be tested to see if it is comprised of one or more constructs. If the construct 'confidence in the relevant authorities' is a 1-factor structure, there will be 7 constructs in the model in total, however, if it has more than one construct, eight or nine factors will remain in the model. Hence, for this factor analysis, 7, 8, 9 and 10-factor structure will be examined. Based on the theoretical support and the observation of the factor analysed data pattern, the 9-factor structure was seen to better fit the data than the other structures. It is recommended that at least 3 items in each extracted factor need to be retained, however, an exceptional case is explained, when scales including more than one factor might contain components consisting of two items (Raubenheimer, 2004), such as the scale included in Yoo and Donthu's study (Yoo and Donthu, 2001). This information can be applied to justify the retention of the sub-structures of the construct 'confidence in the relevant authorities' whose items factored into 3 sub-constructs, as described in the following sections.

· **7-factor structure**

Poor loadings in the seventh factor were detected, for example, seeking views, having been informed, which were scored 0.392 and 0.415 respectively. They were factored with the element 'informal social control', and this is regarded as a disparate construct based on the reviewed literature. Being as different factors, identified as components constituting the one construct, would be an elucidation for the poor loadings of the variables. (The EFA results are presented in the Appendix D.1)

· **8-factor structure**

In the scree plot, the natural bend was found at the point of 8, and the eigenvalues of the first eight factors were scored above 1.0, and the rest of the points of the factors including the ninth one, were rated below 1.0. This means that the structure is likely to consist of the observed number of the factors. However, when determining factor structures, solely relying on eigenvalues might not be accurate (Beavers et al., 2013). Especially, in this case, the eigenvalue of the ninth factor was 0.95, which was just below the threshold level. In this circumstance, judgement entirely based on the cut-off value might result in dismissing a significant factor. Therefore, the

referenced literature regarding confidence in the authorities was reviewed again, and the construct 'fairness', which represent treating passengers fairly, and being friendly and approachable, is merged into the authorities' engagement (Jackson and Bradford, 2010), which might result in low measurement weights in a measurement model in the CFA process. (The EFA results are presented in the Appendix D.2)

- **9-factor structure**

In this structure, no cross loadings were found in the pattern matrix with the values scored below 0.32 suppressed, and the cut-off value has been proposed by Osborne and Costello (Osborne and Costello, 2009).

Supported by the reviewed literature, fairness of the authorities (TfL and BTP treating fairly, and being friendly) was classified as a different factor. (The EFA results are presented in the Appendix D.3)

- **10-factor structure**

The tenth factor could not be clearly identified. There included two variables revealed as possible significant factors, whose absolute values of the loadings rated above 0.32 (Osborne and Costello, 2009). However, they cross-loaded to the factor 'perceived physical ability', that were already factored as the second element in the structure. For these reasons, it seems reasonable to claim that the 10-factor structure does not represent the data properly. (The EFA results are presented in the Appendix D.4)

- **The optimal structure**

Based on the results generated from the four trials for identifying underlying factors in the structure, it is estimated that the 9-factor structure seems to be more optimal than other structures, for the reasons described above, therefore, it will offer empirical background for modifying the model in the confirmatory factor analysis and structural equation modelling process.

### **6.3.1.8. Model testing and modification process**

In this section, the process and outcomes from the test of the hypothesised model will be illustrated in detail. The section will unfold in three main sub-sections. In the first sub-section, measurement model testing and

modification processes will be described, which are comprised of two parts, confirmatory factor analysis with the measurement model modification, and multi-group invariance analysis. In the second sub-section, structural equation model testing and modification processes will be presented. In the third sub-section, testing a moderating effect of gender in the relationship between perceived physical ability and uncontrollability will be delineated. For assessing the moderation effect, the measurement invariance across genders will be examined first using the modified measurement model, and then the moderating effect will be tested using the re-specified structural equation model. The procedure will be conducted following the steps proposed by Bollen and Long, "(1) specification, (2) identification, (3) estimation, (4) testing fit, (5) re-specification" (Bollen and Long, 1992). However, in the entire procedure, multiple iterative processes will be involved if returning to previous stages is necessary, for example, conducting estimation after re-specification.

- **Structural equation modelling as a method for model testing, and its process**

Structural equation modelling (SEM) is a statistical methodology that enables to test a structural theory that helps explain certain phenomenon. It is considered as a confirmatory approach that involves hypothesis testing distinguished from exploratory approach. Normally, in the theory, several factors are included in order to elucidate causal processes between antecedents and outcome variables (e.g. X predicts Y, X accounts for Y,  $X \rightarrow Y$ ) with demonstrating inter-relationships among them.

SEM is characterised that "the causal processes under study are represented by a series of structural (i.e., regression) equations", and that clearer conceptualisation of the theory is enabled by graphic presentation of the causal relationships among the components in a model. The proposed model comprised of multiple factors representing hypothesised relationships that can be tested simultaneously in a model. The outcome of the hypothesised model testing is either accepting or rejecting the established hypothesis based on goodness-of-fit statistics of the model which present how well the model represents the data that was hypothetically considered to reflect the phenomenon of interest (e.g. anxiety) (Byrne, 2016).

SEM is also described as a method for representation, estimation, and examination of "a theoretical network of (mostly) linear relations between

variables". It is added that the variables might be observable or "directly unobservable" (Marcoulides, 1998). This point is connected to one of the advantages of SEM in the sense that it can handle both observable and unobservable variables. The directly unobservable variables indicate latent variables or factors representing theoretical constructs that cannot be directly measured (e.g. anxiety, controllability, and confidence in the relevant authorities). They need to be operationally defined and then connected to observed variables for the constructs to be measurable (e.g. feeling tense, feeling nervous). The examples of the observation might contain self-report scales, coded interview responses (e.g. the State-Anxiety Inventory) (Byrne, 2016).

SEM is particularly useful to determine significant constructs to be enhanced or modified when attempting to establish robust theoretical backgrounds of the chosen constructs, especially issues regarding users' perceptions that will offer guidance for designing information aimed to improve users' emotional experiences. As SEM enables to test multiple hypotheses simultaneously in a single model, possible solutions generated based on the model testing result are likely to be more effective because the chosen factors are confirmed to be significantly inter-related with the targeted matter to a certain extent concurrently. Moreover, users' emotional experiences are closely connected to emotional states which may be easily regarded as constructs or factors, such as anxiety, which can be effectively handled in SEM software.

As explained, SEM is one of the methods which enables implementation of causal modelling. Causal modelling is addressed as a type of multivariate analysis for testing structural theories which are attempted to account for causal relationships. This method is extensively used for hypothesis testing in non-experimental studies. Despite the fact that proving causes of certain effects tend to be rather "beyond the capabilities of any single research study", especially in the fields in which non-experimental studies are widely carried out, considering the purpose of studies involving hypothesising, specifying interrelated components, and testing to verify if data supports the proposed statements, the intention resembles the purpose of causal modelling (Bentler, 1988). As the objective of this present study is to clarify the relationships among coping resources, perceived control, and anxiety, through testing the hypotheses formulated based on the relevant theories in a non-experimental manner, the method, structural equation modelling seems to suit this purpose. Especially, the addressed factors are

“hypothetical constructs”, which is stated that they cannot be measured directly. They are evaluated through indicator(s), presumed to reflect the concept appropriately. For this present study, a number of indicators which are included in order to measure the hypothetical constructs. This is another reason to apply structural equation modelling which can handle latent constructs consisting of multiple variables for the analysis (Bollen and Long, 1992).

In addition, both the measurement model and structural model will undergo multiple modifications to find out a better structure than others from a statistical, empirical, and theoretical point of view, since it is conveyed that “Model generating (MG)” is the most commonly conducted practice in structural equation modelling. To be more specific, Jöreskog renders three different situations to which SEM is applied according to their purposes and modes of utilisation. They are, first, “Strictly confirmatory (SC)”, second, “Alternative models (AM)”, third, “Model generating (MG). In the SC situation, only one model is generated, and then tested against collected data. The model is accordingly, determined to be accepted or rejected. In the AM situations, one of the several hypothesised models is chosen after tested against empirical data. In the MG situations, an a priori model is suggested first, and is modified during the testing process based on the same data set if the model does not represent the data adequately. The procedure for identifying the most suitable model can be either theory or data driven. The ultimate goal of the process could be explained that it is to define a model which statistically best fits the data, as well as to identify a model which produces meaningful interpretations (Jöreskog, 1993).

In structural model testing, it is stated that a measurement model is suggested to be examined first, in the sense that it does not seem reasonable and sound if the selected indicators do not contribute to measuring the constructs properly (Jöreskog, 1993). Therefore, the measurement model will be tested first, with the addition of a number of modification steps delineated. In the course of model re-specification, theoretical and/or empirical grounds which correspond to the each process for making decisions will be provided, which are addressed as prerequisites (Jöreskog, 1993; Byrne, 2016).

In the course of model modification, the procedure, named “Specification searches”, and recommended by MacCallum will be applied. It can be taken into consideration when a model does not fit empirical data well. To begin with, modification indices and standardised residuals need to be scrutinized



in order to discover specification error. Then, it is advised to give one modification at a time, since an alteration can influence other parts in the estimation. Additionally, it is suggested that adding new parameters before removing parameters, which means it is advisable that enhancing model fit first, then improving parsimony later (MacCallum, 1986).

- **Confirmatory factor analysis (CFA)**

The main objective to test the measurement model is to evaluate multivariate data to ascertain if a hypothesised model (a set of hypotheses) represents the data well, and Confirmatory factor analysis (CFA) is generally used for the examination (Fox, 2010). CFA is introduced as a type of structural equation modelling, handling measurement models, with identifying the relationships between observed variables and latent constructs. Amongst various advantages of the statistical method, three chief features are of interest for the present study. They are, first, its utility in assessment of measurements, second, in evaluation of construct validity, third, in examination of measurement invariance (equivalence). The first feature could be accounted for as its viability to determine the number of inherent dimensions, through verifying the number of factors and factor loadings of its items contributing to measuring the factor. The second property could be represented as its robustness of the outcomes as the strong substantiation of validity of the constructs (Brown, 2006). Validity is “extent to which a measure or set of measures correctly represents the concept of study”. In other words, it signifies “how well the concept is defined by the measure(s)” using correct questions (Hair, 2010). For the present study, validity would represent how well the scales and a set of questions previously chosen (see the section 6.2.2) represent the constructs of interest (e.g. anxiety, perceived uncontrollability, perceived physical ability). The third attribute could be elucidated as its practicability of estimation of invariance (equivalence) of measurement which could perform as evidence of the potential generalisability across groups (Brown, 2006) to see the defined measures are understood and rated by respondents in a statistically equivalent manner across the groups.

- **Measurement model assessment and modification**

Regarding validity in the context of structural equation modelling (SEM), Hair et al. addresses that in order to provide an answer to a question “Is the

measurement model valid?”, there are two different features which need to refer to. They are goodness-of-fit statistics (GOF statistics), and indications of construct validity (Hair et al., 2010). Assessment of validity of models is a significant part of confirmatory factor analysis (CFA), as an initial stage of structural equation modelling. Therefore, this section will be allocated to explain procedures to evaluate identified measurement models with demonstrating the relevant evidences of validity of the tested models. Detailed information about validity of the hypothesised and modified measurement models will be included in the Table 6.23 (see the values of the AVE and CR of the models), and the Table 6.24 (see the GOF statistics). First, in terms of model fit, “model fit compares the theory to reality by assessing the similarity of the estimated covariance matrix (theory) to reality (the observed covariance matrix)”. The mathematical comparison enables to see how close the estimated and observed covariance matrices are, and a better model fit is achieved when they are close (Hair et al. 2010). There are several criterions that will be consistently applied to in the decision making process if validity of the tested models is achieved. They are Goodness-Of-Fit (GOF) indices, and their acceptable benchmark values used to determine how well the models fit to the data are presented below in the Table 6.21. It is advised to selectively report necessary GOF statistics generated in the model testing process. Kline provides guidance for choosing GOF statistics to report, and they are chi-square test statistic ( $\chi^2$ )  $p$ -value, the Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standard root mean squared residual (SRMR) (Kline, 2005). Along with the four suggested indices, values of normed chi-square, Goodness-of Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Tucker Lewis Index (TLI) generated in the model testing procedures will be presented in the present study (see the Figure 6.18, Figure 6.19, Figure 7.1, Figure 8.1).

Table 6.21 Referenced goodness of fit (GOF) indices

Fit index	Recommended value	References
<b>Chi-square test statistic (<math>\chi^2</math>) <math>p</math>-value</b> (higher the better)	> 0.05	Schumacker and Lomax, 2010
<b>2. Normed chi-square</b> (lower the better)	< 2.0	Tabachnick and Fidell, 2007
	< 5.0	Bagozzi and Yi, 1988;
<b>3. Goodness-of Fit</b>	> 0.9	Hu and Bentler, 1999; Hair et al., 2010

<b>Index (GFI)</b> (higher the better)	> 0.8	Etezadi-Amoli and Farhoomand, 1996; Seyal and Rahman, 2002
<b>4. The Root Mean Square Error of Approximation (RMSEA)</b> (lower the better)	< 0.06	Hu and Bentler, 1999
	< 0.08	Bagozzi and Yi, 1988; Hair et al., 1998; Browne and Cudeck, 1992
<b>5. Standard root mean squared residual (SRMR)</b> (lower the better)	< 0.08	Hu and Bentler, 1999; Hooper et al., 2008
	< 0.08 with CFI above 0.92 (N> 250)	Hair et al., 2010
<b>6. Adjusted Goodness-of-Fit Index (AGFI)</b> (higher the better)	> 0.8	Bagozzi and Yi, 1988; Hair et al., 1998;
<b>7. Tucker Lewis Index (TLI)</b> (higher the better)	> 0.9	Hair et al., 2010
	> 0.8	Taylor et al., 2003; Tucker and Lewis, 1973
<b>8. Comparative Fit Index (CFI)</b> (higher the better)	> 0.9	Hair et al., 2010; Hooper et al., 2008

Second, with regard to construct validity, two types of validity will be assessed, which are convergent validity in conjunction with construct reliability, and discriminant validity. Hair et al. explain convergent validity is determined by factor loadings, average variance extracted, and construct reliability. First, higher convergent validity can be explained by means of higher loadings of items on a certain factor, that is, they converge on the construct. In that case, significant standardised factor loadings greater than 0.5 as minimum, ideally higher than 0.7 are required. Second, the average variance extracted (AVE) performs as one of the indicators of convergent validity (Fornell and Larcker, 1981). It is the mean of variances extracted from the observed variables which load onto a latent construct, and it needs to be greater than 0.5. If it is below the threshold, the variances explaining the construct are less than the error remains. Lastly, construct reliability (CR) is also mentioned it is used as a determinant of convergent validity. The value is calculated from “the squared sum of factor loadings for each construct and the sum of the error variance terms for a construct”. CR is suggested to be higher than 0.7 (Nunnally and Bernstein, 1994), however, it might be acceptable when other constructs in the model produce good validity (Hair et al., 2010). Lastly, regarding discriminant validity which stands for uniqueness of the constructs investigated in a model in the sense

that they are distinguished from another (Hair et al., 2010). It is suggested that it can be confirmed through comparison between the AVE and squared inter-construct correlations. If the AVE is greater than the correlations, it can be judged that discriminant validity is achieved (Fornell and Larcker, 1981). Hence, based on the indices and indicators provided, the examination and modification of the measurement model will be conducted.

The assessment and modification process of the measurement model will be illustrated. Maximum likelihood estimation was utilised for the measurement model and structural model testing. The reason is that it is the most widely used method (Brown, 2006), and it is as the default mode in most SEM software packages, it generates more reliable outcomes than other estimation methods (Hair, 2010). The testing process including modification practices will be described with producing estimated values and the relevant theoretical and/or empirical evidence for modifications.

To begin with, the list of variables in the hypothesised model is presented below in the Table 6.22. On the left hand side of the table, the constructs and the corresponding indicators in the a priori model are listed, and on the right hand side of it, the constructs and the indicators in the modified model are demonstrated. 6 out of 7 latent variables, and 28 out of 34 indicators remain in the final measurement and structural model. It has been determined that the construct ‘Confidence in the authorities’ consists of three factors, and they are identified as ‘Confidence in the authorities engagement’, ‘Confidence in the authorities communication’, and ‘Confidence in the authorities fairness’. The deletion and the division criteria and rationales will be further described later in this section.

Table 6.22 List of variables

Constructs in the a priori model				Changes in the modified model		
Constructs		Indicators		Re-defined constructs		Deleted
Safety Knowledge	SK	SK1	Event staff			
		SK2	Event facilities			
		SK3	Event process			
Physical Ability	PA	PA1	React quickly			
		PA2	Physically strong			
		PA3	Slow(R)			
		PA4	Poor(R)			
		PA5	Self-defence skills			

<b>Confidence in the Authorities</b>	<b>CA</b>	CA1	Tackle effectively	<b>Confidence in the Authorities Engagement</b>	<b>CAE</b>	
		CA2	Deal with ASB			
		CA3	Understand			
		CA4	Seek views	<b>Confidence in the Authorities Communication</b>	<b>CAC</b>	
		CA5	Been informed			
		CA6	Treat fairly	<b>Confidence in the Authorities Fairness</b>	<b>CAF</b>	
		CA7	Friendly approachable			
<b>Social Control</b>	<b>SC</b>	SC1	Not tell off(R)			*
		SC2	Contact TfL			*
		SC3	Not get attention(R)			*
<b>Perceived Invulnerability</b>	<b>PI</b>	PI1	Nothing serious happen			*
		PI2	No problem why now			
		PI3	Seldom incidence			
		PI4	Rarely something serious			
<b>Perceived Uncontrollability</b>	<b>PU</b>	PU1	Nothing I can do			
		PU2	Matter of chance			*
		PU3	Little I can do			
		PU4	Not my action			
		PU5	No matter what I do			*
		PU6	Out of control			
<b>State Anxiety</b>	<b>SA</b>	SA1	Tense			
		SA2	Worrying			
		SA3	Nervous			
		SA4	Jittery			
		SA5	Worried			
		SA6	Frightened			

Notes: (R): Reverse coded items, : Separated constructs after modifications

\* : Deleted items

In order to suit the purposes of CFA, validity and model fit have been evaluated. The overall fit statistics of the a priori (hypothesised) measurement model and modified models are presented in the Table 6.24, and the validity issues in the test results of the a priori model and modified models are described in the Table 6.23. The Table 6.23 also provides information about the modifications implemented in the CFA process guided by the AVE and CR values. The validity issues mainly result from lower GOF statistics, or lower AVE (concerned with validity) and CR (concerned with

reliability) values. When a suitable level of validity of is not achieved, it is recommended to implement modifications to a certain degree (Jöreskog, 1993). Also, model modification is extensively practiced when using SEM techniques. The two tables are suggested to be examined concurrently to facilitate understanding about information of the a priori (hypothesised) and modified models regarding validity and reliability. Following Jöreskog's (1993) guidance, the hypothesised model was tested first, and modifications have been applied when necessary according to generated GOF statistics, the AVE and CR, reviewed on the basis of the cut-off criteria presented earlier (see the Table 6.21 and the text below the table). Taking MacCallum's advice, one re-specification was conducted at a time, and once addition of parameters was finished, deletion of them was conducted (MacCallum, 1986).

