

# **Cultural differences in an evacuation scenario - *A study comparing Australian and Swedish responses***

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**Report 5253, Lund 2008**



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- A study comparing Australian and Swedish responses

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**Report 5253**

**ISSN: 1402-3504**

**ISRN: LUTVDG/TVBB--5253--SE**

Number of pages: 75

Illustrations and photo: Kristin Andrée and Beatrice Eriksson

Keywords

Evacuation, Fire alarm, Australia, Sweden, Cross-cultural study, Pre-movement time, Associations, Group behaviour, Cultural differences, Emergency, Fire

Sökord

Utrymning, Brandlarm, Australien, Sverige, Tvärkulturell studie, Beslut- och reaktionstid, Associationer, Grupp beteende, Kulturella skillnader, Nödsituation, Brand

Abstract

Experimental fire drills were conducted in Sweden and Australia to investigate if culture has an influence on human behaviour in evacuation scenarios. The studied variables of interest were the participants' association to the fire alarm, their feelings during the event, pre-movement time and group behaviour. Seven fire drills were conducted in Sweden and six in Australia during regular tutorials at universities. The participants were a total of 257 university students of both sexes. Questionnaires, video recordings and semi-structured interviews were used to collect the data. The conclusions were that the Australians interpreted the fire alarm as more serious than the Swedish students both regarding their associations to the alarm and also how they felt during the fire drill. There was no significant difference between the two countries for the pre-movement time and group behaviour. More data would increase the reliability of the conclusions.

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## Summary

The research of human behaviour in fires has rarely touched the area of cultural aspects and its influence on behaviour. Where a comparison has been made between two cultures, the settings usually varied or the participants only had to predict how they would react in an emergency situation. Since the total research of human behaviour in fires is relatively limited in the world, data are usually utilized across countries' boundaries. The aim of this study was therefore to investigate if these transferences are acceptable or if particular considerations need to be taken when exchanging data between countries. This research was based on experimental fire drills which were conducted on university campuses in Sweden and Australia.

The study aimed to explore several variables; the participants' associations to the fire alarm, their interpretation of the situation, pre-movement time and group behaviour. Quantitative and qualitative analyses were made, depending on the measured variable, to answer the following research questions:

- How does the pre-movement time differ between the two countries?
- What do the people from the two countries associate when they hear the fire alarm?
- In what degree will the fire alarm be taken seriously by people from the two cultures?
- Are there any distinguished differences in the group dynamics between the two countries?

The fire drills took place at universities in both countries during regular tutorials. The tutor was not present when the alarm activated and the students did not know in advance that the fire drill would occur. Seven fire drills were conducted in Sweden and six in Australia. One hundred and five Swedish and 152 Australians participated in total in the study. The gender distribution was slightly different between the two populations, where Australia had more females than males (68 %) while Sweden only had 38 % females. The age range for the participants varied between approximately 18-40 years.

Four different types of methods were used to collect the data: questionnaires, video recordings, observations and interviews. The questionnaires and video recordings were the main methods of collecting the data. The interviews worked mainly as a compliment to ensure reliable results but also to fill in any gaps which the questionnaires or video recordings could not cover.

The questionnaires consisted of questions about the participants' background, associations to the alarm and how they felt during the drill. The video recordings on the other hand were used to identify characteristics in the group behaviour and pre-movement times. All the quantitative data (questionnaires and pre-movement times) were analysed through hypothesis testing and different statistical tests were used depending on the properties of the collected data. The qualitative data (group behaviour and interviews) were analysed mainly by content analysis.

When comparing the results, Australians tended to regard the situation as more serious, both regarding their associations and the level of fear and insecurity they experienced during the drill. Forty-eight percent of the Australians associated the alarm at first with something serious which can be compared with 21.0 % of the Swedish participants. A majority of all the participants disagreed with the statement that they felt very scared during the drill even though a larger number of Australians (20.4 %) agreed partly with the statement compared to Swedish participants (2.9 %). The level of insecurity also varied where 45.0 % of the Australians felt insecure during the drill compared with 15.4 % of the Swedish participants.

The difference in pre-movement times was not significant between the two cultures, where both countries received a mean of between about 1 min to 1 min and 30 sec. The Australians were more likely to evacuate individually whereas the Swedish participants more often evacuated in groups. Swedish participants also had more discussion which may have lead to a more uniform evacuation. Australians on the other hand were interpreted to be more inhibited by other group members' behaviour.

Although there were differences between participants from the two countries, the general conclusion is that care must be taken when generalising findings across different countries, especially about people's association and feelings in emergencies. More research should be conducted about the pre-movement times and group behaviour since the amount of data for this study is limited. It is also important to emphasize that these results are from an academic environment in Sweden and Australia. Comparisons with other cultures or settings may show a different pattern of significant differences. Australia and Sweden are both countries which are regarded as Western societies. However, an additional comparison with, for example an Asian country, may show clearer differences between cultures. It is also important to further evaluate how one culture interprets different types of alarm since this may be valuable for tourist facilities, among others, which have many international visitors.

## Sammanfattning

Forskningen om människors beteende vid brand har sällan berört området om kulturella aspekter och dess inflytande på beteende. I de fall där en jämförelse har ägt rum mellan två kulturer varierade ofta förutsättningarna eller så fick deltagarna enbart förutspå hur de skulle reagera i en nödsituation. Eftersom den totala forskningen om människors beteende vid brand är relativt begränsat i världen används ofta data över länders gränser. Syftet med den här studien var därför att undersöka om dessa överföringar är godtagbara eller om särskild hänsyn måste tas vid utbyte av data mellan länder. För att minska antalet varierande variabler baserades denna studie på experimentella brandövningar som genomfördes i Sverige och Australien.

Studien syftade till att utforska flera variabler; deltagarens associationer till brandlarmet, deras tolkning av situationen, beslut- och reaktionstid samt grupp beteende. Kvantitativa och kvalitativa analyser genomfördes beroende på den uppmätta variabeln för att svara på följande frågeställningar:

- Hur skiljer sig beslut- och reaktionstid mellan de två länderna?
- Vad associerar människor från de två länderna brandlarmet med?
- I vilken utsträckning blir brandlarmet taget seriöst av de två nationalkulturerna?
- Är det några utmärkande skillnader i gruppdynamiken mellan de två länderna?

Brandövningarna ägde rum på universitet i de båda länderna under vanliga övningslektioner. Övningsledaren var inte närvarande när larmet aktiverades och studenterna kände inte till i förväg att en brandövning skulle äga rum. Sju övningar genomfördes i Sverige och sex i Australien. Totalt deltog 105 svenskar respektive 152 australiensare i studien. Könsfördelningen skiljde sig något mellan de två populationerna, där Australien hade fler kvinnor än män (68 %) medan Sverige hade den omvända uppsättningen med 38 % kvinnor. Åldersspannet för deltagarna varierade mellan ungefär 18-40 år.

Fyra olika sorters metoder användes för att samla in data: frågeformulär, videoinspelningar, observationer samt intervjuer. Frågeformulären och videoinspelningarna var kärnan i datainsamlingen. Intervjuerna verkade i huvudsak som ett komplement för att försäkra pålitliga resultat samt att fylla i hålrum som frågeformulären och videoinspelningarna inte kunde registrera.

Frågeformulären bestod av frågor om deltagarens bakgrund, associationer till larmet och hur de kände sig under övningen. Videoinspelningarna användes å andra sidan för att identifiera karakteristiska grupp beteenden samt beslut- och reaktionstid. All kvantitativ data (frågeformulären och beslut- och reaktionstid) analyserades genom hypotesprövning och olika statistiska test användes beroende på egenskaperna hos insamlad data. De kvalitativa data (grupp beteende och intervjuer) var i huvudsakligen analyserat genom innehållsanalys.