Table 6.23 Validity issues in the measurement model and its modification steps

Measurement model	Issues				Modifications
	Large MI/EPC	Loadings below 0.5	AVE below 0.5	CR below 0.7	
<b>A priori</b>	<u>e5-e8</u> : 43.423/0.244 e13-e14: 88.232/0.212 e15-e16: 50.124/0.289	CA5: 0.36	PI: 0.495 SC: 0.413 CA: 0.417 PU: 0.433	SC: 0.671	[1st] e5-e8 correlated
<b>1</b>	<u>e13-e14</u> : 88.190/0.212 e15-e16: 50.120/0.289	CA5: 0.36	PI: 0.495 SC: 0.414 CA: 0.417 PU: 0.433	SC: 0.671	[2nd] CA6, CA7 separated as a different construct from CA
<b>2</b>	<u>e15-e16</u> : 51.145/0.295	CA5: 0.35	PI: 0.495 SC: 0.414 CA: 0.471 PU: 0.433	SC: 0.671	[3rd] CA4, CA5 separated as a different from CA
<b>3</b>	-	-	PI: 0.494 SC: 0.414 PU: 0.433	SC: 0.670	[4th] SC dropped
<b>4</b>	-	-	PI: 0.494 PU: 0.433	-	[5th] PI1 dropped
<b>5</b>	-	-	PU: 0.433	-	[6th] PU5 dropped
<b>6</b>	-	-	PU: 0.460	-	[7th] PU2 dropped
<b>Final model</b>	-	-	-	-	-

**Notes:** MI: Modification indices, EPC: Expected parameter change,

Underlined Modified indicators/constructs or error terms in the subsequent test

Examining the testing results of the a priori model, there are four main issues regarding its convergent validity, construct reliability and model fit. Model re-specification was carried out accordingly. Firstly, regarding the 1st modification, in the MI/EPC column, three large error covariances are observed. In terms of the error covariance between item PA5 and PA2 (e5-e8), it seems that the two variables might overlap in their meanings. Correlating high error covariances is available only when it is supported by strong theoretical and/or empirical evidence (Byrne, 2016). As an empirical reason, the large MI, and EPC could be suggested, and as a theoretical ground, regarding fear of crime, it is mentioned that physical vulnerability is mainly identified as physical strength and ability to defend themselves (Liu et al., 2009). Additionally, it is addressed that females feel less safe due to their deficiency of self-defence capability accounted for by their less sufficient physical strength (Loewen, 1993). Hence, the error terms were correlated based on the reasons, and the model fit increased accordingly. Secondly, in terms of the 2nd modification, after the 1st modification was finished, observing the results of the analysis of the measurement model 1, amongst the issues, the large error covariance between the item CA7 and CA6 (e13-e14, MI/EPC: 88.190/0.212) was taken into consideration for re-specification. Although the factor loadings are greater than the cut-off 0.5, (CA7: 0.54, CA6:0.54), it seems reasonable to judge that their relatively low loadings led to the insufficient AVE. As Jackson and Bradford (Jackson and Bradford, 2010) address that when the constructs relating to overall confidence in policing, trust in effectiveness, and trust in fairness were treated as one component, the model did not fit the data well. It seems that the large error covariance and low loadings might represent the point, implying that the two variables whose errors significantly covariate could measure a different construct to be in the same construct of CA. In their study, fairness was identified as a separate construct which predicted trust in the police engagement as well as confidence. Consequently, in this present study, the item 7 and 6 were identified as influencing factors of confidence in the authorities' engagement, and the factor consisting of the two items was named as 'confidence in the authorities fairness' (CAF) accordingly. Thirdly, in regard to the 3rd modification, the high error covariance between the variables CA5, and CA4 (e15-e16, MI/EPC:

88.190/0.212) was re-specified as a separate construct based on the Hohl et al.'s study. It reveals direct communication between the citizen and police can improve overall confidence, specifically, a perception about police engagement (Hohl et al., 2010). Also, the low loading of CA5 (0.36) was problematic when it was identified as one of the indicators in the construct 'CA' which led to the low AVE. Consequently, CA5 and CA4 were re-specified as a distinct construct, confidence in the authorities communication (CAC). In short, the construct CA was divided into three different constructs, with causal relationships premised among the constructs, such as CAF, and CAC lead to confidence in the authorities engagement (CAE). Further, the modification is on the basis of the results produced in the exploratory factor analysis. Fourthly, concerning the 4th modification, the construct SC which generated poor AVE (0.414) and CR (0.670), it seemed appropriate to drop, since it was seen that the items did not perform adequately enough to measure the constructs to meet the level of validity. This type of practice has been made in the pre-existing studies, such as, Webb et al.'s (Webb et al., 2008) and Fournier et al.'s (Fournier et al., 2013). Fifthly, in the following modification (5th), to satisfy the required level of construct reliability, the item PI1 was dropped. Sixthly, in the following modifications (6th and 7th), the item PU5, and PU2 which presented the lowest loadings were deleted one at a time to improve AVE (Sirohi et al., 1998). It is suggested that items with lower squared multiple correlations need to be removed first (Stamenkov and Dika, 2015), hence, removal of the item PU5 was followed by deletion of PU2. The values of AVE increased consequently from 0.460 to 0.505. The GOF statistics for each re-specified model are presented below in the Table 6.24, and all the values of the final model in the last row are within the acceptable range, apart from GFI which is slightly below 0.9, however it is above the cut-off (0.8) proposed by Etezadi-Amoli and Farhoomand (Etezadi-Amoli and Farhoomand, 1996), and Seyal and Rahman (Seyal and Rahman, 2002). Finally, after a number of modifications, the model 7 has been decided as a final model that does not have concerns with validity which produces values of the AVE and CR and GOF statistics (see the cut-off criteria from the Table 6.21) that are all in the acceptable range. Thus, this model will be used for testing causal relationships among identified constructs through examining the established hypotheses.

Table 6.24 A summary of GOF statistics for tests of measurement models

Measurement	$\chi^2$ ; df/	$\chi^2$ /df	GFI	A	TLI	CFI	S	RM
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model	p-value			GFI			RMR	SEA
<b>A priori model</b>	1030.411 ; 506/ 0.000	2.036	0.817	0.785	0.868	0.881	0.0624	0.062
<b>1</b>	977.564; 505/ 0.000	1.936	0.826	0.795	0.881	0.893	0.0623	0.059
<b>2</b>	862.095; 498/ 0.000	1.731	0.843	0.812	0.907	0.917	0.0588	0.052
<b>3</b>	800.208; 490/ 0.000	1.633	0.855	0.824	0.919	0.929	0.0566	0.049
<b>4</b>	681.831; 405/ 0.000	1.684	0.864	0.833	0.924	0.934	0.0565	0.051
<b>5</b>	587.096; 376/ 0.000	1.561	0.877	0.848	0.940	0.948	0.0549	0.046
<b>6</b>	527.336; 348/ 0.000	1.515	0.884	0.855	0.947	0.955	0.0540	0.044
<b>7 Final model</b>	487.411; 321/ 0.000	1.518	0.889	0.860	0.949	0.957	0.0525	0.044

Table 6.25 Means, standard deviations, and factor loadings

Constructs	Indicators	Estimate	Sig.	Mean	SD	Mean	SD	$\alpha$
<b>PI</b>	PI2	0.590	***	2.524	1.031	2.922	0.861	0.775
	PI3	0.792	***	3.100	1.034			
	PI4	0.820	***	3.141	1.045			
<b>PA</b>	PA1	0.753	***	3.204	1.000	3.022	0.899	0.887
	PA2	0.749	***	2.758	1.205			
	PA3	0.898	***	3.130	1.080			
	PA4	0.791	***	3.372	1.038			
	PA5	0.659	***	2.647	1.081			
<b>CAE</b>	CA1	0.854	***	3.271	0.766	3.331	0.739	0.842
	CA2	0.907	***	3.361	0.782			
	CA3	0.670	***	3.535	0.784			
<b>CAC</b>	CA4	0.888	***	2.993	0.838	2.719	0.791	0.680
	CA5	0.586	***	2.446	0.974			

<b>CAF</b>	CA6	0.814	***	3.695	0.715	3.688	0.650	0.810
	CA7	0.837	***	3.680	0.703			
<b>SK</b>	SK1	0.753	***	3.156	1.039	3.223	0.879	0.818
	SK2	0.770	***	3.286	1.042			
	SK3	0.800	***	3.227	0.998			
<b>PU</b>	PU1	0.689	***	3.502	1.193	3.645	0.910	0.802
	PU3	0.771	***	3.691	1.135			
	PU4	0.686	***	3.390	1.140			
	PU6	0.694	***	3.996	1.128			
<b>SA</b>	SA1	0.708	***	2.766	0.939	2.413	0.807	0.919
	SA2	0.712	***	2.297	0.962			
	SA3	0.920	***	2.520	0.960			
	SA4	0.813	***	2.204	1.011			
	SA5	0.877	***	2.520	0.912			
	SA6	0.831	***	2.171	0.954			

Note: **Sig.**=Significance level, **SD**=Standardised deviation,  $\alpha$ = Cronbach's alpha

Deleted variables: PI1, SC, PI3, PU5

Table 6.26 Inter-construct correlations

	<b>PI</b>	<b>PA</b>	<b>CAE</b>	<b>CAC</b>	<b>CAF</b>	<b>SK</b>	<b>PU</b>
<b>PI</b>							
<b>PA</b>	0.237**						
<b>CAE</b>	0.304***	0.144*					
<b>CAC</b>	0.095 ns	0.103 ns	0.533***				
<b>CAF</b>	0.188*	0.211**	0.579***	0.388***			
<b>SK</b>	0.272***	0.347***	0.476***	0.323***	0.376***		
<b>PU</b>	-0.284***	-0.347***	-0.283***	-0.109 ns	-0.094 ns	-0.323***	
<b>SA</b>	-0.501***	-0.366***	-0.187**	-0.115 ns	-0.038 ns	-0.301***	0.287***

Note: \*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ , ns =  $p > 0.05$

Table 6.27 Squared inter-construct correlations, the average variance extracted, and construct reliability

	<b>PI</b>	<b>PA</b>	<b>CAE</b>	<b>CAC</b>	<b>CAF</b>	<b>SK</b>	<b>PU</b>	<b>SA</b>	<b>CR</b>
<b>PI</b>	<b>0.549</b>								0.782
<b>PA</b>	0.056	<b>0.599</b>							0.881
<b>CAE</b>	0.092	0.021	<b>0.667</b>						0.855
<b>CAC</b>	0.009	0.011	0.284	<b>0.566</b>					0.715
<b>CAF</b>	0.035	0.045	0.335	0.151	<b>0.682</b>				0.811
<b>SK</b>	0.074	0.120	0.227	0.104	0.141	<b>0.600</b>			0.818
<b>PU</b>	0.081	0.120	0.080	0.012	0.009	0.104	<b>0.505</b>		0.803
<b>SA</b>	0.251	0.134	0.035	0.013	0.001	0.091	0.082	<b>0.663</b>	0.921

Note: **AVE** is in bold in the diagonal

To sum up, with respect to validity, as evidenced by the produced values of each factor loading ( $> 0.5$ , preferably  $> 0.7$ ), and the AVE of each construct ( $> 0.5$ ), it can be interpreted that convergent validity was achieved. As verified by the values of squared inter-construct correlations, all rated lower than the values of AVE of each construct with its squared correlations with other constructs, it can be regarded that discriminant validity was met. Furthermore, the CR values of each construct, greater than 0.7 represent that there is no concern about construct reliability (Hair et al., 2010). The relevant values are listed in the last row in the Table 6.23.

#### · **Test of multi-group invariance (between genders)**

A multi-group equivalence test was conducted based on the re-specified measurement model (Model 7). Testing for measurement invariance is essential, since the moderating role of gender in the relationship between perceived physical ability and perceived uncontrollability has been hypothesised, and will need to be examined accordingly. The importance of measurement invariance is accounted for as follows. Evidence of measurement invariance is described as a required condition for the subsequent judgements based on the results generated through the measure to be regarded as trustworthy (Steenkamp and Baumgartner, 1998). It is also explained that it is a prior condition for outcomes from testing moderating effect to be judged reliable (Hair et al., 2010). For these reasons, a test of invariance was carried out first, followed by a test of moderation. The procedure of the test applied in the present study is in accordance with the process of testing multi-group invariance suggested by Byrne (Byrne, 2016).

#### · **Test of configural invariance**

It is described that, before examining invariance, determining a baseline model is the initial step. It is explained as a process to identify an optimised model which best fits to each data set of both groups, however, the best-fit models could vary depending on the sample. In this study, although modifications could be added according to fitness of models, the final measurement model (Model 7) suggested in the previous section has been decided to be used without additional modifications. It was because re-specification at this phase could make it harder to make a judgement about equivalence (Byrne, 2016). It was also because the model fit adequately to

the data sets for both groups when male, and female model were tested separately. The information on the GOF statistics of both groups is presented in the Table 6.28. As shown, considering the adequate fit indices, it seems appropriate to reason that the both models are fitted well to the data for each group. In terms of configural invariance, it is verified when a configural model fits well across the groups. This can be assessed through testing a configural (baseline) model, without imposing any constraints on parameters, with using the data for both groups in the same estimation simultaneously. The evidence of configural invariance is adequacy of model fit across the groups. The indices used for assessment of configural model are  $\chi^2$  statistics, CFI, and RMSEA (Byrne, 2016). As exhibited, the model fit well to the data across male and female groups, thus, it seemed appropriate to conclude that configural invariance was supported. The fit statistics of this model will perform as baselines for judgement of between-group equivalence, compared to fit statistics of subsequent models which will be specified to test for measurement invariance.

Table 6.28 Baseline (configural), male, and female model

	<b>Model</b>	<b><math>\chi^2</math>; df/p-value</b>	<b><math>\chi^2</math>/df</b>	<b>CFI</b>	<b>RMSEA</b>
<b>1</b>	Baseline model-Male	486.785;321/0.000	1.156	0.919	0.062
<b>2</b>	Baseline model-Female	396.685;321/0.003	1.236	0.956	0.042
<b>3</b>	Baseline (configural) model/ Unconstrained (totally free)	883.467;642/0.000	1.376	0.936	0.038

**Notes:** : Evidence of configural invariance

### • Test of measurement invariance

According to the results of the assessment of configural invariance, the factor structure is analogous for male and female group. However, it can hardly be estimated at which level the models differ because no parameters were imposed in the model used for testing configural invariance. The subsequent test was conducted to determine “the extent to which parameters in the measurement and structural components of the model are equivalent across the two groups”. Elucidating the process for determination of measurement invariance, first, it is implemented through comparing  $\chi^2$  test results of a configural model (totally free model) and those of a measurement model with constraints imposed for all factor loadings. Since,

$\chi^2$  difference test is commonly selected as a method for confirmation of equivalence between models (Yoo, 2002; Byrne, 2016). If the difference is shown to be non-significant, it is the evidence of full measurement invariance. However, if it is determined to be significant, it is evidence for non-invariance. Second, if it is ascertained that the models are non-invariant at this level, subsequent tests for invariance of factor loadings of each construct are needed. Third, if non-invariance of factor loadings at subscale level is confirmed, then tests for equivalence of each factor loading need to be performed. Through the step, equality constraints for factor loadings which have been determined to be equivalent remain in the subsequent tests, however, they are released for loadings found to be non-equivalent. Multiple tests have been implemented, and the results are presented below in the Table 6.29. As displayed in the table, the second test (Model B), comparison between the Model A and B reveals that the  $p$ -value of the  $\Delta\chi^2$  test produced was 0.001, which is the evidence of non-invariance, therefore, full measurement invariance has not been supported. Full measurement invariance can hardly be achieved, and is not required as a prior condition for execution of further tests (Byrne, 2010; Steenkamp and Baumgartner, 1998). Therefore, as full measurement invariance was not achieved in this present study, partial measurement invariance is expected and subsequent tests will be carried out to verify it. Based on the results of the following tests from the third to tenth test, it was identified that the noninvariant factor loadings between genders are inherent in the construct PI, PA, and SK. The construct showing the biggest difference based on the significance level, was the target of the subsequent test, thus, equality constraints for each factor loading of PA were added one by one, and the differences were compared. PA 5 was released, since inclusion of the constraints of the factor led to noninvariance. Finally, after the constraints for PA5, SK3, PI2 were released, partial measurement invariance was achieved, presenting the non-significant  $p$ -value.




Table 6.29 A summary of  $\Delta\chi^2$  test results for assessment of measurement invariance

<b>Model</b>	<b>Constrained factor loadings</b>	<b>Comparative models</b>	<b><math>\chi^2</math></b>	<b>df</b>	<b><math>\Delta\chi^2</math></b>	<b><math>\Delta</math> df</b>	<b>Statistical significance</b>
<b>A</b>	Unconstrained	-	883.467	642	-	-	-
<b>B</b>	All loadings	A vs B	929.63	662	46.164	20	0.001
<b>C</b>	Loadings only for PI	A vs C	890.976	644	7.509	2	0.023
<b>D</b>	Loadings only	A vs D	900.193	646	16.726	4	0.002

	for PA						
<b>E</b>	Loadings only for CAE	A vs E	887.065	644	3.598	2	0.165
<b>F</b>	Loadings only for CAC	A vs F	883.476	643	0.009	1	0.926
<b>G</b>	Loadings only for CAF	A vs G	883.561	643	0.094	1	0.759
<b>H</b>	Loadings only for SK	A vs H	894.404	644	10.937	2	0.004
<b>I</b>	Loadings only for PU	A vs I	886.563	645	3.096	3	0.377
<b>J</b>	Loadings only for SA	A vs J	887.981	647	4.515	5	0.478
<b>K</b>	Loadings for CAE, CAC, CAF, PU, SA	A vs K	894.833	654	11.366	12	0.498
<b>L</b>	Model K with PA1	A vs L	898.129	655	14.662	13	0.32
<b>M</b>	Model K with PA1, PA2	A vs M	904.436	656	20.970	14	0.102
<b>N</b>	Model K with PA1, PA2, PA3	A vs N	906.905	657	23.438	15	0.075
<b>O</b>	Model K with PA1, PA2, PA3, <u>PA5</u>	A vs O	915.699	658	32.233	16	0.009
<b>P</b>	Model K with PA1, PA2, PA3, SK1	A vs P	907.833	658	24.366	16	0.082
<b>Q</b>	Model K with PA1, PA2, PA3, SK1, <u>SK3</u>	A vs Q	917.575	659	34.109	17	0.008
<b>R</b>	Model K with PA1, PA2, PA3, SK1, <u>PI2</u>	A vs R	915.045	659	31.579	17	0.017
<b>S</b>	Model K with PA1, PA2, PA3, SK1, PI3	A vs S	910.654	659	27.187	17	0.055

**Notes:** df: degrees of freedom,  $\Delta\chi^2$ : changes in  $\chi^2$ ,  $\Delta$ df: changes in degrees of freedom,

Underlined: Released constraints of loadings in the subsequent test,

- : Nonsignificant  $\Delta\chi^2$ ,
- : Full measurement invariance not supported,
- : Partial measurement invariance supported

As evidenced by the non-significant  $p$ -value of the  $\chi^2$  difference of the Model S, it can be interpreted that partial measurement invariance has been gained. This model will be used for testing for the moderating effect of gender later in this chapter.

- **Structural model assessment and re-specification**

This section describes the process of testing the structural equation model formulated based on the modified measurement model and the results. Through the modification process, the construct 'Confidence in the relevant authorities (CA)' has been divided into the three different constructs, 'Confidence in the relevant authorities engagement (CAE)', 'Confidence in the relevant authorities communication (CAC)', and 'Confidence in the relevant authorities fairness (CAF)'. Additionally, the construct 'Informal social control (SC)', and the indicators, PI1 from 'Perceived invulnerability', PU2, and PU5 from 'Perceived uncontrollability' have been dropped. Consequently, the structural model consists of eight latent variables, including twenty eight indicators. As previously mentioned, CAC and CAF were hypothesised as the determinants of CAE supported by the relevant studies clarifying the interrelationships among the constructs. Therefore, six hypothesised relationships were tested, and modifications were applied through the process. The test results of the finalised model are presented in the Figure 6.19.

The analysis and modification process will be described in four stages. They are first, testing for the a priori structural model developed based on the modified measurement model, second, modified structural model, third, the hypothesised mediation effects which will provide evidence for verification of the hypotheses. Lastly, an alternative model will be offered which presents enhanced explanatory power of the model.