Vid jämförelsen av resultaten tenderade australiensarna att uppfatta situationen som seriösare, både när det gäller deras associationer och mängden rädsla och osäkerhet som upplevdes under övningen. Fyrtioåtta procent av australiensarna associerade till en början larmet med någonting seriöst, vilket kan jämföras med 21,0 % av de svenska deltagarna. En majoritet av samtliga deltagare tog avstånd från ställningstagandet att de kände sig väldigt rädda under övningen, även om en större andel australiensare (20,4 %) instämde delvis med påståendet i jämförelse med svenska deltagare (2,9 %). Nivån av osäkerhet varierade där 45,0 % av australiensarna kände sig osäkra under övningen i jämförelse med 15,4 % av de svenska deltagarna.

Skillnaden i beslut- och reaktionstider var inte signifikant mellan de två kulturerna, där både länderna hade ett medelvärde på omkring 1 min – 1 min och 30 sek. Australiensarna uppvisade även en mer individualistisk utrymning medan svenska deltagare utrymde oftare i grupp. Svenska deltagare hade även mer diskussioner vilket kunde leda till en mer enhetlig utrymning. Australiensarna däremot tolkades som mer hämmade av andra gruppmedlemmars beteende.

Det fanns skillnader mellan deltagarna från de två populationerna. Den generella slutsatsen är därför att viss försiktighet måste uppmärksammas när man överför data mellan länder om människors associationer och känslor i nödsituationer. Mer forskning bör genomföras om beslut- och reaktionstid samt grupp-beteende, eftersom mängden data i den här studien var begränsad. Det är även viktigt att betona att dessa resultat är giltiga för en akademisk miljö i Sverige och Australien. Jämförelser med andra kulturer eller förhållanden kan visa signifikanta skillnader. Australien och Sverige är båda två länder som anses vara västerländska samhällen. Däremot skulle en ytterligare jämförelse med till exempel ett Asiatiskt land kunna visa tydligare skillnader mellan kulturer. Det är även viktigt att utvärdera hur personer från en kultur tolkar olika typer av larm eftersom det kan vara värdefullt för bland annat turistfaciliteter som har många internationella besökare.



## Preface

This report is the final result of our extended Bachelor Project in Fire Protection Engineering (22.5 ECTS, European Credits Transfer System) which is compulsory to get a Bachelor in Science in Fire Protection Engineering at Lund University in Sweden. It will in an academic way introduce the subject of cultural differences in an evacuation scenario from different perspectives. Hopefully, this report will enhance the interest for cross-cultural studies in emergency situations and also be a starting-point for future research in the area. We will in this chapter give some personal reflections about the process and also thank all the helpful people who have guided us somewhere, or all along the line.

First of all, we would like to thank our supervisors Ph.D. student Daniel Nilsson and Lecturer Håkan Franzich at Lund University for their help through the entire course. They have given us valuable comments and tips in all stages of the research process. We would also like to give a great thanks to Ångpanneföreningen's Foundation of Research and Development for financing our research part in Australia. Without this financial aid it may not have been possible to conduct the study.

Beyond the writing presented in this report, it has been a very exiting and valuable learning session during the entire procedure. As undergraduate students, we realised quickly how much there is to learn about the research process, and in this case even how it may vary in different countries. We would like to thank Prof. Dorothy Bruck at Victoria University and Dr. Wendy Saunders for their support in Australia and their help with explaining the system and terminology over there.

The concept *planning* received a deeper meaning for us where you should always have a plan B or an excessive amount of time. You should never overlook the plausibility of misfortunes along the road even though the planning is at the time regarded as spotless. We learnt that the demands and expectations on the ethical application may vary between the countries which delayed our start in Australia. However, we still managed to carry it through and would like to thank Denise Charman in Victoria University's Ethical Committee for helping us with the final application. We would also like to thank Grant Keys at the Occupational Health and Safety Unit at Victoria University for his time and flexibility to help us conducting the fire drills in Australia.

To be able to conduct the fire drills in Sweden we needed mobile fire alarm bells and we would therefore like to thank Per-Eric Thisell at Siemens AB for providing us with this equipment.

With all these new acquisitioned knowledge we are very satisfied with the final result we have achieved. Even though the large numbers of methods were overwhelming at some stages, it also contributed to a general experience how to analyse and validate different types of data. Research is therefore not as strange to us anymore and we will try to take good care of our recently obtained knowledge, both about the research process and our findings.

We should not forget to thank all the participants in the study and also their tutors for letting us conducting the drills and taking their time! Also a great thank you to the rest of the people who voluntarily helped us during the way to come up with the final result.

We hope you will have an interesting reading,

Kristin Andrée  
Beatrice Eriksson

Lund 2008

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# 1 Introduction

In today's Fire Safety Planning, people are internationally exchanging results from experiments and other kinds of research. Since the extent of present fire safety research is relatively limited in the world, the exchange of results between countries is an essential part to receive new information about different phenomena. This study will investigate if there are any cultural differences in behaviour in an emergency situation. It may show if caution has to be taken when this type of data is transferred between different countries. The results may also indicate if it is suitable to utilize the same input data in the simulation programs for evacuations worldwide.

The concept of *culture* can be defined in many different ways. In this report the concept will be defined in the Swedish social-anthropological science sense (directly translated from Swedish): **[1.]**

*“Collective consciousness, that is, many people's shared perspective and values (which can be more or less conscious).”* p.12

The study refers to the culture that has appeared because of the belonging to the same nation, so-called *national culture*. Within the boundaries of each country there exist large variations in culture among the population. Perspectives and values of people can for example depend on the place of birth (in the city or on the countryside), belonging to a minority (for example in Sweden there are the Sámi, and in Australia the Aborigines), or the belonging to a certain social class. These variations within the national culture are called *sub cultures*. **[2.]** Cultural identity is multifaceted and often dependent on social interactions with others. It is therefore difficult to divide people into certain classes since they often overlap into different groups depending on their surroundings. For example may an Afro-American feel very American while talking to an exchange student, who has just arrived to the country but more African compared to other American students. **[3.]**

To define national culture for each country it is not only about the similarities between the *majority* of the inhabitants. Other characteristic actions and values can appear when they are compared to other countries. For example, a measurement could be used to identify shyness in a country's population. If the study shows that 25 % of the Swedish population answered that they were, although it is not a majority of the Swedish people, it is not entirely wrong to say Swedish people are shy if other countries showed a much lower frequency. **[2.]** This research study will evaluate if there are cultural differences between Sweden and Australia in an evacuation scenario. National culture will therefore be defined as the culture differences between these two countries.

When analysing the importance of national culture in an evacuation scenario it is necessary to pay attention to the sub cultures. To determine if variations in an evacuation scenario exist between different countries requires that the populations in question come from similar conditions, irrespective of country. This study will therefore try to minimize the numbers of variations between the groups of participants, in order

to facilitate the analysis between the two national cultures. Evacuation experiments will be performed both in Sweden and Australia. The selection of participants was confined to university students and controlled so the age and gender distribution will be similar.

### **1.1 Variety between and within Australian and Swedish national cultures**

Australia and Sweden are two countries which are both regarded as cultures from Western societies. However, the cultural variety between and within these nations should not be overlooked when conducting a cross-cultural study. Characteristics for the national cultures may give explanations to differences in the results (if they exist) from this study.