- **A priori structural model test results**

First, the a priori structural equation model was tested. Looking at the confirmed relationships, it was identified that 'Perceived invulnerability (PI)', 'Perceived physical ability (PA)', were negatively associated with 'Perceived uncontrollability (PU)'. PU was positively correlated with 'State anxiety (SA)'. Further, CAC and CAF were verified as determinants of CAE. Examining the structural paths which were not significant, they were 'Confidence in the

authorities engagement (CAE)', and 'Safety knowledge (SK)' to SA. It seems a further scrutiny of the relationships is needed. In terms of the relationship between SK and PU, based on the modification index and parameter change of the direct relationship between SK and SA were relatively high, as 9.152, and -0,200 respectively. These might imply the potential likelihood of the direct relationship between SK and SA may be significant. As theoretical supports, Lazarus explains knowledge on coping in the cognitive appraisal of threat, suggesting example such as, knowing where exits are in a theatre in case of fire, or being aware of street conditions when faced with sudden floods. These types of knowledge can be taken into account before or after the assessment about how threatening the situation is (primary appraisal). Basically, the activities for coping are mentioned to be a process engaged to reduce the level of potential harm. Therefore, the perceived safety knowledge in the hypothetical situation, when seeing other passengers' anti-social behaviour, could play a role as the resources for knowing what to do in the situation, its role as a buffer of anxiety was effective accordingly (Lazarus and Opton, 1966). An analogous situation when potential danger is anticipated is empirically tested in the Jones et al.'s study on fear of fire. The level of fear of the subjects in the group who were exposed to safety information delineating procedures to take in the fire-related emergency was reduced significantly that the untrained group (Jones et al., 1989). Craske and Barlow address the level of fear might be moderated by availability of safety procedures (Craske and Barlow, 1988), using Rachman's remarks, provision of resources of safety would lead to new safety procedures to be established, in turn will contribute to fear reduction (Rachman, 1984). Given that, the safety knowledge is re-hypothesised to have a direct impact on state anxiety in this study. As nonsignificant paths are recommended to be removed in a structural model, for the sake of parsimony (Byrne, 2010 p. 185), the path SK→PU was eliminated in the subsequent test. The hypothesis testing results and the model fit statistics are suggested in the Figure 6.18.



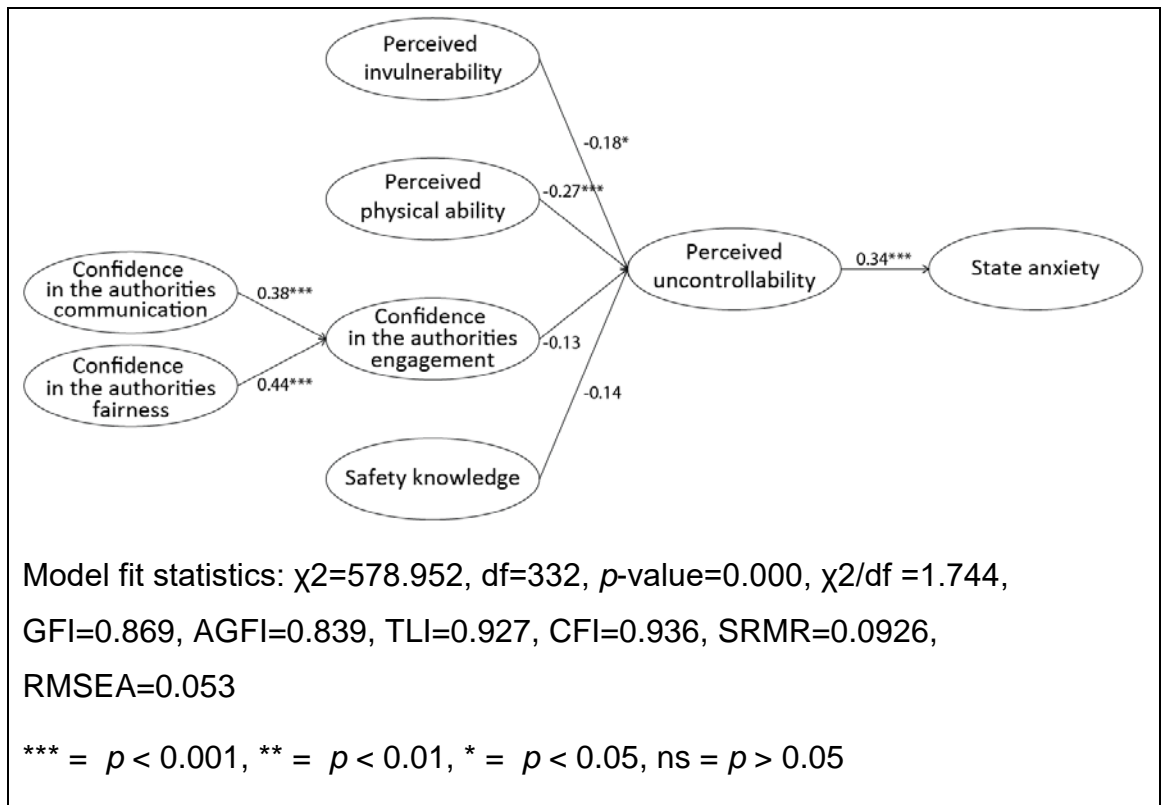


Figure 6.18 A priori structural equation model developed based on the modified measurement model

Table 6.30 Structural model modification process

Type of model	Modifications	Issues	
		MI/Par change	Non-sig paths
A priori model		SK-SA: 9.152/-0.200	CAE → -PU ( $p=0.063$ ) SK → -PU ( $p=0.090$ )
Final model	Direct path between SK and SA	-	-

It has been confirmed that the relationship between SK and SA was significant after the modification, as well as the relationship between CAE and PU. The results are shown in the Table 6.32

- **Final hypothesis test results**

Before finally confirming the hypotheses, further examination an intervening effect (Mathieu and Taylor, 2006) of the factor ‘Perceived uncontrollability (PU)’ was conducted. To start with, addressing conditions of mediation seems necessary, since there have been divergent views on mediating effect (ibid).

First of all, according to Baron and Kenny, in order for a mediation relationship to be valid, an association between predictor (X) and outcome

variable (Y) should be significant as a prerequisite, then a relationship between (X) to an intervening variable (M) should be significant. Subsequently, the significance of the relationship of the  $M \rightarrow Y$  with X being controlled needs to be attested (Baron and Kenny, 1986; Kenny et al., 1998). Second, MacKinnon et al.'s (MacKinnon et al., 2002) elucidates that “an intervening variable (mediator) transmits the effect of an independent variable to a dependent variable”, which means mediation is established when the indirect effect is significant which is transmitted by the  $X \rightarrow M$ , and  $M \rightarrow Y$ . The two different perspectives have created confusion about the concepts of mediation, and led to usage of the term mediator interchangeably when referring to a mediating or an indirect affect (Holmbeck, 1997). Preacher and Hayes (Preacher and Hayes, 2004) help clarify the confusion by mentioning “a mediated effect is usually thought of as the special case of indirect effects when there is only one intervening variable”. It is added that in order for indirect effects to be justified, the assumption which is statistical significance of an  $X \rightarrow Y$  relationship is not required, and even when a significant total effect is not found, an indirect effect of X to Y through an intervening variable can be found. Also, indirect effects among the relationship of  $X \rightarrow M \rightarrow Y$  can be established when an  $X \rightarrow Y$  relationship is not significant (Hayes, 2009; Rucker et al., 2011), which is a prerequisite for mediation in the Baron and Kenny's approach (Baron and Kenny, 1986). As Baron and Kenny's approach has been criticised due to low statistical power produced (Mackinnon et al., 2007; MacKinnon et al., 2002). Additionally, scepticism has been expressed because the judgement whether indirect effects are formed or not is inferred from the test result of the set of hypotheses, rather than examining “the very thing” (Hayes, 2009). Hence, for the present study, the verification of the effect of the intervening variable PU was based on the concept of indirect effects. In order to assess the indirect effects, bootstrapping was used. Since the method is commonly used for testing mediating effects (Shrout and Bolger, 2002; Leth-Steensen and Gallitto, 2016), and in simulation study conducted by MacKinnon et al., bootstrapping method is seen more valid, when bias corrected bootstrap was used (MacKinnon et al., 2004), and it is available in some SEM software including AMOS (Hayes, 2009). According to the steps from the Hayes's study (Hayes, 2009), bias corrected bootstrap was selected, with using 95% confidence interval, and 5000 bootstrap samples. All the indirect effects through the PU were seen significant. The results are presented in the Table 6.31. Hence, it can be claimed the decisions of the hypothesis testing are made as supported based on confirmed significant indirect

effects among the relationships of PI → - PU → + SA, PA → - PU → + SA, and CAE → - PU → + SA.

Table 6.31 Bootstrap analysis results of the standardised indirect effects in the final structural model (95% CI)

Relationships	(1) PI → -PU → SA	(2) PA → -PU → SA	(3) CAE → -PU → SA
Standardised indirect effects	-0.047	-0.072	-0.044
Lower/Upper bounds (BC)	-0.132/-0.002	-0.162/-0.019	-0.102/-0.009
Two tailed Significance (BC)	0.031	0.003	0.012

Note: The relationships (1), (2), and (3) were tested simultaneously in the final structural model, Bias corrected percentile method was used, Two-tailed significance

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ , ns =  $p > 0.05$

Table 6.32 List of hypotheses in the modified structural model based on its test results, supported by the bootstrap analysis

	Hypotheses	Regression weights and $p$ -values	Decision
1	PI → - PU → + SA	-0.192* / 0.246***	Supported
2	PA → - PU → + SA	-0.295*** / 0.246***	Supported
3-1	CAE → - PU → + SA	-0.178* / 0.246***	Supported
3-2	CAC → + CAE	0.381***	Supported
3-3	CAF → + CAE	0.436***	Supported
5-1	SK → - SA	-0.255***	Supported

Note: As a result of the removal of the construct SC, the hypothesis 4 (SC → - PU → + SA) was not tested. The dropped indicators: PI1, PU2, PU5

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ , ns =  $p > 0.05$

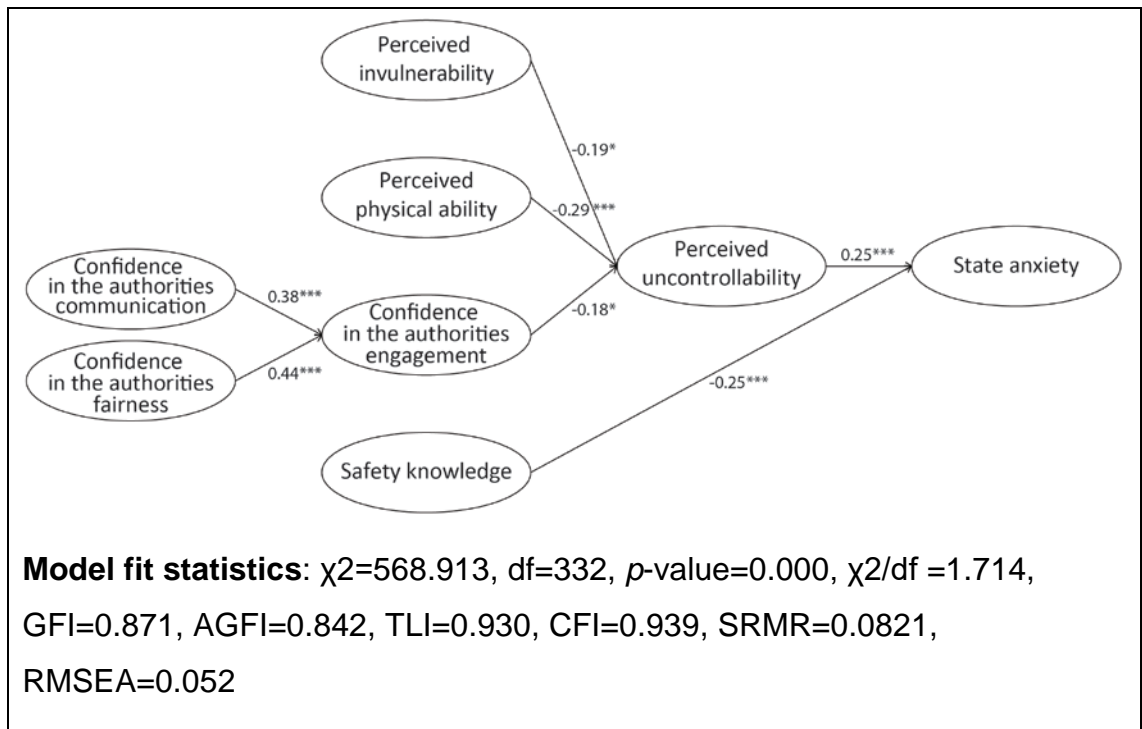


Figure 6.19 Final structural equation model

- **Testing a moderating effect of gender**

Assessment of a moderating effect is an extension of multi-group invariance test. As partial metric invariance was obtained in the model with the equality constraints for the factor loadings of PA5, SK3 and PI2 relaxed, it will be taken into account for the analysis. In other words, in this examination, the same equality constraints were imposed as the model, along with an equality constraint assigned to the structural path between PA and PU. The non-significant test  $p$ -value of the  $\chi^2$  difference test demonstrated that the moderating effect was not supported. However, the value was slightly below the threshold level, it might be weak evidence of the effect.

Table 6.33 A summary of GOF statistics and  $\Delta\chi^2$  test results for assessment of moderating effect of gender

Model	Constrained factor loadings	Comparative model	$\chi^2$	df	$\Delta\chi^2$	$\Delta df$	Statistical significance
A	Unconstrained	-	962.958	664	-	-	-
B	All factor loadings constrained equal except for PA5, SK3, PI2, with the	A vs B	991.266	682	28.308	18	0.058

	structural path PA-PU constrained equal						
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Notes: Underlined: Released constraints of loadings

## 6.4. Chapter summary

In this summary, a brief recap of the research model formulation, and that of the research model testing process and its results will be described. This study endeavours to identify the causal relationships among the constructs regarding cognitive appraisal of threat which leads to anxiety deduced from the cognitive theory of stress and coping (Lazarus, 1966; Lazarus and Folkman, 1984) which provides theoretical grounds on the cognitive appraisal process, included in the model of a trait-state conception of anxiety (Spielberger, 1966; 1972). In the threat appraisal process, there are two types of assessments, they are primary and secondary appraisal. As a construct relating to primary appraisal, which relates to identifying whether the situation is harmful, beneficial or irrelevant, perceived invulnerability is suggested. As constructs connected to secondary appraisal, which concerns with coping resources and options, physical ability, informal social control, confidence in the authorities, and safety knowledge are presented. As perceived uncontrollability is widely addressed as a significant factor influencing anxiety or stress, it is hypothesised to be negatively associated with anxiety. Moreover, control is addressed as a product of the appraisals of resources and options for coping, and the capability to implement them (Folkman, 1984), thus it is hypothesised to be an outcome of the antecedents, as well as a predictor of anxiety. Also, on the basis of empirical results of the relevant studies, hypotheses are formulated that the constructs pertaining to primary and secondary appraisal are negatively associated with state anxiety mediated through the effect of perceived uncontrollability. For the test of the hypotheses, structural equation modelling was used. The analysis consists of five main phases, first, confirmatory factor analysis (CFA), second, test of measurement invariance, third, evaluation of the structural equation model, fourth, examination of the indirect effect of perceived uncontrollability to confirm its role as a mediator, lastly, test of moderating effect of gender. Multiple modifications were implemented during

the CAF, and structural model testing process, based on strong theoretical and empirical supports. The effect of informal social control was not able to be tested, since it was deleted during the CFA process, due to its low AVE and CR values. The results reveal that perceived invulnerability, perceived physical ability, and confidence in the authorities engagement (which was predicted by confidence in the authorities communication, and fairness) had significant indirect influence on anxiety through perceived uncontrollability, however, safety knowledge had a direct impact on anxiety. The moderating effect of gender in the relationship between perceived physical ability and perceived uncontrollability was not supported.

In sum, useful information has been obtained based on the empirical findings which enable to establish intervention strategies for designing information to help reduce the Underground users' anxiety. Overall, greater anxiety reduction is likely to be expected when individuals tend to believe that negative events result from other passengers' anti-social behaviour are less likely to occur to them, and coping resources and options are better provided and perceived.

## **Chapter7. Discussion**

### **7.1. Introduction**

This chapter discusses the main findings from the accomplished primary studies. First, the results are summarised based on the explorative study which consisted of an exploratory survey questionnaire, an expert group interview, and photography. Second, the results are discussed based on the quantitative study findings achieved from testing of the research model and the hypotheses, through the analysis of the empirical data gathered from an explanatory questionnaire survey. Interpretations are made based on the findings.

### **7.2. Summary of the studies and findings**

#### **7.2.1. Explorative study**

The pilot study was conducted to explore the London Underground passengers' anxiety, which was comprised of three sub-studies, which were an exploratory questionnaire, an expert group interview, and photography. First, a wide variety of negative situations were reviewed in the relevant literature about public transport use, and an exploratory questionnaire was developed and then conducted to identify anxiety situations. In the development process, scales that measure anxiety in non-clinical situations were reviewed, and the structures of the anxiety screening questions were designed according to the format, for instance, "I feel anxious when...", followed by the each selected negative situation. According to the results from the questionnaire data, the main anxiety inducing situations were when seeing other passengers' anti-social behaviour, over-crowding in trains or at platforms, too much noise, and late-night travel, long-waits, disruptions, missing train announcements, or platform announcements, no toilet access, and not being able to find information from signs. With regard to difference between genders, the female participants tended to report higher levels of anxiety about all the situations, with the exclusion of the items, disruptions, no toilet access, and not being able to find information from signs. Amongst the negative situations, the most anxiety inducing situation, which was when

seeing other passengers' anxiety was selected as the stressor for developing the research model of anxiety. Second, in the expert group interview, the measures and activities which are taken to support passengers' personal safety especially in the potential anxiety-inducing situations, such as when seeing anti-social behaviour, and the types of resources which are equipped to be harnessed by the passengers were identified. As the relevant activities, campaigns and events which offer the opportunities for passengers to directly communicate with the staff were mentioned, and as the related physical and human resources, help points, passenger alarms, CCTVs, and help from station staff were addressed. By using photography, the suggested resources were surveyed. Those aforementioned resources were used as items for constructs relating to safety knowledge in the research model.

### **7.2.2. Quantitative study**

The main study consists of two sections, they are first, research model and hypothesis formulation, and second, test of the research model.

#### **7.2.2.1. Research model formulation**

A research model and hypotheses were developed based on the Spielberger's state-trait conception of anxiety (Spielberger, 1966; 1972), whose threat appraisal process is accounted by the Lazarus's cognitive theory of stress and coping (Lazarus 1966; Lazarus and Folkman, 1984). The theory sheds light on the individuals' cognitive threat appraisal process, by proposing two classes of appraisals, which are primary, and secondary appraisals. The former appraisal relates to identification of a stimulus in the situation whether it is threatening (harmful), beneficial or irrelevant, the latter appraisal pertains to coping activities, whose process is set in motion whose function is to minimise the potential harm (Lazarus and Opton, 1966). A situational appraisal of control is described as products of assessments of the individuals' resources and options for coping and their capability to practice the strategies for coping (Folkman, 1984). These theoretical ideas take a cognitive approach to inquiry into anxiety and emotion. The reasons for applying the approach into this present study is that, it is popular amongst clinicians, and it is particularly beneficial for treating anxiety allowing to directly tackle individuals' cognitive appraisals (Barlow, 2002).



Further, the approach is addressed by Bagozzi et al. (Bagozzi et al., 1999), and Johnson and Stewart (Johnson and Stewart, 2005) as a promising avenue for inquiry of emotion in the context of consumer behaviour (Watson and Spence, 2007). Based on the model and theory which elucidate the process of anxiety including threat appraisal, with enabling the understanding about causality between stimuli and anxiety, factors pertaining to primary and secondary appraisals of coping are considered to be included in the model. Further, in order to identify the potential influencing factors of anxiety in the context of anti-social behaviour, the Killias's framework has been referred to which provides more detailed guidance in the selection of the factors (Killias, 1999). The framework explains vulnerability in fear of crime, proposing three dimensions and three factors of the vulnerability. The suggested dimensions are "exposure to risk, seriousness of consequences, loss of control", and suggested the factors are "physical, social, and situational" components (ibid). The three factors are associated with the dimensions, in this study, they are postulated to be related to loss of control, and then lead to anxious arousal. On the basis of the theoretical background, the research model has been built, which is comprised of five influencing factors of anxiety mediated through perceived uncontrollability, and state anxiety. The factors are presented as follows. As a factor concerning primary appraisal, perceived invulnerability is presented. As factors associated with secondary appraisal, perceived physical ability (physical factor), informal social control (social factor), and confidence in the authorities, and safety knowledge (situational factors) are demonstrated.

#### **7.2.2.2. Research model and hypothesis testing**

The results of the model and hypotheses testing will be discussed. The model testing process mainly comprised five phases: exploratory factor analysis (EFA), confirmatory factor analysis (CFA), test of measurement invariance, test of the structural equation model, and moderation effect of gender. Firstly, in the EFA process, the underlying structures of the construct 'Confidence in the relevant Authorities' were identified. The construct was divided into three factors, 'Confidence in the relevant Authorities Engagement (CAE)', 'Confidence in the relevant Authorities Communication (CAE)', and 'Confidence in the relevant Authorities Fairness (CAF)'. Secondly, in the CFA process, construct validity and reliability were examined, and a number of modifications were applied based on theoretical and empirical reasons. Also, the construct 'Informal Social Control (ISC)',

and the indicators, PI1 (Perceived Invulnerability 1: nothing serious would happen in the situation), PU2 and PU4 (Perceived Uncontrollability 2, 4: matter of chance, not my action) were removed from the model, due to relatively low contribution to measuring the constructs. After the practiced modifications, all the constructs presented adequate level of construct validity and reliability. Moreover, measurement invariance which is considered as a prerequisite of testing moderating effect (Byrne, 2016) was achieved after the constraints of the factor loadings for three indicators were released. They were, PA5 (possessions of self-defence techniques), SK3 (knowledge in what to do in emergency), PI2 (likelihood of a bad thing happens now due to lack of experiencing problems resulting from anti-social behaviour). It presents the evidence of partial measurement invariance ( $\Delta\chi^2$  test statistical significance,  $p = 0.055$ ). Fourthly, structural equation model was examined in order to investigate the intensities and significances of the relationships among the constructs. In general, the findings paralleled the theoretical arguments and predictions. The results are presented in the Figure 7.1 in conjunction with the Table 7.1 and Table 7.2. Perceived invulnerability was suggested as a construct pertaining to primary appraisal, and perceived physical ability, confidence in the relevant authorities, and safety knowledge were proposed as constructs involving secondary appraisal of coping resources and options. The results were revealed that perceived invulnerability is negatively associated with anxiety mediated through perceived uncontrollability. Also, perceived physical ability was negatively related to anxiety mediated through perceived uncontrollability. Additionally, confidence in the relevant authorities (CA) was negatively correlated with anxiety mediated through perceived uncontrollability. As previously mentioned, the construct CA was separated into three constructs, CAE, CAC, and CAF in the EFA process. The decision was made based on empirical support in the CFA process (large MI/EPC of e15-e16 = 51.145/0.295, those of e13-e14 = 88.190/0.212), and theoretical support which explains that communication between the citizen and police predicts police engagement (Hohl et al., 2010), and police fairness accounts for confidence in the authorities engagement (Jackson and Bradford, 2010). Thus it was modified as CAC and CAF predict CAE, and the relationships were significant (0.038\*\*, 0.44\*\*). Consequently, the effect of CAE was confirmed as a significant determinant mediated through perceived uncontrollability. Moreover, the direct negative effect of safety knowledge on anxiety was ascertained as significant. Fifthly, moderating effect of gender was tested. As previously described, the measurement invariance was

tested, and partial measurement invariance was achieved with releasing the constraints of the loadings of the three factors. The moderating effect was tested by comparing the  $\chi^2$  difference between the male and female model, and the result was revealed that the moderating effect was not significant ( $\Delta\chi^2$  test statistical significance  $p = 0.058$ ).

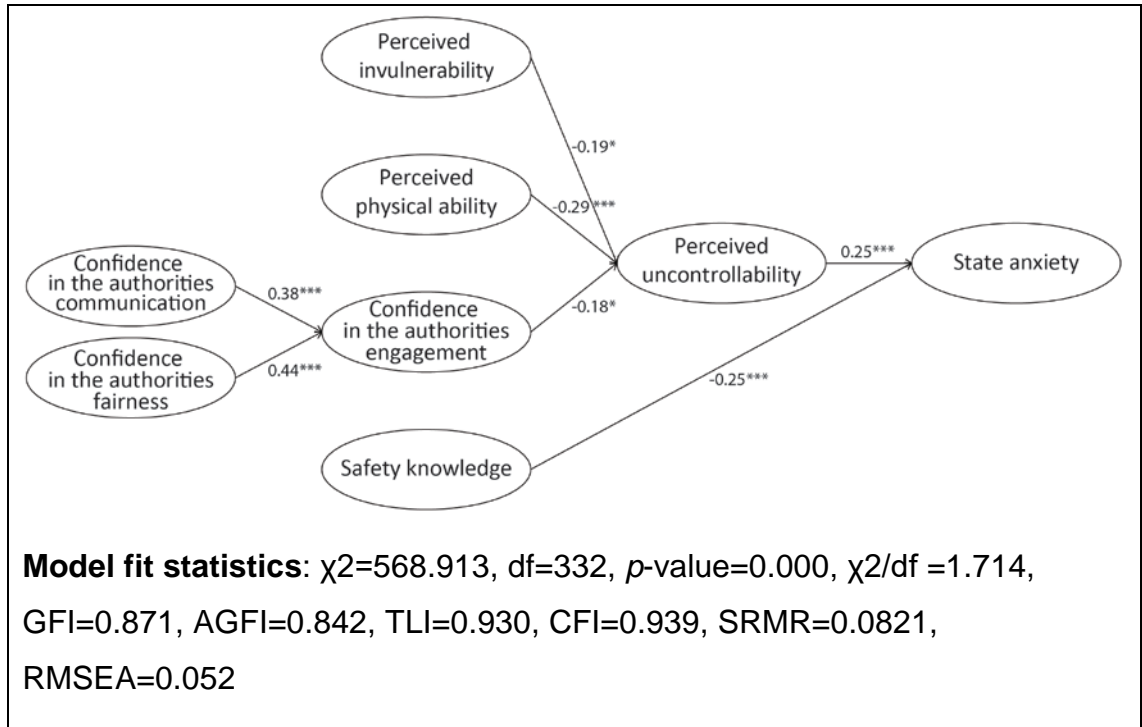


Figure 7.1 Final structural equation model

Table 7.1 Bootstrap analysis results of the standardised indirect effects in the final structural model (95% CI)

Relationships	(1) PI → -PU → SA	(2) PA → -PU → SA	(3) CAE → -PU → SA
Standardised indirect effects	-0.047	-0.072	-0.044
Lower/Upper bounds (BC)	-0.132/-0.002	-0.162/-0.019	-0.102/-0.009
Two tailed Significance (BC)	0.031	0.003	0.012

Note: The relationships (1), (2), and (3) were tested simultaneously in the final structural model, Bias corrected percentile method was used, Two-tailed significance

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ , ns =  $p > 0.05$

Table 7.2 Hypothesis testing result

	Hypotheses	Regression weights and <i>p</i> -values	Decision
1	PI→ - PU→ + SA	-0.192* / 0.246***	Supported
2	PA→ - PU→ + SA	-0.295*** / 0.246***	Supported
3-1	CAE→ - PU→ + SA	-0.178* / 0.246***	Supported
3-2	CAC→ + CAE	0.381***	Supported
3-3	CAF→ + CAE	0.436***	Supported
5-1	SK→ - SA	-0.255***	Supported

Note: As a result of the removal of the construct SC, the hypothesis 4 (SC→ - PU→ + SA) was not tested. The dropped indicators: PI1, PU2, PU5

\*\*\* =  $p < 0.001$ , \*\* =  $p < 0.01$ , \* =  $p < 0.05$ , ns =  $p > 0.05$

### 7.3. Discussions of the findings

Interpretations drawn from the test results will be described in two sections, they are first, interrelationships among the factors, and second, moderating effect of gender.

#### 7.3.1. Testing the interrelationships among the constructs

The quantitative study has been conducted with the purpose to examine the hypothesised causal relationships among the constructs including an intervening variable and a moderator variable by using structural equation modelling techniques. In order to achieve the goal, five phases of analysis were proceeded. First, exploratory factor analysis was practiced to mainly investigate the underlying structure in the construct 'Confidence in the Authorities (CA)'. Second, confirmatory factor analysis was conducted to chiefly evaluate the construct validity of the each construct (e.g. convergent and discriminant validity), and construct reliability, as well as model fit of the measurement models. Through the process, a number of modifications were applied, including deleting indicators, correlating errors based on the empirical and theoretical supports. Third, using the final measurement model, measurement invariance was tested and it was met after a number of constraints were released, which enabled a subsequent test of moderation effect of gender. Fourth, the magnitudes and significances of the causal relationships, including the hypothesised indirect effect of perceived uncontrollability in the structural model were examined. Fifth, the moderating

effect of gender was assessed in the final males' and females' structural equation models. Discussions will be mainly offered on the basis of the results generated in the fourth and fifth phases. The interrelationships among the constructs, the associations among the antecedents and anxiety, as well as the role of perceived uncontrollability in the threat appraisal process will be described. The findings were generally consistent with the relevant theories and the reviewed literature.

Regarding the relationships between the suggested constructs and anxiety, perceived invulnerability which was considered as a construct pertaining to primary appraisal, and perceived physical ability, and confidence in the authorities which were assumed to be coping resources and options relating to secondary appraisal, were negatively related to a sense of control, and in turn, the sense of uncontrollability was positively associated with anxiety. Additionally, perceived safety knowledge, which was proposed as one of the coping resources and options, was directly and negatively associated with anxiety. These findings represent that the potential harm perceived as a result of witnessing other passengers' anti-social behaviour tend to be cancelled out by the belief of invulnerability, and the known coping strategies. The results tend to parallel the claims inferred from the model of a trait-state conception of anxiety (Spielberger, 1966; 1972) and the cognitive theory of stress and coping (Lazarus and Folkman, 1984). Regarding the confirmed significant indirect effect of perceived uncontrollability, helps extend our knowledge on the relationship between coping and control. In terms of "situational appraisals of control" in the cognitive appraisal process, it is mentioned that they are products of the assessments of the demands in the situation, and of the individuals' capability to perform the required resources and options for coping (Folkman, 1984). The results from this study partially provide an empirical support for the assumption. In the results, appropriate discriminant validity among the construct of coping resources and perceived uncontrollability, and causal relationships between them were found. These results reveal that control is a distinguished concept from the coping resources and options, and may be a product of evaluations of them. However, in the final structural model, the mediating effect of perceived uncontrollability between safety knowledge and anxiety was not supported.

### **7.3.1.1. Indirect effect of perceived invulnerability to anxiety through perceived uncontrollability (H1)**

Perceived invulnerability is considered as a factor related to primary appraisal, in the context that previous experience of getting victimised has been regarded as one of the individual factors in primary appraisal (Wright and Fitzgerald, 2007). A sense of invulnerability is shattered by experiences of actual victimisation, and helplessness may have been experienced during the negative events which were seen uncontrollable (Peterson and Seligman, 1983; Janoff-Bulman and Frieze, 1983). Perloff addresses that individuals' perception of vulnerability is intensified after experiencing traumatic events, with their perceived invulnerability being shattered, and with psychological stress induced. In this sense, it is suggested that "illusions of unique invulnerability" which have a buffering effect against anxiety and an improving effect of perceived control (Perloff, 1983). In this study, the test result whose buffering effect on anxiety mediated through perceived uncontrollability was confirmed. Thus, it seems to be important to assist the users to retain the belief. Since, it is a belief that individuals are less vulnerable which is maintained among persons who have not been victims of certain negative life events. The belief tends to be a source of sense of control, as well as a moderator of anxiety (Perloff, 1983). The perception might be adaptive in the sense that it helps mitigate anxiety, and boost a sense of control. It is mentioned as an adaptive coping strategy for elders (Hunt and Stein, 2004). However, it might be also maladaptive because the perception would lead non-victims to be less precautionary, and to feel much harder to recover after they get victimised (Perloff, 1983). Therefore, the tone of message which aims to make feel passengers safe simply by delivering information on low accident or crime rates, hence the likelihood of falling victim is low may not be appropriate, since it may develop their biased optimistic perception.

### **7.3.1.2. Indirect effect of perceived physical ability to anxiety through perceived uncontrollability (H2)**

There are a number of assets which perform as coping resources including physical asset, such as, individuals' health conditions and energy (Folkman, 1984). In addition, perceived physical ability is determined as a significant factor which predicts the fear-related arousal about crime (Killias and Clerici, 2000), and this relationship is further clarified by Jackson that perceived

physical ability to defend themselves influences sense of control, and in turn, worry about personal crime (Jackson, 2009). Thus, in the present study, perceived physical ability was assumed to have an indirect influence on anxiety through perceived uncontrollability. The result parallels to the previous studies which uncovered that the effect of perceived physical capability on worry about crime through the effect of control was significant, and its effect on perceived uncontrollability was higher than the rest of the variables (ibid). Based on the test results, it can be interpreted that the less the respondents felt able, such as, feeling that they can react quickly, and defend themselves because they are physically strong, and quick with their movements, and feeling that they have good control of movements, and self-defence techniques, the less they found the situation controllable, and then felt more anxious. Thus, it seems to be necessary to support users who find themselves feel less able, and provide appropriate supports so they can feel less vulnerable in the situation.

#### **7.3.1.3. Moderating effect of gender between perceived physical ability to perceived uncontrollability (H2a)**

Prior to testing the moderating effect of gender, measurement invariance was tested. In order to meet the equivalence, three factor loadings of the items, PA5 (possessions of self-defence techniques), SK3 (knowledge in what to do in emergency), PI2 (likelihood of a bad thing happens now due to lack of experiencing problems resulting from anti-social behaviour) were released. The effects of those indicators may widen the disparity between the male and female models, consequently, it would help enhance our understanding about the differences between genders. With the loadings of the items being relaxed, the moderating effect was evaluated, and the result revealed that the difference between the genders was not significant, showing the  $p$ -value of 0.058. This means, gender did not have a significant moderating effect in the relationship between perceived physical ability and uncontrollability. This can be interpreted that one unit change in perceived physical ability predict the equal amount of change in perceived uncontrollability of both male and female respondents (Myers et al., 2012; Conway et al., 2016). Consequently, an inference can be drawn that male passengers' physical ability is as significant as that of female passengers in accounting for perceived uncontrollability which is triggered by lack of physical ability. Although the moderating effect was not supported by the data, this still provides a meaningful aspect of control and anxiety.

Considering that “a moderator is a variable that alters the direction or strength of the relation between a predictor and an outcome” (Frazier et al., 2004), gender did not play a role in altering or strengthening the relationship between physical ability and perceived uncontrollability. In other words, a significant interaction was not found between the two regression lines (Kraemer et al., 2001). This means, perceived physical ability needs to equally be given weight as a contributing factor which predicts perceived uncontrollability of both males and females which leads to anxiety.

#### **7.3.1.4. Indirect effect of confidence in the authorities to anxiety through perceived uncontrollability (H4 rehypothsised)**

Confidence in the relevant authorities is suggested that it might be a potential source of hope for a resolution of negative situations in the London Underground environment. It can be seen as a type of social support, which has a positive impact on sense of control, and psychological wellbeing (Langford et al., 1997). Also, Barlow states that social support might have buffering effect against anxiety through enhancement of perceived control, amongst individuals with biological vulnerability, or persons who have undergone previous behavioural experiences which resulted in psychological vulnerability in unpredictable and uncontrollable situations (Barlow, 1998). In this sense, confidence in the authorities was hypothesised as a construct which is negatively associated with anxiety mediated through perceived uncontrollability. The perception that the authorities understand and deal with issues regarding anti-social behaviour which matter their journey presented indirect effect to anxiety through perceived uncontrollability. Therefore, it seems appropriate to argue that improvement of the confidence is necessary. The construct ‘confidence in the authorities (Transport for London and the British Transport Police)’ was ascertained that it consisted of three sub-factors through the exploratory factor analysis, and it fitted better to the data in the confirmatory factor analysis process. The rationales behind the decision were trust in the police engagement was predicted by police fairness as a separate construct (Jackson and Bradford, 2010), and also, communication between the citizen and police accounted for police engagement (Hohl et al., 2010). Consequently, the construct CA was divided into three constructs, which are confidence in the authorities engagement (CAE), communication (CAC), and fairness (CAF). Moreover, a causal structure was found among the variables, confidence in the authorities engagement was significantly



accounted by confidence in the authorities communication, and fairness. Thus, it seems reasonable to argue that the confidence in the authorities engagement is likely to be enhanced by sharing information on what the authorities attempt to tackle anti-social behaviour issues, and by seeking passengers' views (CAC). In addition, treating customers fairly, and being friendly and approachable would be helpful (CAF). Ultimately, confidence in the authorities engagement could be improved through tackling anti-social behaviour more effectively, and dealing with it which matters passengers' journey, as well as through understanding issues regarding anti-social behaviour which affect the passengers' journey.

#### **7.3.1.5. Safety knowledge to anxiety (H5 rehypothsised)**

Safety knowledge is considered to be used as coping resources and options in the stressful situation, when the passengers are seeing other people's anti-social behaviour. The initial hypothesis was modified after the testing of the a priori structural model, since the relationship between safety knowledge and perceived uncontrollability was not supported. It was rehypothsised that safety knowledge directly predicts anxiety, with being supported by Jones et al.'s study pertaining to fear of fire. The intensity of fear of the subjects in the group who were exposed to safety information describing procedures to take in the fire-related emergency was decreased significantly than the untrained group (Jones et al., 1990). Additionally, Craske and Barlow address the level of fear might be moderated by availability of safety procedures (Craske and Barlow, 1988), using Rachman's remarks, provision of resources of safety would lead to new safety procedures to be formulated, in turn will contribute to reduction of fear (Rachman, 1984). An empirical support was provided as relatively high modification index and parameter change of the direct association between safety knowledge and state anxiety (M.I. = 9.152, Expected Par Change = - 0.200) were found. Given that, the safety knowledge was re-hypothsised to have a direct impact on state anxiety. The result showed that safety knowledge had a direct negative impact on anxiety. Thus, it can be reasoned that provision of information on the location and usage of human or physical resources, such as emergency alarm, and help point, and what to do if there is an emergency as a process seems recommendable.

## **8. Conclusion**

### **8.1. Introduction**

This chapter concludes the thesis by revisiting the aim and objectives of this research to discuss accomplishment of the objectives, and by briefly reviewing the main findings from the explorative and quantitative studies. Recommendations for designing information will be provided. Further, contributions to knowledge generated through this study will be described. Lastly, limitations of this research followed by future work will be presented.

### **8.2. Restatement of aim and objectives**

#### **8.2.1. Aim**

This study has been conducted with an aim to develop theoretical grounds for designing information with the purpose to reduce passengers' anxiety by identifying the antecedents of anxiety, and establishing and testing a causal model of anxiety, which explicates the relationships among the antecedents and the level of anxiety, in order to provide insights for service providers and future designers to re-design information environments that help alleviate the passengers' anxious arousal

#### **8.2.2. Objectives**

- **Objective 1 (Chapter 2)**

To critically review the literature regarding designing information and the pre-existing studies discussing anxiety reduction through information provision, as well as to comprehensively review the relevant theories of anxiety and the literature regarding passengers' anxiety associated with public transport travel

First, a critical review of literature discussing designing information, focusing on its initial process, which has been tackled in the present study, along with a discussion about potential information needs in anxiety inducing situations have been carried out. Second, as this study was motivated by the

effectiveness of provision of information as an anxiety reduction strategy, a review of literature about pre-existing studies regarding reduction of travel related anxiety in public transport environment, and passengers' anxiety in pre-operative and pre-screening periods through information provision has been conducted. Further, a review of passengers' anxiety associated with public transport travel was performed to discern what has been discussed about the issue. A research gap was identified that the pre-existing literature discussing passengers' anxiety has scarcely proposed solutions for reducing anxiety by investigating causality between antecedents and the arousal. Further, scarcity of data which can be used for re-designing information has been observed, thus the identified causality has been decided to be linked as resources for design of information. Lastly, a comprehensive review of literature regarding anxiety, and its theories and models has been conducted. Amongst the diverse approaches to study of anxiety, cognitive approach was taken. Since it offers advantages which allow researchers to directly tackle individuals' appraisal process, and it is considered as a promising approach for inquiring into emotion in the context of consumer behaviour (Watson and Spencer, 2007).