Even though it is difficult to concretise differences between national cultures, Geert Hofstede (in Hofstede & Hofstede (2005)) tried to compare 74 nations and regions (among them Sweden and Australia) regarding their perspectives and values. He summarized data from questionnaires which were mainly handed out to people working within the multi international company IBM group. The answers were coded on a scale from 1-5 and different indexes were calculated depending on the measured value. The values and perspectives that were included in this study were:

- Social inequality (distance to power)
- Individuality versus collectivism
- The conception of masculinity and femininity
- Views on insecurity and uncertainty

Australia and Sweden showed similar responses regarding the distance to power, were both the participating countries showed a low rank (62 respectively 67/68). This means that they are both countries with a fairly flat hierarchy. For low-ranked countries, staff members are more independent and not as afraid to take up discussions and disagree with their boss. Discussions and consultations are also the preferred method to progress with the work. To translate it to the school and academic world, a low-ranked country encourage their students to be creative, criticising and think independently. The teacher is regarded as equal as well as the students.

The other three values showed a more distinguished difference between Australia and Sweden. Australia was the second most individualistic nation in the world, just after the United States of America. Sweden also showed an individualistic pattern with a shared position with France on place 13/14. However, the individualistic index for United States of America, Australia and Great Britain (3<sup>rd</sup> rank) were significant higher than the other countries, with the given points 89-91. This can be compared with Canada on a 4<sup>th</sup> place with 80 points and Sweden with 71 points. An individualistic county puts one self before the group, whereas it is the opposite for a collectivistic county. In an individualistic country every human is expected to have an own opinion about different phenomena whereas the opinions in a collectivistic country often are predetermined by the group.

Australian and Swedish views on masculinity and femininity differed even more. Sweden was defined as the most feminine country from the study with rank 74 whereas Australia showed a masculine pattern with the rank 20. In a feminine society relations and life quality is more important than challenges, salaries and acknowledgement which are norms that better reflect a masculine society. In school-related values, a feminine society sees the average student as the norm and weak students becomes encouraged. In a masculine society it is on the other hand the top students that are regarded as the norm and furthermore get acknowledged. When solving conflicts, a feminine society compromise and negotiates whereas a masculine society let the strongest part win. This may contradict the low distance to power in Australia, but of course all parameters vary within each nation and some may not be specific for that certain country. The masculinity in Australia may also show the views on males and females were male should be ambitious and have attitude whereas females should be soft and more concern about relations. In a feminine society, both males and females should be modest and focus on relations.

Finally the study also comprised in which extent the nations avoided uncertainties. Sweden received a low rank (70/71), which stands for a low avoidance of uncertainties, whereas Australia did show a higher rank (55/56). Characteristics behaviours and values for nations with weak avoidance of uncertainties are that there is a low level of stress and anxiety; aggressiveness and feelings may not be showed; and what is different is exciting. In nations with a strong avoidance of uncertainties, there is a bigger level of stress and anxiety, feelings and aggressiveness may be showed during the right circumstances and differences are dangerous. These nations are also more worried about money and health and in more need of precision and formality. [4.]. A summary of the comparison is presented in Table 1.

**Table 1. Rank for Australia and Sweden from the different indexes (of total 74 participating countries or regions)**

| Value or perspective       | Australia (rank) | Sweden (rank) |
|----------------------------|------------------|---------------|
| High distance to power     | 62               | 67/68         |
| Individualistic society    | 2                | 13/14         |
| Masculine society          | 20               | 74            |
| Avoidance of uncertainties | 55/56            | 70/71         |

Of course, there may be differences within each country's sub cultures as well. Australia is for example very culturally diverse. In 2001, 19.4 % of young Australians in the age-range 20-29 years old were born overseas. Hittar inte referenskölla.. Most of them, approximately 82 %, were born in Asia. The number is probably even higher in an urban environment like at universities where there are many international students. A comparative number from 1998 in Sweden is 10.9 %, which describes the Swedish population who were born in another country for *all* age groups [6.].

## 1.2 Who are afraid?

Mark Warr (1990) studied how different cues (night, novelty and being alone) affected the level of fear people felt by different gender and age. Since previous studies show that the differential in the level of fear regarding to age is most distinct if you are older or younger than 50 years old, the study used this as the definition of young respectively old people. An example of a used statement is:

*“You are waiting on (a crowded/an empty) street corner downtown (in the afternoon/at night) in an area you (know well/do not know well)”* p. 899.