- **Objective 2 (Chapter 4)**

To explore passengers' anxiety about encounters with negative situations in the London Underground environment and its service environment

Anxiety is a response to potential risk which is interpreted as threatening, thus it was significant to identify the stimuli in the environment. An exploratory questionnaire was developed and administered, which investigated the levels of anxiety about selected negative situations in public transport environment. Other passengers' anti-social behaviour was identified as the highest ranked anxiety trigger, and the female respondents rated higher level of anxiety about it. An expert focus group interview was performed to discover what types of supports were provided for passengers' safety. The suggested resources were surveyed at the Underground stations and in the trains.

- **Objective 3 (Chapter 5)**

To develop a research model of anxiety, and a set of hypotheses which explicate the influences of the factors on the passengers' anxiety

A research model was developed guided by the theoretical background, the Spielberger's state-trait conception of anxiety (Spielberger, 1966; 1972), and the Lazarus's cognitive theory of stress and coping (Lazarus, 1966; Lazarus and Folkman, 1984) both of which take a cognitive approach. On the basis of the knowledge gained through an understanding about how anxiety is elicited from the model and the theory, the Killias's analytical framework of different dimensions of vulnerability (in connection with fear of crime) (Killias, 1990) enabled more specifically to determine the factors pertaining to anxiety associated with anti-social behaviour in the context of fear of crime. The model which included five hypotheses was developed with an attempt to investigate the effects of the antecedents relating to primary appraisal and secondary appraisal of coping on anxious arousal through the effect of perceived uncontrollability.

- **Objective 4 (Chapter 6)**

To test and modify the proposed model of anxiety and the hypotheses against empirical data

The research model was tested through a series of steps, first, exploratory factor analysis (EFA) was conducted to evaluate underlying structure of the constructs, second, confirmatory factor analysis (CFA) was practiced, including test of construct validity, and construct reliability as well as goodness of fit of the model. In the CFA process, the construct 'informal social control' was removed. Third, measurement invariance was assessed, and partial measurement invariance was achieved after the constraints of loadings of three indicators were released. Fourth, a test of the structural equation model was implemented to examine the hypothesised relationships among the constructs. Generally, three hypotheses were accepted as they were predicted ( $PI \rightarrow -PU \rightarrow SA$ ,  $PA \rightarrow -PU \rightarrow SA$ ,  $CAE \rightarrow -PU \rightarrow SA$ ), one hypothesis was modified as its effect has an effect on anxiety ( $SK \rightarrow -SA$ ). Lastly, the moderating effect of gender in the relationship between perceived physical ability and perceived uncontrollability was confirmed as not significant.

- **Objective 5 (Chapter 7 and 8)**

To provide recommendations for designing information which aims to reduce the passengers' anxiety associated with the Underground travel, and to elucidate theoretical and practical implications of the study

On the basis of the findings, suggestions are offered for designing information that is expected to help relieve passengers' anxiety, which can provide insight to service providers and designers. Further, contributions to knowledge created through this research are delineated.

### **8.3. Summary of findings**

#### **8.3.1. Explorative study**

In the explorative study, anxiety associated with the London Underground travel was explored. First, potential anxiety inducing situations were determined according to the exploratory questionnaire data which was collected from 81 London Underground users. The anxiety triggers were identified as anti-social behaviour on the train or at platforms, over-crowdedness, too much noise, late-night travel, long waits, disruptions, missing train announcements, missing platform announcements, no toilet access, and not being able to find information from signs. The female respondents tended to rate higher anxiety than the males respondents.

#### **8.3.2. Quantitative study**

In the quantitative study, a research model of anxiety was established based on theoretical background which takes a cognitive approach to study of anxiety. The Spielberger's model which describes how state anxiety is elicited, proposing important components involved in the process. The model highlights the significance of threat appraisal process, whose outcome determines the level of arousal, and the process is accounted for by the Lazarus's cognitive theory of stress and coping. Based on the understanding about the process of elicitation of anxiety, Killias's framework (Killias, 1990) explaining vulnerability in fear of crime provided guidance in seeking for factors which may influence on anxiety about anti-social behaviour. Situational appraisals of control have been suggested as a product of individuals' evaluations of coping resources and options in the situation (Folkman, 1984). Besides, in the Killias's framework, three types of factors (physical, social, situational factors) are mentioned to be associated to loss of control (Killias, 1990). Consequently, perceived uncontrollability was hypothesised to be intervened in the relationship between the determinants of anxiety and anxious arousal. Accordingly, the model was

built in order to identify influencing factors of anxiety, and to examine the magnitudes and significance of the relationships, and also clarify interrelationships among the variables.

In total, five hypotheses were established, and the analysis process was composed of five phases. First, exploratory factor analysis was conducted to uncover the underlying structure of the set of variables (Fabrigar et al., 1999), and the results presented sufficient evidence that the construct 'Confidence in the relevant Authorities (CA)' consisted of three sub-constructs, which were 'Confidence in the Authorities Engagement (CAE)', 'Confidence in the Authorities Communication (CAC)', and 'Confidence in the Authorities Fairness (CAF)'. Second, confirmatory factor analysis (CFA) handles measurement model was carried out (Brown, 2014). In the process, construct validation was assessed including construct validity (convergent, discriminant validity), and reliability were examined. Initially, five hypotheses were developed, however, one of them has not been tested because the construct informal social control was deleted due to insufficient construct validity and reliability (factor loadings  $< 0.5$ , the AVE  $< 0.5$ , CR  $< 0.7$ , (Hair et al., 2010)) in the CFA process. Three indicators PI1 (Perceived Invulnerability 1: nothing serious would happen in the situation), PU2 and PU4 (Perceived Uncontrollability 2, 4: matter of chance, not my action) were removed due to relatively low contribution to measuring the constructs. After the modifications, all the constructs presented adequate level of validity and reliability. Third, measurement invariance was assessed in order to meet the condition in which moderating effect of gender can be tested later. After the constraints of three factor loadings (PA5: possessions of self-defence techniques, SK3: knowledge in what to do in emergency, PI2: more lowly appraised likelihood of a bad thing happens now due to lack of experiencing problems resulting from anti-social behaviour) were relaxed, partial measurement invariance was achieved across genders ( $\Delta\chi^2$  test statistical significance,  $p = 0.055$ ). Fourth, based on the EFA results, and reviewed pre-existing studies supporting the causal relationships among the construct CAE, CAC, and CAF, it was reypothesised that CAC and CAF predict CAE. The relationships were ascertained as significant (CAC  $\rightarrow$  CAE: 0.38\*\*\*, CAF  $\rightarrow$  CAE: 0.44\*\*\*). Consequently, it was reypothesised that CAE predicts state anxiety mediated through perceived uncontrollability. Thus, the four hypotheses were tested, and the results generally parallel the expectations. The test results demonstrated that perceived invulnerability, perceived physical ability, confidence in the authorities engagement were confirmed to be negatively associated with perceived uncontrollability (-

0.19\*, -0.29\*\*\*, -0.18\* respectively), and in turn, perceived uncontrollability was positively associated with state anxiety (0.25\*\*\*). The mediating role of perceived uncontrollability was confirmed as significant in the relationships through testing the indirect effect of perceived uncontrollability according to the results from bootstrapping analysis (standardised indirect effects: -0.047, -0.072, -0.044, significance: 0.031, 0.003, 0.012 respectively). Moreover, safety knowledge was negatively and directly associated with state anxiety (-0.25\*\*\*). In terms of perceived invulnerability, it performed as a source of control, therefore it was effective in reducing perceived uncontrollability. Regarding perceived physical ability, it also functioned as a resource for a sense of control, thus it was negatively related to perceived uncontrollability. With regard to confidence in the authorities engagement, it played a role in improving sense of control, hence it also showed negative association with perceived uncontrollability. The effects of the three constructs presented a significant indirect effect on state anxiety through perceived uncontrollability. Fifth, using the structural model with the constraints of the aforementioned three factors (PA5, SK3, PA5) being released, the moderating effect of gender in the relationship between perceived uncontrollability and anxiety was assessed. The result uncovered that the effect was not significant ( $\Delta\chi^2$  test statistical significance,  $p = 0.058$ ), which means that one unit change in perceived physical ability predict the equal amount of change in perceived uncontrollability of both male and female respondents (Montgomery et al., 2012; Conway et al., 2015).

In sum, according to the findings, the chosen factors have buffering effect either through the effect of perceived uncontrollability on anxiety or directly on anxiety. In order to create an environment which is expected to help relieve the passengers' anxiety, it seems important to assist the passengers to sustain the sense of invulnerability to a certain level, however, it might not be appropriate to simply highlight that the low probability of the occurrence of negative events, hence the likelihood of falling victim is low may not be appropriate, since it may develop their biased optimistic perception. Rather, it seems more important to support them with improving their knowledge on coping resources and options, such as, help point, emergency alarm, and staffed stations, and process for utilise the resources, because the direct and negative effect of safety knowledge on anxiety was confirmed. Also, it seems beneficial to improve the passengers' confidence in Transport for London and the British Transport Police's engagement in issues and concerns about anti-social behaviour issues of the passengers. Based on the findings that the confidence in the authorities was predicted by that of

communication and fairness, it would be helpful to seek the passengers' views on anti-social behaviour, and to inform the authorities' activities to tackle anti-social behaviour, as well as to treat the passengers fairly, and to be friendly and approachable. As the effect of physical ability has a negative effect on perceived uncontrollability, in turn it leads to anxiety, it seems that careful supports are needed for groups of users who feel that they are physically less able.

#### **8.4. Recommendations for designing information environments**

As this study was motivated by the verified effective role of information in alleviating travel-related anxiety (Lee and Oh, 2007), and anxiety experienced in pre-operative or pre-screening periods (Danino et al., 2005; Kiyohara et al., 2004; Ng et al., 2004; Sjöling et al., 2003; Luck et al., 1999; Marteau et al., 1996; Kilborn and Labbé, 1990; Grey et al., 2000), information was chosen as a potential tool to relieve the London Underground passengers' anxiety. Jacobson argues that designed information performs its functions, hence, it is important to fully understand the functions when designing information (Jacobson, 2000). It is said that it is almost impossible to set firm rules for information design however, if there is an important principle that information designers should follow is "it depends" (Pettersson, 2010a). Also, it is hard to predict whether designed information would work or not, since information design is highly context-dependent (Jacobson, 2000). Given these claims, it seems essential to design information based on understanding about the function and context in which the information will be provided. When considering the purpose of information design in the present study, which is expected to mitigate the passengers' anxiety especially about when they are seeing other people's anti-social behaviour, it seems reasonable to seek out the basis of reduction in anxiety from the theoretical explanations which elucidate how anxiety is elicited, and what elements are involved in the process. Thus, through the implementation of this research, the effects of the selected factors have been confirmed. They are perceived invulnerability, perceived physical ability, confidence in the authorities, and safety knowledge. The first three factors have negative effects on perceived uncontrollability, in turn, on anxiety, and the last factor has a direct negative effect on anxiety. Thus, the



influences of these four factors are suggested to be reflected in the development of the content of information.

Information design is explained that “the defining, planning, and shaping of the contents of a message and the environments in which it is presented, with the intention to satisfy the information needs of the intended recipients” (International Institute for Information Design, 2017). Information needs may arise in anxiety inducing situations, since individuals’ “cognitive and emotional needs” arise when faced with difficulties or problems, and they may be fulfilled by gaining and applying appropriate information (Nicholas and Herman, 2009). In the present study, the passengers’ information needs are assumed to arise from the cognitive gap between the passengers’ current level of knowledge and the required level of knowledge on how to cope with the situation when they are seeing other peoples’ anti-social behaviour in trains or at platforms. As Pettersson describes information has a purpose to meet the intended receivers’ information needs, which consists of “analysis, planning, presentation and understanding of a message - its content, language and form” (Pettersson, 2010a). He further provides several sets of principles of information design, above all, functional principles seem to better suit to the purpose of this study than others (e.g. cognitive design principles, administrative and aesthetic principles, and principles of multimedia learning and research). The principles consist of six principles, such as “(1) defining the problem, (2) providing structure, (3) providing clarity, (4) providing simplicity, (5) providing emphasis, and (6) providing unity” (Pettersson and Avgerinou 2016). The present study is particularly related to the “(1) defining the problem” principles, thus a detailed account about this phase needs to be further described. In these principles, organisation of the project, analysis of the group of the intended receivers, identification of the receivers’ specific attributes and requirements, analysis of the intended message, collection and review of facts and data which are necessary, determination of the objectives, selection of a way to frame the message, and medium are conducted (Pettersson, 2010a). Nine sub-categories in the principles are suggested as, “(1) The sender, (2) The representation, (3) The receivers, (4) The contexts, (5) Providing structures, (6) Providing clarity, (7) Providing simplicity, (8) Providing emphasis, and (9) Providing unity” (Pettersson and Avgerinou 2016). The findings from the present study particularly contribute to the first and the third principles, as well as review of facts and data which are necessary.

### **8.4.1. The sender**

First, a sender is referred to anyone that wishes to deliver “an intended message” to a receiver or receivers, who create information sets and are in charge of production and dissemination. The sender needs to identify what is wanted to be achieved, and what is going to happen. The designed information should be connected to the goals of overall activity of the organisation, and messages presented in various media need to be developed to work together (Pettersson and Avgerinou 2016). The sender of information will be Transport for London, and designers in the organisation will mainly work on the development of the information whose purpose is to help relieve passengers’ anxiety. The information would provide a function for the passengers to find the travel on the London Underground more relaxing, as a result of reduced negative arousal (Watson and Tellegen, 1985).

### **8.4.2. The receivers**

Second, this study provides useful guidance in investigating the potential receivers according to the findings which showed the levels of anxiety in different user groups. Pettersson and Avgerinou claim that “The smaller a group of receiver is, the greater our ability is to describe it”. They further address that the group of intended receivers should be defined by information designers, and important information when identifying the group is culture, age, gender, and socio-demographic components (Pettersson and Avgerinou 2016). The degrees of anxiety among the groups of the respondents were compared, such as the intensities of anxiety between genders were significantly different. Female users may need more information support from the service provider. Furthermore, the respondents who have been attacked, harassed or threatened by anti-social behaviour before reported significantly higher anxiety (Mean=29.04) than those who have not (Mean=27.19), showing the *p*-value of independent sample t-test result as 0.020 ( $t=2.350$ ,  $df=267$ ). Consequently, it seems reasonable to suggest that more careful support needs to be provided for passengers who have been victimised. In terms of age, it has been identified that the age group of which the respondents who rated the highest scores of state anxiety was the bracket 25-34 (Mean of scores of State Anxiety scale from Spielberger’s State Trait Personality Inventory score = 28.71) (Spielberger, 1995). The next highest-rated group was the bracket 35-44 (Mean = 28.59),

followed by 19-24 (Mean = 28.33), and 55-64 (Mean = 27.15). Although the samples are small, the degrees of anxiety amongst the rest of the age groups were seen to gradually decrease. Accordingly, it seems that young people should not be excluded from the target group for support. A meaningful pattern from the comparison of the intensities of anxiety according to frequency of use was not found, thus, frequency of use does not provide useful guidance on selecting the intended groups of receivers. According to the model testing result, perceived physical ability was a significant source of control, and a buffer of anxiety, it would be important for the information designers to pay attention to the passengers who feel physically vulnerable.

#### **8.4.3. Review of necessary facts and data**

The intended information that will be developed based on the research findings from this study, which is expected to have anxiety buffering effects. The theoretical basis of this prediction has been found through the process of the research model testing by structural equation modelling. As previously mentioned, the antecedents whose negative effects on anxiety have been verified are perceived invulnerability, perceived physical ability, confidence in the authorities, and safety knowledge. The first three factors have negative effects on perceived uncontrollability, in turn, on anxiety, and the last factor has a direct negative effect on anxiety. Therefore, the influences of these four factors are suggested to be reflected in the development of the content of information. The findings from the model testing offers practical guides what is expected to happen, when applying the factors whose buffering effects on anxiety were verified. For example, the less they think problematic situations would occur as a result of anti-social behaviour, the more they physically feel able, and have confidence in the relevant authorities, the respondents tended to perceive the situation less uncontrollable, and they felt less anxious. Moreover, the more the respondents had the knowledge on safety resources, the lower the level of anxious arousal. When designing information, designers should note that it would be effective to support the passengers to retain the optimism that anything bad would not happen, however it might be maladaptive because the perception would lead non-victims to be less precautious, and to feel much harder to recover after they get victimised (Perloff, 1983). Therefore, the designers are advised to find an effective way to deliver the message that the environment is safe, by avoiding simply highlighting the probability

of occurrence of incidents as a result of anti-social behaviour is low. Rather, it would be beneficial to provide information relating to coping resources, such as help point, emergency alarm, and staff resources, and the process to effectively use them. Also, it would be helpful to offer designed information which boosts the confidence in the authorities (Transport for London, and the British Transport Police). It is advised to convey information which shows their strong intention to tackle and deal with anti-social behaviour issues which concern the passengers based on profound understanding about them. These will be enabled by offering information regarding what activities have been conducted by the authorities, and by seeking for their views on anti-social behaviour issues. Besides, it would be useful to show the authorities' intention to treat them fairly and stay approachable through designed information.

## **8.5. Contributions to knowledge**

Contributions which were made through this research will be articulated into two categories, theoretical and practical contributions.

### **8.5.1. Theoretical contributions**

In terms of theoretical implications, this study has contributed to enhancement of our understanding about passengers' anxiety experienced by exposure to potential risk in public transport environment. The current literature regarding passengers' anxiety has rarely discussed how the emotional state is aroused, and what the contributing factors are involved in the elicitation of the emotional response. Thus, this study has attempted to investigate the emotional state through a lens of theoretical background which elucidates causality of anxiety by presenting the process and components engaged in the process. Consequently, based on the understanding about anxiety, the present study has identified the factors influencing passengers' anxious arousal in the London Underground service environment, and examined the effects of the factors on anxious arousal. However, passengers' anxiety have rarely been discussed in the Underground context, possible situations which lead to anxiety have been explored prior to the quantitative phase of this study.

#### **8.5.1.1. Identification of potential anxiety inducing situations**

In the initial stage of the study, the London Underground passengers' anxious responses experienced by exposure to negative situations were investigated. The potential anxiety triggers in the environment are identified, and the highest ranked situation, which is a situation when passengers are seeing other people's anti-social behaviour, is selected as a target for a further scrutiny.

#### **8.5.1.2. Determination of factors influencing anxious arousal**

Passengers' anxiety experienced in the situation is examined based on the theoretical ideas related to anxiety and stress. On the basis of the understanding about how state anxiety is elicited as a process, and the cognitive threat appraisal which is intervened in the process, whose outcome determines the level of anxiety, factors influencing anxious arousal have been identified. A closer observation of anxiety about anti-social behaviour was guided by the framework explaining vulnerability to fear of crime. The three factors, which are physical, social, and situational components which are described to be related to loss of control, in this sense, the identified influencing factors are selected based on the criteria.

#### **8.5.1.3. Confirmation of the effects of the factors and the interrelationships among them**

The identified factors are perceived invulnerability, perceived physical ability (as physical factor), informal social control (as social factor), confidence in the authorities and safety knowledge (as situational factors), and perceived uncontrollability as a mediator. With the exception of the construct informal social control, the effects of the factors were examined. As hypothesised, the effects of perceived invulnerability, perceived physical ability, and confidence in the authorities were negatively associated with perceived uncontrollability, and in turn it is positively associated with state anxiety. The indirect effect of perceived uncontrollability was confirmed as significant. Safety knowledge was directly and negatively associated with state anxiety. These results support the Spielberger's state-trait conception of anxiety (Spielberger, 1966; 1972), and Lazarus's cognitive theory of stress and coping (Lazarus, 1966; Lazarus and Folkman, 1984) by presenting that the less the individuals feel that they were vulnerable, and the more they were

equipped with coping resources and options, the less anxious in the situation. Furthermore, the results have particular significance in the sense that the mediating role of perceived uncontrollability was confirmed as significant, which has been somewhat unclear and has rarely been empirically tested in the current literature regarding coping and control in stressful situations.

The need of closer investigation of the role of perceived control arises because it has been regarded as an influential factor which determines the level of stress as an effective stress buffer. Besides, it is because “situational appraisals of control” have been mentioned as a part of secondary appraisals of coping, or as one of the coping resources, having been given equal weight as other coping options. Additionally, studies aiming to identify their causal relationships between coping and control as determinants of stress response, as distinguished causal constructs have not widely been conducted. This study has made an effort to tackle the gap through a closer observation of the individuals’ cognitive appraisal process, with centring the role of perceived uncontrollability. This trial has enabled clearer understanding about the interrelations among coping, a sense of control, and anxious response. Therefore, this study will contribute to extend the knowledge on coping and control in cognitive appraisal stage in anxiety-inducing situation, by posing the importance of mediating role of perceived control between coping and arousal.

To be specific, regarding the theoretical basis on which this study relies, anxiety has been understood through the application of the Spielberger’s model, “a state-trait conception of anxiety” arguing that the degree of state anxiety results from the outcomes of cognitive appraisal. His model draws upon the elucidation of cognitive appraisal process specified in Lazarus’s “transactional model of stress and coping” as theoretical grounds. Lazarus and Folkman assert that cognitive appraisal process consists of two types of appraisal, primary and secondary appraisal. The former is concerned with evaluation of transaction between the situation and individual in connection with his or her well-being, and the latter is related to assessment of resources and strategies for coping with the harmful situation. As mentioned earlier, the concept of control is described as a part of secondary appraisal, or in a similar fashion, as one of coping resources. In addition, it is recognised to be synonymous to coping. On the other hand, it is also explained as an outcome of estimation from coping resources and options. Moreover, difficulties of its investigation are illustrated, such as, complexity

of its measurement, and perplexity in delimitation of its domain on which and how they have an influence on cognitive appraisal stage are mentioned as an account of its complex nature. So to speak, it seems confusion has occurred in relation to how control should to be viewed and positioned leaving room for questions, for instance, is it synonym to coping?, or is it a product from appraisals of coping?. If it is rather baffling to limit its range of influence, a possible solution may be, being based on theoretical grounds which can provide guidance for selection of factors, such as, relevant coping resources and testing the relationships between the coping resources and control, and to stressful arousal. Hence, it seems reasonable to say that it is testable, within the range that empirical data (representing the selected factors) can cover, and then, worthwhile to put effort into. In sum, in this study, attempts have been made to help clear up the confusion, and find a theoretically appropriate position of control in cognitive appraisal based on empirical evidence. The results from this study provide evidence that sense of control is distinguished construct from coping resources and options, and it has a mediating effect between certain coping resources and anxious arousal, which means that the possibility that it is a product of appraisals is partially supported.

Lastly, in relation to anxiety reduction, if only direct relationships between possible coping resources and anxious responses are examined, potential factors regarding coping could be dismissed, when they have an impact on anxiety fully mediated through a sense of control. In this sense, selection and evaluation of effectiveness of coping resources might be worth being re-investigated.

Theoretical contributions can be summarised as follows.

- Legitimation of the need for investigation of passengers' anxiety in the London Underground by critically reviewing the relevant literature regarding public transport user studies
- Formulation of research model which explicates the potential relationships between the determinants of anxiety and anxious arousal through the effect of perceived uncontrollability
- Examination and confirmation of the effects of the determinants of anxiety on anxious arousal through structural equation modelling (the verified significant relationships: 1) perceived invulnerability → - perceived uncontrollability → anxiety, 2) perceived physical ability → - perceived uncontrollability → anxiety, 3) confidence in the relevant

authorities → - perceived uncontrollability → anxiety, 4) safety knowledge → - anxiety)

- Clarification of the interrelationships among the factors through ascertaining the mediating effect of perceived uncontrollability

### **8.5.2. Practical contributions**

This study discussing 'anxiety as a state' might open up the potential for service providers to widen their perspective on customers' safety and comfort, enabling them to see the environments from users' perspective, through their experiences of anxiety whilst travelling on the London Underground. Accidents, crime and fatality rates are widely believed to be good indicators of safety in public transport environments in various studies (Wretstrand et al., 2014). Referring to literature about differences between fear and anxiety, anxiety is differentiated from fear in the sense that anxiety is a response to potential threat, however, fear is a reaction to direct and imminent threat (Craske, 1999). Accordingly, what customers might have felt when experiencing crimes and accidents may have been fear, that individuals experience when sensing immediate danger, unlike anxiety which is understood as "a diffuse, objectless apprehension" and anticipatory (Barlow, 2002). Investigating the passengers' emotional state through anxiety, which is not easily presented by the statistics, will allow the service providers to understand more about passengers' need and discover room for improvement. Since, anxiety is a negative emotional state, accompanied by uncomfortable arousals, such as muscle tension, worry and vigilance (Spielberger, 2010; Barlow, 2002). Anxiety has functions which prepare individuals for future danger (Barlow, 2002), however, unnecessarily heightened arousal needs to be reduced (Nordeng et al., 2010; Skeppner and Wranne, 1993; Monnier, 2007). Thus the findings of the present study provide directions for what needs to be preferentially offered to support passengers in expectation of diminished the negative arousal. Particularly, the functions of coping resources, whose buffering effects on anxiety mediated through perceived uncontrollability, or whose buffering effect on anxiety need to be paid attention to, and strengthened.

Besides, the findings have offered clearer directions to service providers and future designers to enable them to create better information environments that help relieve passengers' anxious arousal based on the confirmed effects of the suggested factors.



Practical contributions can be summarised as follows.

- The process conducted through the quantitative and deductive approach to inquiring into anxiety taken in this research is expected to provide novel insight to future designers about how to define and verify important elements which can be closely connected to the contents of information pertaining to anxiety reduction.
- The findings from the present study structural equation model testing will provide evidence-based data to service providers and future designers to create information environments which help relieve passengers' anxiety associated with the Underground travel

## **8.6. Limitations and future work**

### **8.6.1. Designing information for alleviation of passengers' anxiety associated with the London Underground travel**

This study has been designed with the purpose to generate theoretical grounds for designing information which helps relieve the London Underground passengers' anxiety. Although, the theoretical evidence of the effects of the influencing factors have been confirmed through the process in this study, however, when considering the entire information design process, designers would require more detailed strategies to design effective information which help reduce the passengers' anxiety. Thus, it is suggested to develop guidelines for designing information based on the findings from the model testing which explains the relationships among the influencing factors and anxiety. Using the findings to develop the content of the information, and define the vulnerable group of users, a more specific message needs to be designed. For example, if the factor safety knowledge is used for the content, then more detailed information about the locations and usage of the facilities and resources, such as help point, emergency alarm, and staff resources. Also, according to the Pettersson's functional information design principles (Pettersson, 2010a), it needs to be identified which medium (audio, visual, and words) would be suitable to deliver the message in order for the information to be effectively communicated with the passengers. Also, internal context needs to be considered, such as the relationships among elements, such as headings, illustrations, text, table, and other components in a certain medium, such as book, or a poster.

Along with the internal context, social context should also be considered, such as the entire setting of the communication, for example, the intended message and the sender, and the environments and the receivers. Furthermore, in order to facilitate “perception, interpretation, understanding, learning and memory” of the content of information, design of structure which is clearly visible for the receiver would be needed. Using layout that each level has distinct headings, and typography is advised. In designing information, legibility which is achieved by clearly designed text, picture, layout, on suitable media, such as paper, wall charts, or screens, should also be considered. In addition, readability, which is determined by “how well the language and style are adapted to the readers’ level of understanding”, needs to be taken into account. Additionally, emphasis can be placed to attract attention by using layout and typography to present hierarchy, and unity needs to be provided to gain “an overall togetherness” because inconsistently designed information may confuse viewers (Pettersson and Avgerinou, 2016).

### **8.6.2. For better understanding about passengers’ anxiety associated with the London Underground travel**

Regarding the investigation into the London Underground passengers’ anxiety, this study was initiated based on a relatively robust theoretical background, in the sense that anxiety is understood as an emotional state that results from cognitive appraisals of threat. However, the situation involving anti-social behaviour as an anxiety-provoking threat in public transport settings has rarely been investigated. Therefore, this study embraces both confirmatory and exploratory phases. Multiple modifications were applied in the model testing process, and they might represent the exploratory nature of this study. Limitations may also be tied to it, and they may be accounted for as the relatively less valid measures. For example, the construct informal social control was deleted, and the two indicators from the construct perceived uncontrollability, as well as one indicator from perceived invulnerability were dropped. This might have led to comparatively less sufficient variances explained by the measures. Furthermore, there may be more predicting factors associated with anxiety and/or stress appraisals, such as trait anxiety (Spielberger, 1979), and generalised beliefs about control (Folkman, 1984). Also, perceived unpredictability is suggested as an antecedent of anxiety (Barlow, 2002; Zvolensky et al., 2000). Thus, it seems

more efforts need be invested in identifying the potential influencing factors of anxiety.

Alternatively, the inclusion of the unmediated relationship between PI and SA in the model was tested. Following the principle of parsimony, the path between PI and PU was excluded. The test results are presented below in the figure 8.1. An empirical reason for this modification is that comparatively high MI, and Par Change (28.269/-0.323), that imply the direct relationship between PI and SA may be stronger than its indirect relationship through PU. Therefore, an additional parameter was included in the model. In accordance to the principle of parsimony, the path from PI to PU was deleted from the model, since it is believed that simpler models tend to be more generalizable (Bollen, 1989). Consequently, the model fit has improved, with revealing a greater R-squared value as 0.29, which was previously 0.15 in the final structural model (see the Figure 6.18 in the Chapter 6). Theoretical reasons for this re-specification should be supported. Perceived invulnerability is explained as a belief that individuals who have not been a victim of negative life events tend to have that is they are less vulnerable to them than others. It is mentioned that the belief is shattered by actual events (Perloff, 1983). If situational estimation of likelihood of falling a victim and perceived risk matter to a great extent in the case, rather than the belief tends to be held by non-victims, perceived invulnerability might be a predictor of state anxiety in a similar vein as perceived likelihood or risk is a determinant of fear of crime, which is widely mentioned in the relevant studies (Jackson, 2011; 2005; Mesch, 2000).

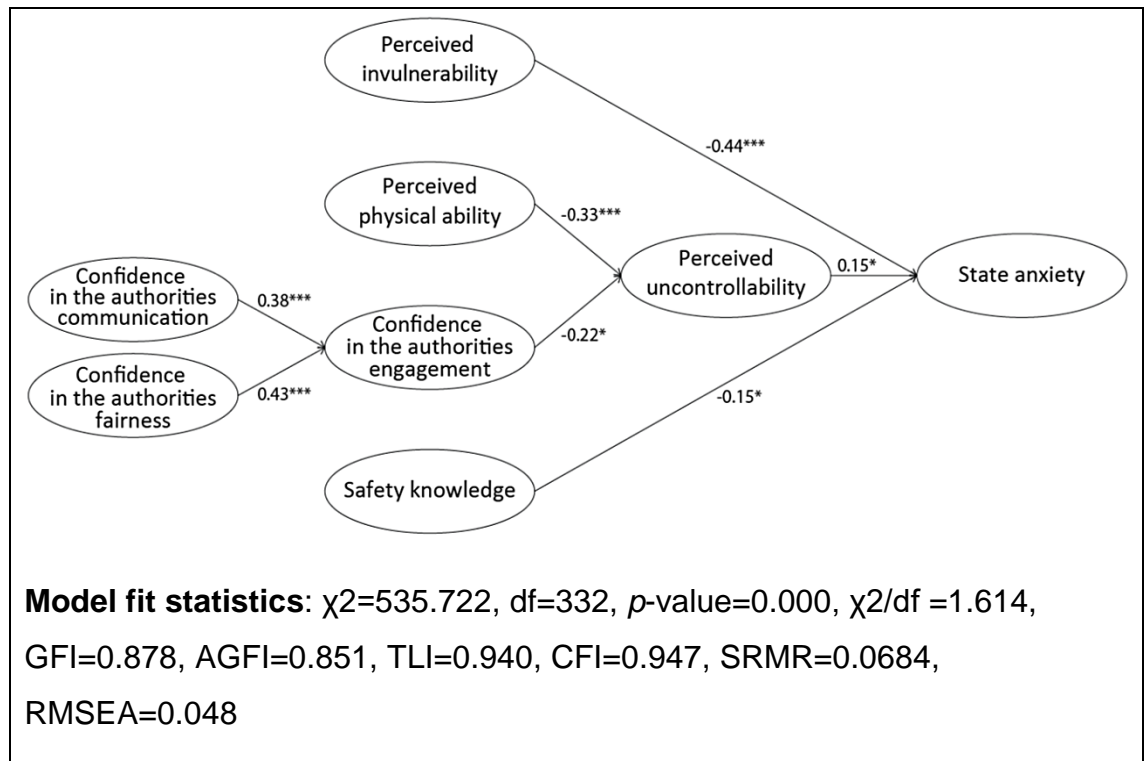


Figure 8.1 Alternative structural model

In the alternative model, the direct linkage between perceived invulnerability and state anxiety, with the exclusion of the path between perceived invulnerability to perceived uncontrollability led to improvement in the degree of explained variance of anxiety from 15% (the final structural model) to 29% (the alternative structural model). This can be interpreted that perceived invulnerability may be the most significant which directly predicts anxiety. The concept is explained as a belief retained by non-victims, which is a tendency that they are less likely to fall victim to negative events (Perloff, 1983). In circumstances when seeing other passengers' anti-social behaviour on the Underground, this belief helps buffer passengers' anxiety by having a thought, for example, that nothing bad would happen to me as a result of the behaviour. There may be much more to be discovered than what has been explored hitherto, regarding anxious arousal in public transport environments and its reduction strategies. It seems that advancement would be achieved through back-to-the-basics approach, focusing our viewpoint to etiology of the negative arousal in the environment. As the Spielberger's state-trait conception of anxiety model, and the Lazarus's cognitive theory of stress and coping describe, if negative arousal results from the interpretation of the harmful situation involving threat, then perceived risk may play a major role in arousing anxiety because the risk perception might be the outcome of the appraisal. Future research could

investigate further on the mediating role of perceived risk and their public transport travel-related stress arousal.

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## Appendix A

### A.1 Questionnaire form for explorative study

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### Travel experience on the Underground

**Instructions:** Please tick the appropriate box or fill in the blank.

1. Where do you live?

In London                       Outside London                       Other

2. What is your gender?

Female                       Male                       Prefer not to answer

3. What is your age?

15-24                       25-34                       35-44                       45-54  
 55-64                       65-74                       75-84                       85+  
 Prefer not to answer

4. Do you wear spectacles or contact lenses?

Yes                       No                       Prefer not to answer

5. Do you use hearing aids?

Yes                       No                       Prefer not to answer

6. Do you consider that you have a difficulty in walking?

Yes                       No                       Prefer not to answer

7. Do you have a driving licence?

Yes                       No                       Prefer not to answer

(If yes, answer to question 8.)

8. How often do you drive?

------------------------------

Very frequently      Frequently      Occasionally      Rarely      Very rarely      Other

4 times a week or more      2-3 times a week      1 time a week      2-3 times a month      1 time a month or less

9. Do you use location based services such as google maps to plan your journey or check your location on your smartphone while travelling?

- Yes       No       Other       I don't use a smartphone

10. What modes of transport do you prefer to use? Select all that apply.

- |   |  |
|---|--|
| <input type="checkbox"/> Buses              | <input type="checkbox"/> Tram                                  |
| <input type="checkbox"/> London Underground | <input type="checkbox"/> Walking                               |
| <input type="checkbox"/> London Overground  | <input type="checkbox"/> Cycling                               |
| <input type="checkbox"/> Cabs               | <input type="checkbox"/> Private transport (Car or motorcycle) |
| <input type="checkbox"/> Train              | <input type="checkbox"/> Other                                 |
- .....

11. When you use the Underground, what is the main purpose of your journey?

- Shopping
  - Medical purpose
  - Visiting family and friends
  - Work
  - Leisure activities
  - Other
- .....

12. How often do you use the Underground?

- 
- Very frequently      Frequently      Occasionally      Rarely      Very rarely      Other
- 4 times a week or more      2-3 times a week      1 time a week      2-3 times a month      1 time a month or less

13. Do you feel you need to plan your journey when travelling by the Underground?

- Yes       No       Other

14. Where do you gain information when searching for the Underground travel information when planning your trip before your journey? Select all that apply.

- On the Internet
  - On smartphone applications
  - On printed materials
  - By asking people
  - Other
- .....

**Instructions:** In this section, you will be asked about your emotions when using the Underground and opinions about their services. Please, tick on the appropriate box according to how much you agree with each item below.

1	2	3	4	5
Strongly agree	Agree	Neutral	Disagree	Strongly disagree

Please rate your overall feelings about the Underground and their services.

1.	The Underground journey is relaxing.	1	2	3	4	5
2.	The Underground journey is pleasant.	1	2	3	4	5
3.	The Underground journey is comfortable.	1	2	3	4	5
4.	The Underground journey is safe.	1	2	3	4	5
5.	The Underground service is reliable.	1	2	3	4	5
6.	I think environments of the Underground are clean.	1	2	3	4	5
7.	I'm satisfied with their services in general.	1	2	3	4	5
8.	I think I can get assistance from staff whenever I want to.	1	2	3	4	5
9.	I feel anxious when the planned service is disrupted unexpectedly.	1	2	3	4	5
10.	I'd choose bus if I can get to a place both by the Underground and bus.	1	2	3	4	5
11.	I wouldn't want to use the Underground because I have a bad experience.	1	2	3	4	5

Please rate your feelings with regard to physical aspects.

12.	I think train doors shut too quickly.	1	2	3	4	5
13.	I feel anxious when platform gaps are big.	1	2	3	4	5
14.	I'm worried that I may not be able to get a seat on a train.	1	2	3	4	5
15.	I feel anxious about walking up and down long staircases at stations.	1	2	3	4	5
16.	I feel anxious about having a long walk to platforms or exits.	1	2	3	4	5
17.	I feel anxious when I don't have access to toilets.	1	2	3	4	5

Please rate your feelings with regard to environmental aspects.

18.	I feel anxious when a train is running in a tunnel between stops.	1	2	3	4	5
19.	I feel anxious because I can't see where I am by looking outside.	1	2	3	4	5
20.	I feel respected by other passengers.	1	2	3	4	5
21.	I feel anxious when I see other passengers' anti-social behaviour on trains.	1	2	3	4	5
22.	I feel anxious when a train is overcrowded.	1	2	3	4	5
23.	I feel anxious when passengers make too much noise on trains.	1	2	3	4	5

24. I feel anxious when I have to wait for a train for a long time at platform.	1	2	3	4	5
25. I feel anxious when I get the Underground late at night.	1	2	3	4	5

Please rate your feelings with regard to informational aspects.

26. I feel anxious when I have to transfer between lines.	1	2	3	4	5
27. I feel anxious when I cannot find exits.	1	2	3	4	5
28. I feel anxious if I can't find information I need on a sign.	1	2	3	4	5
29. I feel anxious when I don't know where I am when I'm on a train.	1	2	3	4	5
30. I feel anxious when I can't understand train announcements.	1	2	3	4	5
31. I feel anxious when I can't understand platform announcements.	1	2	3	4	5
32. I feel anxious when I have an unfamiliar Underground journey.	1	2	3	4	5
33. It is difficult to plan the Underground journey.	1	2	3	4	5
34. The Underground map is confusing to me.	1	2	3	4	5

Please rate your feelings with regard to emotional aspects.

35. I feel guilty when I'm moving slow when getting on and off.	1	2	3	4	5
36. I feel anxious when I travel alone on the Underground.	1	2	3	4	5
37. I feel anxious that I might get lost during the journey.	1	2	3	4	5
38. I feel anxious that I might miss stops where I should get off.	1	2	3	4	5
39. I'm worried that there will be an accident.	1	2	3	4	5
40. I'm worried that I might be a victim of a crime.	1	2	3	4	5

Thank you very much for your participation.

## A.2 Questionnaire for quantitative study (2nd draft)

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### Anxiety on the London Underground

**Directions:** Please tick the appropriate box.

1. What is your gender?  Male  Female

2. What is your age?

<input type="checkbox"/> 19-24	<input type="checkbox"/> 25-34	<input type="checkbox"/> 35-44	<input type="checkbox"/> 45-54	<input type="checkbox"/> 55-64
<input type="checkbox"/> 65-74	<input type="checkbox"/> 75-84	<input type="checkbox"/> 85+	<input type="checkbox"/> Prefer not to answer	

3. How often do you use the Underground?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very rarely	Rarely	Occasionally	Frequently	Very frequently	Other
1 time a month or less	2-3 times a month	1 time a week	2-3 times a week	4 times a week or more	

4. For how long have you used the Underground?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less than 1 year	1-3 years	3-5 years	5-10 years	More than 10 years	Other

5. Have you felt threatened by anti-social behaviour?

Yes  No

#### Scale for questions 6-30

<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree

Please tell me how you think about the Underground service.

6. In general, the Underground system is a safe environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I'm concerned that I might be a victim of crime during the Underground travel.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Transport for London (TfL) has been doing a good job recently on presence/visibility of security personnel and/or police.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Safety information about locations and instructions of safety facilities - emergency alarms, help point, first aid, defibrillates - are very clear to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I think anti-social behaviour issues on the Underground are problematic.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### Directions for questions 10-37

Please rate your opinions about when you're in the situation described below.

You're seeing other people's **anti-social behaviour** at stations or on trains during your Underground journey, **but the behaviour is NOT specifically directed at you.**

**Anti-social behaviour** is a wide range of selfish and unacceptable activity, any aggressive and intimidating behaviour that lowers the quality of life. It includes rowdy, noisy or drunken behaviour, offensive or threatening language, littering and vandalism, and a menacing group.

#### Safety knowledge [11-15]

Please rate the level of your knowledge on how to protect your personal safety if you don't feel safe **in the situation.**

11. I have a good knowledge on how to find the nearest staff, how to contact them, and what kind of assistance I can request in the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I have a good knowledge about what/where safety facilities - CCTV, emergency alarm, help point - are equipped, and how/when I can use them in the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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## Anxiety on the London Underground

Directions: Please tick the appropriate box.

1. What is your gender?  Male  Female

2. What is your age?

<input type="checkbox"/> 19-24	<input type="checkbox"/> 25-34	<input type="checkbox"/> 35-44	<input type="checkbox"/> 45-54	<input type="checkbox"/> 55-64
<input type="checkbox"/> 65-74	<input type="checkbox"/> 75-84	<input type="checkbox"/> 85+	<input type="checkbox"/> Prefer not to answer	

3. How often do you use the Underground?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very rarely	Rarely	Occasionally	Frequently	Very frequently	Other
1 time a month or less	2-3 times a month	1 time a week	2-3 times a week	4 times a week or more	

4. For how long have you used the Underground?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less than 1 year	1-3 years	3-5 years	5-10 years	More than 10 years	Other

5. Have you felt threatened by anti-social behaviour?  Yes  No

### Scale for questions 6-30

<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree

Please tell me how you think about the Underground service.

6. In general, the Underground system is a safe environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I'm concerned that I might be a victim of crime during the Underground travel.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Transport for London (TfL) has been doing a good job recently on presence/visibility of security personnel and/or police.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Safety information about locations and instructions of safety facilities - emergency alarms, help point, first aid, defibrillates - are very clear to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I think anti-social behaviour issues on the Underground are problematic.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Directions for questions 10-37

Please rate your opinions about when you're in the situation described below.

You're seeing other people's **anti-social behaviour** at stations or on trains during your Underground journey, **but the behaviour is NOT specifically directed at you.**

**Anti-social behaviour** is a wide range of selfish and unacceptable activity, any aggressive and intimidating behaviour that lowers the quality of life. It includes rowdy, noisy or drunken behaviour, offensive or threatening language, littering and vandalism, and a menacing group.

### Safety knowledge [11-15]

Please rate the level of your knowledge on how to protect your personal safety if you don't feel safe **in the situation.**

11. I have a good knowledge on how to find the nearest staff, how to contact them, and what kind of assistance I can request in the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I have a good knowledge about what/where safety facilities - CCTV, emergency alarm, help point - are equipped, and how/when I can use them in the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



13. I have a good knowledge on how to cope with anti-social behaviour in the situation. 1 2 3 4 5
14. I'm well aware of procedures to follow how to protect my personal safety in the situation. 1 2 3 4 5
15. I have a good knowledge about how TfL and British Transport Police tackle anti-social behaviour, what power they can exert on offenders, and what penalties will be imposed to offenders. 1 2 3 4 5

**Trust in people [16-19]**

Please rate your opinion about how other passengers would behave **in the situation**.

16. If there are people behaving anti-socially, other passengers will tell them off. 1 2 3 4 5
17. If a serious event occurs to me due to anti-social behaviour, other passengers can be relied upon to contact TfL or the police. 1 2 3 4 5
18. If I sensed trouble due to anti-social behaviour, I could raise attention from other passengers for help. 1 2 3 4 5
19. Most passengers on the Underground trust one another. 1 2 3 4 5

**Trust in Transport for London (TfL) and British Transport Police (BTP) [20-26]**

Please rate your opinion about how they deal with anti-social behaviour issues that matter to your journey.

20. TfL and BTP are dealing effectively with anti-social behaviour in general. 1 2 3 4 5
21. They are dealing with anti-social behaviour issues that matter to your journey. 1 2 3 4 5
22. They understand anti-social behaviour issues that affect you journey. 1 2 3 4 5
23. They seek passengers' views on anti-social behaviour issues that matter to the journey. 1 2 3 4 5
24. I've been informed about what they have been doing to tackle anti-social behaviour issues that matter to the Underground journey over the last 12 months. 1 2 3 4 5
25. They would treat you fairly and respectfully if you had contact with them regarding the issues. 1 2 3 4 5
26. They would be friendly and approachable to talk about the issues. 1 2 3 4 5

**Your perception of anti-social behaviour [27-37]**

Please tell me how you perceive the behaviour in the situation where you're seeing other people's **anti-social behaviour** at stations or on trains, **but the behaviour is NOT specifically directed at you**.

27. I can predict when frightening events due to the anti-social behaviour will occur. 1 2 3 4 5
28. I can predict when stressful situations caused by the anti-social behaviour are over. 1 2 3 4 5
29. I can predict how long conflicts created by the anti-social behaviour will last. 1 2 3 4 5
30. How much do you agree that you will be harmed in your personal safety? 1 2 3 4 5
31. How much do you agree that you feel threatened in the situation? 1 2 3 4 5

<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

32. When I'm frightened by anti-social behaviour, there is generally nothing I can do. 0 1 2 3 4 5
33. Whether I can successfully escape from the frightening situation is a matter of chance. 0 1 2 3 4 5
34. There is little I can do to change frightening events created by anti-social behaviour. 0 1 2 3 4 5
35. The extent to which the situation resolves itself has nothing to do with my actions. 0 1 2 3 4 5

36. If something is going to hurt me, it will happen no matter what I do. 

0	1	2	3	4	5
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37. Situations created by anti-social behaviour are outside my control. 

0	1	2	3	4	5
---	---	---	---	---	---

**Anxiety [38-75]**

**Directions:** Please read each statement and then check the appropriate number to the right of the statement to indicate how you would feel in each situation. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your feelings best.

How would you feel when you're seeing other people's **anti-social behaviour** at stations or on trains during your Underground journey, **but the behaviour is NOT specifically directed at you?**

	Not at all	Somewhat	Moderately so	Very much
38. I feel calm	1	2	3	4
39. I feel secure	1	2	3	4
40. I feel tense	1	2	3	4
41. I feel strained	1	2	3	4
42. I feel at ease	1	2	3	4
43. I feel upset	1	2	3	4
44. I am presently worrying over possible misfortunes	1	2	3	4
45. I feel satisfied	1	2	3	4
46. I feel frightened	1	2	3	4
47. I feel comfortable	1	2	3	4
48. I feel self-confident	1	2	3	4
49. I feel nervous	1	2	3	4
50. I feel jittery	1	2	3	4
51. I feel indecisive	1	2	3	4
52. I feel relaxed	1	2	3	4
53. I feel content	1	2	3	4
54. I feel worried	1	2	3	4
55. I feel confused	1	2	3	4
56. I feel steady	1	2	3	4
57. I feel pleasant	1	2	3	4

How would you feel when you're travelling on the train or waiting at the platform **alone late at night?**

	Not at all	Somewhat	Moderately so	Very much
58. I feel calm	1	2	3	4
59. I feel tense	1	2	3	4
60. I feel upset	1	2	3	4
61. I feel relaxed	1	2	3	4
62. I feel content	1	2	3	4
63. I feel worried	1	2	3	4

How would you feel when you're in very **crowded** trains or at stations?

	Not at all	Somewhat	Moderately so	Very much
64. I feel calm	1	2	3	4
65. I feel tense	1	2	3	4
66. I feel upset	1	2	3	4
67. I feel relaxed	1	2	3	4
68. I feel content	1	2	3	4
69. I feel worried	1	2	3	4

How would you feel when you're in very **noisy** trains or at stations?

	Not at all	Somewhat	Moderately so	Very much
70. I feel calm	1	2	3	4
71. I feel tense	1	2	3	4
72. I feel upset	1	2	3	4
73. I feel relaxed	1	2	3	4
74. I feel content	1	2	3	4
75. I feel worried	1	2	3	4

Thank you for your help in completing this questionnaire!

### A.3 Questionnaire for quantitative study (final draft)

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#### Anxiety on the London Underground

**Directions:** Please tick the appropriate box.

1. What is your gender?  Male  Female

2. What is your age?

<input type="checkbox"/> 19-24	<input type="checkbox"/> 25-34	<input type="checkbox"/> 35-44	<input type="checkbox"/> 45-54	<input type="checkbox"/> 55-64
<input type="checkbox"/> 65-74	<input type="checkbox"/> 75-84	<input type="checkbox"/> 85+	<input type="checkbox"/> Prefer not to answer	

3. How often do you use the Underground?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Very rarely	Rarely	Occasionally	Frequently	Very frequently	Other
1 time a month or less	2-3 times a month	1 time a week	2-3 times a week	4 times a week or more	

4. For how long have you used the Underground?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less than 1 year	1-3 years	3-5 years	5-10 years	More than 10 years	Other

5. Have you felt threatened by anti-social behaviour?  Yes  No

#### Scale for questions 6-30

<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree

Please tell me how you think about the Underground service.

6. In general, the Underground system is a safe environment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I'm concerned that I might be a victim of crime during the Underground travel.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Transport for London (TfL) has been doing a good job recently on presence/visibility of security personnel and/or police.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Safety information about locations and instructions of safety facilities - emergency alarms, help point, first aid, defibrillates - are very clear to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. I think anti-social behaviour issues on the Underground are problematic.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

#### Directions for questions 10-37

Please rate your opinions about when you're in the situation described below.

You're seeing other people's **anti-social behaviour** at stations or on trains during your Underground journey, **but the behaviour is NOT specifically directed at you.**

**Anti-social behaviour** is a wide range of selfish and unacceptable activity, any aggressive and intimidating behaviour that lowers the quality of life. It includes rowdy, noisy or drunken behaviour, offensive or threatening language, littering and vandalism, and a menacing group.

#### Safety knowledge [11-15]

Please rate the level of your knowledge on how to protect your personal safety if you don't feel safe **in the situation.**

11. I have a good knowledge on how to find the nearest staff, how to contact them, and what kind of assistance I can request in the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I have a good knowledge about what/where safety facilities - CCTV, emergency alarm, help point - are equipped, and how/when I can use them in the situation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. I have a good knowledge on how to cope with anti-social behaviour in the situation. 1 2 3 4 5
14. I'm well aware of procedures to follow how to protect my personal safety in the situation. 1 2 3 4 5
15. I have a good knowledge about how TfL and British Transport Police tackle anti-social behaviour, what power they can exert on offenders, and what penalties will be imposed to offenders. 1 2 3 4 5

**Trust in people [16-19]**

Please rate your opinion about how other passengers would behave **in the situation**.

16. If there are people behaving anti-socially, other passengers will tell them off. 1 2 3 4 5
17. If a serious event occurs to me due to anti-social behaviour, other passengers can be relied upon to contact TfL or the police. 1 2 3 4 5
18. If I sensed trouble due to anti-social behaviour, I could raise attention from other passengers for help. 1 2 3 4 5
19. Most passengers on the Underground trust one another. 1 2 3 4 5

**Trust in Transport for London (TfL) and British Transport Police (BTP) [20-26]**

Please rate your opinion about how they deal with anti-social behaviour issues that matter to your journey.

20. TfL and BTP are dealing effectively with anti-social behaviour in general. 1 2 3 4 5
21. They are dealing with anti-social behaviour issues that matter to your journey. 1 2 3 4 5
22. They understand anti-social behaviour issues that affect your journey. 1 2 3 4 5
23. They seek passengers' views on anti-social behaviour issues that matter to the journey. 1 2 3 4 5
24. I've been informed about what they have been doing to tackle anti-social behaviour issues that matter to the Underground journey over the last 12 months. 1 2 3 4 5
25. They would treat you fairly and respectfully if you had contact with them regarding the issues. 1 2 3 4 5
26. They would be friendly and approachable to talk about the issues. 1 2 3 4 5

**Your perception of anti-social behaviour [27-37]**

Please tell me how you perceive the behaviour in the situation where you're seeing other people's **anti-social behaviour** at stations or on trains, **but the behaviour is NOT specifically directed at you**.

27. I can predict when frightening events due to the anti-social behaviour will occur. 1 2 3 4 5
28. I can predict when stressful situations caused by the anti-social behaviour are over. 1 2 3 4 5
29. I can predict how long conflicts created by the anti-social behaviour will last. 1 2 3 4 5
30. How much do you agree that you will be harmed in your personal safety? 1 2 3 4 5
31. How much do you agree that you feel threatened in the situation? 1 2 3 4 5

0	1	2	3	4	5
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

32. When I'm frightened by anti-social behaviour, there is generally nothing I can do. 0 1 2 3 4 5
33. Whether I can successfully escape from the frightening situation is a matter of chance. 0 1 2 3 4 5
34. There is little I can do to change frightening events created by anti-social behaviour. 0 1 2 3 4 5
35. The extent to which the situation resolves itself has nothing to do with my actions. 0 1 2 3 4 5

36. If something is going to hurt me, it will happen no matter what I do. 

0	1	2	3	4	5
---	---	---	---	---	---
37. Situations created by anti-social behaviour are outside my control. 

0	1	2	3	4	5
---	---	---	---	---	---

**Anxiety [38-75]**

**Directions:** Please read each statement and then check the appropriate number to the right of the statement to indicate how you would feel in each situation. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your feelings best.

How would you feel when you're seeing other people's **anti-social behaviour** at stations or on trains during your Underground journey, **but the behaviour is NOT specifically directed at you?**

	Not at all	Somewhat	Moderately so	Very much
38. I feel calm	1	2	3	4
39. I feel secure	1	2	3	4
40. I feel tense	1	2	3	4
41. I feel strained	1	2	3	4
42. I feel at ease	1	2	3	4
43. I feel upset	1	2	3	4
44. I am presently worrying over possible misfortunes	1	2	3	4
45. I feel satisfied	1	2	3	4
46. I feel frightened	1	2	3	4
47. I feel comfortable	1	2	3	4
48. I feel self-confident	1	2	3	4
49. I feel nervous	1	2	3	4
50. I feel jittery	1	2	3	4
51. I feel indecisive	1	2	3	4
52. I feel relaxed	1	2	3	4
53. I feel content	1	2	3	4
54. I feel worried	1	2	3	4
55. I feel confused	1	2	3	4
56. I feel steady	1	2	3	4
57. I feel pleasant	1	2	3	4

How would you feel when you're travelling on the train or waiting at the platform **alone late at night?**

	Not at all	Somewhat	Moderately so	Very much
58. I feel calm	1	2	3	4
59. I feel tense	1	2	3	4
60. I feel upset	1	2	3	4
61. I feel relaxed	1	2	3	4
62. I feel content	1	2	3	4
63. I feel worried	1	2	3	4

How would you feel when you're in very **crowded** trains or at stations?

		Not at all	Somewhat	Moderately so	Very much
64.	I feel calm	1	2	3	4
65.	I feel tense	1	2	3	4
66.	I feel upset	1	2	3	4
67.	I feel relaxed	1	2	3	4
68.	I feel content	1	2	3	4
69.	I feel worried	1	2	3	4

How would you feel when you're in very **noisy** trains or at stations?

		Not at all	Somewhat	Moderately so	Very much
70.	I feel calm	1	2	3	4
71.	I feel tense	1	2	3	4
72.	I feel upset	1	2	3	4
73.	I feel relaxed	1	2	3	4
74.	I feel content	1	2	3	4
75.	I feel worried	1	2	3	4

Thank you for your help in completing this questionnaire!

## Appendix B

### B.1 Participant information sheet and informed consent form for explorative study



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### Travel experience on the Underground

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#### Participant Information Sheet

I am a self-funding PhD student doing design research at Brunel University London. The aim of the research is to investigate emotions when using the Underground and to develop more user-centred information environments for passengers. A questionnaire will be used inquiring into your emotions and experience when using the Underground, and it will take approximately 7 to 10 minutes to complete. This study has been reviewed and approved by Brunel University Research Ethics Committee. I would be grateful if you participate in my research by filling in the questionnaire.

#### Informed Consent Form

- I have read the Research Participant Information.
- I have had an opportunity to ask about this study and received answers.
- I know I can withdraw anytime without telling the reasons.
- I understand all the information that you provide will be kept strictly confidential and it will be anonymised when the research is published.
- I understand the information above and agree to participate in this research.

Yes	No

Signature of research participant

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Date

. . 2015
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Name (You don't need to write your name if you don't want to.)

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## B.2 Participant information sheet and informed consent form for the quantitative study (2nd draft)



Date: \_\_\_\_\_ 

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### Anxiety on the London Underground

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#### Information for participants

I am a self-funding PhD student at Brunel University London. The aim of the research is to investigate passengers' anxiety when using the Underground and to provide information to help relieve anxiety. A questionnaire will be used asking your opinions and level of anxiety. It will take approximately 7 to 10 minutes to complete. This study has been approved by Brunel University Research Ethics Committee. I would be grateful if you participate in my research.

#### Informed consent form

- I have read the information for participants.
- I have had an opportunity to ask about this study and received answers.
- I know I can withdraw anytime without telling the reasons.
- I understand all the information that I provide will be kept confidential and anonymised when the research is published.
- I understand the information above and agree to participate in this study. Yes

Signature of participant

Name of participant

---

Email address (Optional)

---

## B.3 Participant information sheet and informed consent form for the quantitative study (final draft)



Date: \_\_\_\_\_

### Passengers' anxiety on the London Underground

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#### Information for participants

I am a self-funding PhD student at Brunel University London. The aim of the research is to investigate passengers' anxiety about anti-social behaviour\* when using the Underground and to provide information to help relieve anxiety. A questionnaire will be used to ask your opinions and level of anxiety. It will take approximately 10 minutes to complete. This study has been approved by Brunel University Research Ethics Committee. I would be grateful if you participate in my research.

If you have any complaints about any aspect of this survey, please contact

CEDPS-Research@brunel.ac.uk

\* Antisocial behaviour means anything you feel to be aggressive, intimidating or destructive activity which damages or destroys someone else's quality of life. This could include: Rowdy, noisy or drunken behaviour, offensive or threatening language, littering and vandalism, a menacing group (TfL, 2016).

#### Informed consent form

- I have read the information for participants.
- I know I can withdraw anytime without telling the reasons.
- I understand all the information that I provide will be kept confidential and anonymised when the research is published.
- I understand the information above and agree to participate in this study. Yes

Signature or initial of participant

Name of participant (Optional)

\_\_\_\_\_  
Email address

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## Appendix C

### C.1 Ethics approval letter for explorative study



Brunel University London  
Uxbridge UBB 3PH  
United Kingdom

[www.brunel.ac.uk](http://www.brunel.ac.uk)

5 May 2015

#### STATEMENT OF ETHICS APPROVAL

Proposer: Jisun Kim ID: 1302987

Dear Jisun,

**Project Title: The Underground Information Environments for Older People**

Under delegated authority from the College Research Ethics Committee, I have considered the application recently submitted by you. I am satisfied that there is no objection on ethical grounds to the proposed study.

Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform me of any change of plans in relation to the information provided in the application form.

In addition, please provide notification to the College Research Office when the study is complete, if it fails to start or is abandoned.

Yours sincerely,

A handwritten signature in black ink, appearing to be "John Park", written over a light blue horizontal line.

**John Park**  
**College Research Manager**  
T +44(0)1895 266057 | E [john.park@brunel.ac.uk](mailto:john.park@brunel.ac.uk)

**Brunel University London**  
College of Engineering, Design and Physical Sciences

## C.2 Ethics approval letter for quantitative study (2nd draft)



College of Engineering, Design and Physical Sciences Research Ethics Committee  
Brunel University London  
Kingston Lane  
Uxbridge  
UB8 3PH  
United Kingdom

www.brunel.ac.uk

14 December 2015

### LETTER OF APPROVAL

Applicant: Miss Jisun Kim

Project Title: Anxiety on the London Underground

Reference: 1721-LR-Dec/2015-1029

Dear Miss Jisun Kim

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

#### Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

A handwritten signature in cursive script, appearing to read 'Hua Zhao'.

Professor Hua Zhao

Chair

College of Engineering, Design and Physical Sciences Research Ethics Committee  
Brunel University London

## C.3 Ethics approval letter for quantitative study (final draft)



College of Engineering, Design and Physical Sciences Research Ethics Committee  
Brunel University London  
Kingston Lane  
Uxbridge  
UB8 3PH  
United Kingdom

www.brunel.ac.uk

5 September 2016

### LETTER OF APPROVAL

Applicant: Miss Jisun Kim

Project Title: Passengers' anxiety on the London Underground (3)

Reference: 3595-LR-Sep/2016- 3997-1

Dear Miss Jisun Kim

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

#### Please note that:

**Please change the start date of your project. No research data collected prior to the final ethical approval should be included in your research.**

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

A handwritten signature in black ink, appearing to read 'Hua Zhao'.

Professor Hua Zhao

Chair

College of Engineering, Design and Physical Sciences Research Ethics Committee  
Brunel University London

## Appendix D

### D.1 Exploratory data analysis results (7-factor structure)

Communalities

	Initial	Extraction
Frightening event staff	.537	.567
Frightening event facilities	.531	.659
Frightening event process	.555	.630
React quickly	.605	.623
Strong	.720	.679
Slow_R	.705	.726
Poor_R	.632	.567
Self-defence	.595	.570
Tackel effectively	.706	.614
Deal with ASB	.721	.629
Understand	.539	.480
Seek views	.430	.354
Been informed	.347	.236
Treat fairly	.576	.518
Friendly and approachable	.554	.478
Not_Tell_Off_R	.305	.340
Contact TfL	.344	.269
Not_Get_Atten_R	.463	.376
Nothing serious can happen	.489	.421
No problem so far why now	.513	.547
Seldom incidence happens	.567	.579
Rarely something serious happens	.572	.649
Nothing I can do	.501	.456
Matter of chance	.367	.317
Little I can do	.556	.606
Not my action	.476	.495

No matter what I do	.399	.345
Out of control	.534	.554
Tense	.544	.536
Worrying	.555	.559
Nervous	.798	.845
Jittery	.669	.671
Worried	.751	.771
Frightened	.690	.696

Extraction Method: Principal Axis Factoring.

**Total Variance Explained**

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
	1	7.978	23.466	23.466	7.578	22.287	22.287
2	3.733	10.980	34.446	3.287	9.667	31.954	4.505
3	2.956	8.694	43.140	2.547	7.490	39.444	3.923
4	2.391	7.033	50.173	1.929	5.675	45.119	3.954
5	1.611	4.739	54.912	1.189	3.497	48.615	4.039
6	1.438	4.231	59.143	1.018	2.995	51.610	4.153
7	1.391	4.090	63.233	.816	2.401	54.011	3.024
8	1.258	3.700	66.933				
9	.950	2.793	69.726				
10	.839	2.467	72.193				
11	.787	2.314	74.507				
12	.739	2.173	76.680				
13	.657	1.932	78.612				
14	.634	1.864	80.475				
15	.579	1.704	82.179				
16	.513	1.508	83.687				
17	.473	1.392	85.079				
18	.470	1.383	86.463				
19	.458	1.348	87.811				
20	.423	1.244	89.056				
21	.387	1.138	90.194				
22	.380	1.117	91.311				
23	.364	1.072	92.383				
24	.320	.940	93.323				
25	.316	.930	94.253				
26	.312	.919	95.172				
27	.269	.791	95.964				
28	.255	.749	96.712				
29	.231	.678	97.390				
30	.226	.663	98.054				
31	.196	.577	98.630				
32	.177	.521	99.151				

33	.153	.451	99.602				
34	.135	.398	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix<sup>a</sup>

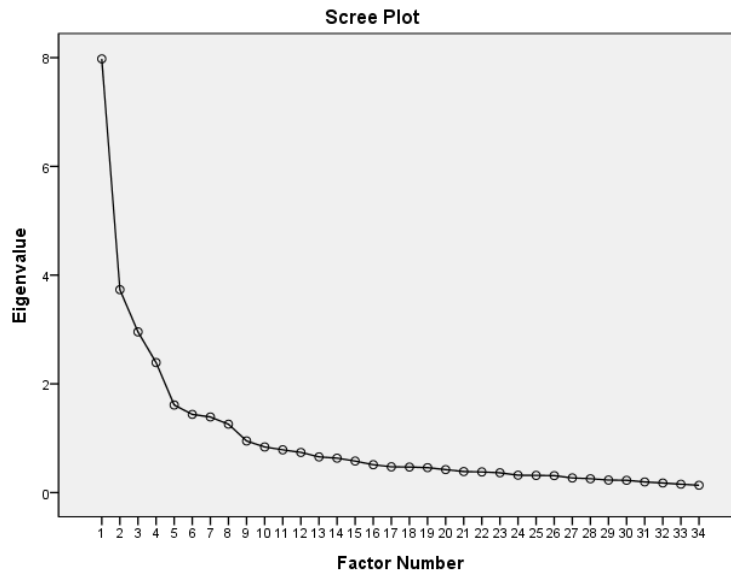
	Factor						
	1	2	3	4	5	6	7
Frightening event staff						.706	
Frightening event facilities						.867	
Frightening event process						.759	
React quickly		.759					
Strong		.790					
Slow_R		.859					
Poor_R		.740					
Self-defence		.746					
Tackel effectively				.591			
Deal with ASB				.698			
Understand				.608			
Seek views				.321			.392
Been informed							.415
Treat fairly				.779			
Friendly and approachable				.693			
Not_Tell_Off_R							.631
Contact TfL							.438
Not_Get_Atten_R							.489
Nothing serious can happen					.527		
No problem so far why now					.709		
Seldom incidence happens					.789		
Rarely something serious happens					.749		
Nothing I can do			.541				
Matter of chance			.447				
Little I can do			.775				
Not my action			.753				
No matter what I do			.544				
Out of control			.758				



Tense	.736						
Worrying	.815						
Nervous	.916						
Jittery	.782						
Worried	.856						
Frightened	.800						

Extraction Method: Principal Axis Factoring.  
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 6 iterations.



## D.2 Exploratory data analysis results (8-factor structure)

### Communalities

	Initial	Extraction
Frightening event staff	.537	.577
Frightening event facilities	.531	.657
Frightening event process	.555	.627
React quickly	.605	.622
Strong	.720	.695
Slow_R	.705	.725
Poor_R	.632	.570
Self-defence	.595	.571
Tackle effectively	.706	.613
Deal with ASB	.721	.628
Understand	.539	.479
Seek views	.430	.547
Been informed	.347	.434
Treat fairly	.576	.515
Friendly and approachable	.554	.479
Not_Tell_Off_R	.305	.337
Contact TfL	.344	.390
Not_Get_Atten_R	.463	.642
Nothing serious can happen	.489	.469
No problem so far why now	.513	.587
Seldom incidence happens	.567	.570
Rarely something serious happens	.572	.635
Nothing I can do	.501	.491
Matter of chance	.367	.330
Little I can do	.556	.607
Not my action	.476	.494
No matter what I do	.399	.340
Out of control	.534	.573
Tense	.544	.534
Worrying	.555	.559
Nervous	.798	.845

Jittery	.669	.671
Worried	.751	.776
Frightened	.690	.696

Extraction Method: Principal Axis Factoring.

**Total Variance Explained**

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
	1	7.978	23.466	23.466	7.592	22.330	22.330
2	3.733	10.980	34.446	3.314	9.748	32.078	4.486
3	2.956	8.694	43.140	2.560	7.529	39.607	3.988
4	2.391	7.033	50.173	1.938	5.701	45.308	4.003
5	1.611	4.739	54.912	1.203	3.538	48.846	4.029
6	1.438	4.231	59.143	1.029	3.026	51.872	4.084
7	1.391	4.090	63.233	.886	2.607	54.479	2.977
8	1.258	3.700	66.933	.760	2.237	56.716	1.877
9	.950	2.793	69.726				
10	.839	2.467	72.193				
11	.787	2.314	74.507				
12	.739	2.173	76.680				
13	.657	1.932	78.612				
14	.634	1.864	80.475				
15	.579	1.704	82.179				
16	.513	1.508	83.687				
17	.473	1.392	85.079				
18	.470	1.383	86.463				
19	.458	1.348	87.811				
20	.423	1.244	89.056				
21	.387	1.138	90.194				
22	.380	1.117	91.311				
23	.364	1.072	92.383				
24	.320	.940	93.323				
25	.316	.930	94.253				
26	.312	.919	95.172				
27	.269	.791	95.964				
28	.255	.749	96.712				
29	.231	.678	97.390				
30	.226	.663	98.054				
31	.196	.577	98.630				
32	.177	.521	99.151				
33	.153	.451	99.602				
34	.135	.398	100.000				

Extraction Method: Principal Axis Factoring.

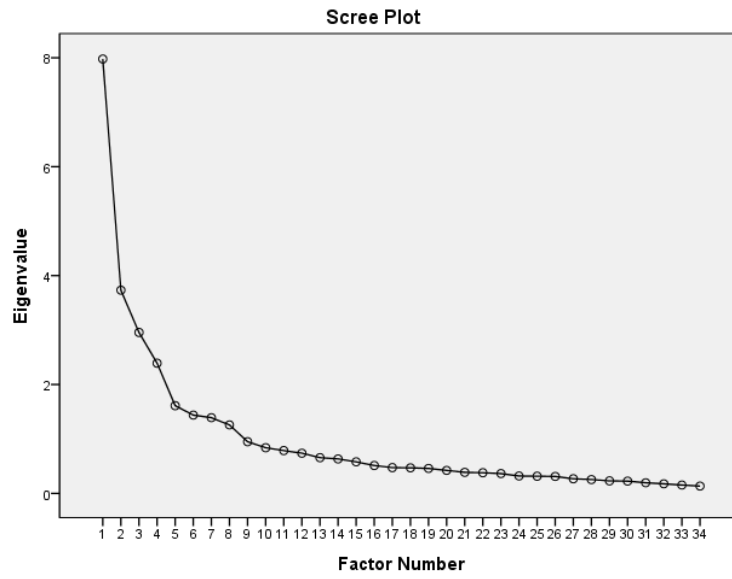
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrix<sup>a</sup>

	Factor							
	1	2	3	4	5	6	7	8
Frightening event staff						.708		
Frightening event facilities						.855		
Frightening event process						.747		
React quickly		.756						
Strong		.798						
Slow_R		.856						
Poor_R		.735						
Self-defence		.747						
Tackel effectively			.579					
Deal with ASB			.693					
Understand			.600					
Seek views								.625
Been informed								.632
Treat fairly			.774					
Friendly and approachable			.688					
Not_Tell_Off_R							.551	
Contact TfL							.596	
Not_Get_Atten_R							.784	
Nothing serious can happen					.597			
No problem so far why now					.765			
Seldom incidence happens					.760			
Rarely something serious happens					.695			
Nothing I can do				.542				
Matter of chance				.444				
Little I can do				.780				
Not my action				.756				
No matter what I do				.544				
Out of control				.772				
Tense	.736							
Worrying	.816							
Nervous	.918							
Jittery	.784							
Worried	.863							
Frightened	.803							

Extraction Method: Principal Axis Factoring.  
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 6 iterations.



### D.3 Exploratory data analysis results (9-factor structure)

**Communalities**

	Initial	Extraction
Frightening event staff	.537	.574
Frightening event facilities	.531	.659
Frightening event process	.555	.632
React quickly	.605	.619
Strong	.720	.703
Slow_R	.705	.739
Poor_R	.632	.562
Self-defence	.595	.571
Tackle effectively	.706	.716
Deal with ASB	.721	.883
Understand	.539	.463
Seek views	.430	.540
Been informed	.347	.482
Treat fairly	.576	.781
Friendly and approachable	.554	.581
Not_Tell_Off_R	.305	.332
Contact TfL	.344	.397
Not_Get_Atten_R	.463	.673
Nothing serious can happen	.489	.457
No problem so far why now	.513	.615
Seldom incidence happens	.567	.583
Rarely something serious happens	.572	.617
Nothing I can do	.501	.496
Matter of chance	.367	.350
Little I can do	.556	.607
Not my action	.476	.493
No matter what I do	.399	.343
Out of control	.534	.573
Tense	.544	.533
Worrying	.555	.555
Nervous	.798	.844

Jittery	.669	.670
Worried	.751	.776
Frightened	.690	.712

Extraction Method: Principal Axis Factoring.

**Total Variance Explained**

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
	1	7.978	23.466	23.466	7.610	22.382	22.382
2	3.733	10.980	34.446	3.385	9.955	32.337	4.615
3	2.956	8.694	43.140	2.567	7.549	39.886	3.941
4	2.391	7.033	50.173	1.945	5.722	45.608	4.000
5	1.611	4.739	54.912	1.211	3.561	49.169	3.794
6	1.438	4.231	59.143	1.057	3.110	52.278	4.092
7	1.391	4.090	63.233	.939	2.761	55.039	2.874
8	1.258	3.700	66.933	.784	2.307	57.346	2.984
9	.950	2.793	69.726	.632	1.859	59.205	1.816
10	.839	2.467	72.193				
11	.787	2.314	74.507				
12	.739	2.173	76.680				
13	.657	1.932	78.612				
14	.634	1.864	80.475				
15	.579	1.704	82.179				
16	.513	1.508	83.687				
17	.473	1.392	85.079				
18	.470	1.383	86.463				
19	.458	1.348	87.811				
20	.423	1.244	89.056				
21	.387	1.138	90.194				
22	.380	1.117	91.311				
23	.364	1.072	92.383				
24	.320	.940	93.323				
25	.316	.930	94.253				
26	.312	.919	95.172				
27	.269	.791	95.964				
28	.255	.749	96.712				
29	.231	.678	97.390				
30	.226	.663	98.054				
31	.196	.577	98.630				
32	.177	.521	99.151				
33	.153	.451	99.602				
34	.135	.398	100.000				

Extraction Method: Principal Axis Factoring.

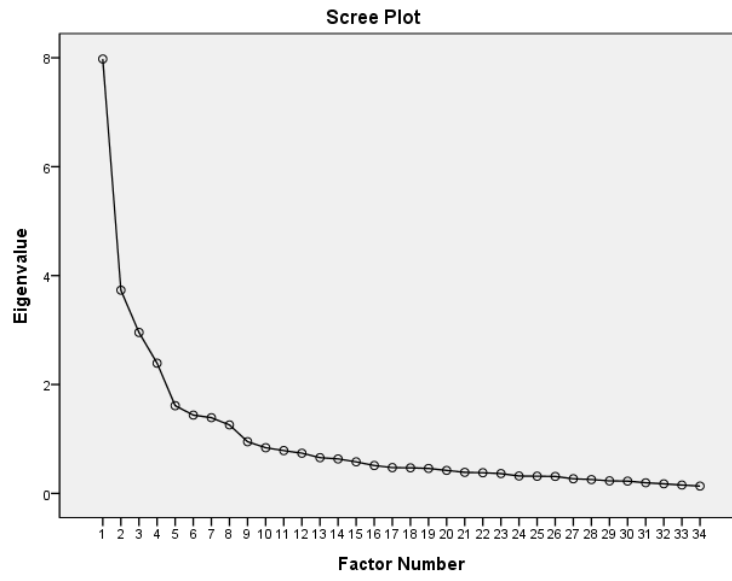
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.





Extraction Method: Principal Axis Factoring.  
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 7 iterations.



## D.4 Exploratory data analysis results (10-factor structure)

### Communalities

	Initial	Extraction
Frightening event staff	.537	.572
Frightening event facilities	.531	.670
Frightening event process	.555	.629
React quickly	.605	.613
Strong	.720	.875
Slow_R	.705	.754
Poor_R	.632	.762
Self-defence	.595	.616
Tackle effectively	.706	.717
Deal with ASB	.721	.886
Understand	.539	.465
Seek views	.430	.608
Been informed	.347	.457
Treat fairly	.576	.914
Friendly and approachable	.554	.543
Not_Tell_Off_R	.305	.348
Contact TfL	.344	.398
Not_Get_Atten_R	.463	.675
Nothing serious can happen	.489	.472
No problem so far why now	.513	.608
Seldom incidence happens	.567	.581
Rarely something serious happens	.572	.653
Nothing I can do	.501	.495
Matter of chance	.367	.353
Little I can do	.556	.609
Not my action	.476	.493
No matter what I do	.399	.342
Out of control	.534	.571
Tense	.544	.534
Worrying	.555	.587
Nervous	.798	.844
Jittery	.669	.671
Worried	.751	.779

Frightened	.690	.723
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Extraction Method: Principal Axis Factoring.

**Total Variance Explained**

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.978	23.466	23.466	7.630	22.441	22.441	5.705
2	3.733	10.980	34.446	3.405	10.013	32.454	4.691
3	2.956	8.694	43.140	2.610	7.677	40.131	3.968
4	2.391	7.033	50.173	1.967	5.784	45.915	4.014
5	1.611	4.739	54.912	1.220	3.590	49.504	3.812
6	1.438	4.231	59.143	1.077	3.166	52.671	4.135
7	1.391	4.090	63.233	.963	2.832	55.503	2.848
8	1.258	3.700	66.933	.801	2.355	57.858	2.883
9	.950	2.793	69.726	.658	1.937	59.794	1.935
10	.839	2.467	72.193	.484	1.422	61.217	.733
11	.787	2.314	74.507				
12	.739	2.173	76.680				
13	.657	1.932	78.612				
14	.634	1.864	80.475				
15	.579	1.704	82.179				
16	.513	1.508	83.687				
17	.473	1.392	85.079				
18	.470	1.383	86.463				
19	.458	1.348	87.811				
20	.423	1.244	89.056				
21	.387	1.138	90.194				
22	.380	1.117	91.311				
23	.364	1.072	92.383				
24	.320	.940	93.323				
25	.316	.930	94.253				
26	.312	.919	95.172				
27	.269	.791	95.964				
28	.255	.749	96.712				
29	.231	.678	97.390				
30	.226	.663	98.054				
31	.196	.577	98.630				
32	.177	.521	99.151				
33	.153	.451	99.602				
34	.135	.398	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Pattern Matrixa

	Factor
--	--------

	1	2	3	4	5	6	7	8	9	10
Frightening event staff						.704				
Frightening event facilities						.876				
Frightening event process						.756				
React quickly		.751								
Strong		.773								-.416
Slow_R		.906								
Poor_R		.852								.374
Self-defence		.702								
Tackel effectively					.749					
Deal with ASB					.979					
Understand					.452					
Seek views									.695	
Been informed									.654	
Treat fairly							.995			
Friendly and approachable							.629			
Not_Tell_Off_R								.556		
Contact TfL								.586		
Not_Get_Atten_R								.786		
Nothing serious can happen				.592						
No problem so far why now				.768						
Seldom incidence happens				.759						
Rarely something serious happens				.696						
Nothing I can do			.520							
Matter of chance			.476							
Little I can do			.780							
Not my action			.751							
No matter what I do			.547							
Out of control			.770							
Tense	.735									
Worrying	.802									
Nervous	.915									
Jittery	.777									
Worried	.862									
Frightened	.826									

Extraction Method: Principal Axis Factoring.  
 Rotation Method: Promax with Kaiser Normalization.  
 a. Rotation converged in 7 iterations.