The study showed that females in general were more afraid than males. Age did not seem to have the same impact on the level of fear. Night and novelty were suggested to have the largest impact on the level of fear whereas being alone or not did not vary as much except for young females. [7.] Table 2 shows a more detailed result score.

**Table 2. Expected Fear Scores under all Levels of the Dependent Variables\***

| Night | Novel | Alone | Young males | Young females | Older males | Older females |
|-------|-------|-------|-------------|---------------|-------------|---------------|
| -     | -     | -     | 0.57        | 2.85          | 0.73        | 3.01          |
| +     | -     | -     | 1.95        | 4.23          | 4.36        | 6.64          |
| -     | +     | -     | 2.30        | 4.58          | 2.46        | 4.74          |
| -     | -     | +     | 1.54        | 3.82          | 2.95        | 5.23          |
| +     | +     | -     | 3.68        | 5.96          | 6.09        | 8.37          |
| -     | +     | +     | 3.27        | 5.55          | 4.68        | 6.96          |
| +     | -     | +     | 4.96        | 7.24          | 4.62        | 6.90          |
| +     | +     | +     | 6.69        | 8.97          | 6.35        | 8.63          |

\* Presented data is from Mark Warr (1990) p. 901.

The study was conducted in the United States but may show a possible pattern even in a Swedish and Australian sense. Since the study is mainly concerned about the level of fear for unknown events from strangers, it is not directly transferable to the level of fear for unexpected event like an evacuation. However, it may give a premonition about the distribution between age and gender. The pressure from society’s values and prejudices may also have affected the answers from the participants. Young male, for example, may have mentioned a lower level of fear since it is regarded by many societies that males should be less afraid.

Thomas Ollendick et. al. (1996) did a survey of how 1200 children and adolescents (7-17 years old) from four different countries, namely, Australia, China, Nigeria and United States of America perceived fear. The participants received 80 items which they would link either to ‘no’ perceived fear, ‘some’ perceived fear or ‘a lot’ perceived fear.

The results from the study showed that Nigerian youths overall felt a higher level of fear than Australian, American and Chinese youths. Girls mentioned a higher level of fear than boys for all the participating countries except Nigeria where no significant



difference was found between the genders. What the youths were afraid for also varied and a reason behind that may be the social context and environment the participants grew up in. Australian and American children and adolescents were more worried about personal safety, e.g. a robber breaking in to the house or getting lost in a strange place. Nigerian youths were more afraid of physical elements, like snakes, guns and deep water. Chinese children, especially in the age-range 11-13 years old were concerned about how they were perceived by others. They were therefore worried about, for example perform badly in school. [8.]

As all studies between different cultural and social context, the complexity surrounding the topic makes it difficult to draw concrete conclusions. There are always variables which can not be included because of the limitations in time, resources and also the impossibility to simplify a group of people to something purely homogenous. However, both of the above studies show a significant difference between males and females from most of the studied countries. The influences of age did differ in the cross-cultural study, were most of the countries showed a decreasing level of fear with age [8.]. Though, this was not shown by the study conducted by Mark Warr (1990). Conversely, it is not unlikely to assume that the decreasing perceived fear starts to level away after a certain age when it becomes more fixed.

### 1.3 Pre-movement time and why people decide to evacuate

Pre-movement time is defined as the time from that the signal of the fire alarm activates to people's initial movements towards the exit. The pre-movement time is divided in recognition and response. The *recognition* describes the time it takes for a person to analyse and make decisions after hearing the alarm. The *response* is a physical action which does not lead the participant closer to the exit, e.g. getting dressed and gathering valuables. The pre-movement time is over when the participant has taken a first step towards the exit. The total time it takes for an evacuation is called *evacuation time*.

The pre-movement time depends on different variables. People tend to react differently depending on the settings of the fire or drill. The number of cues has a vast impact on how people will react. When the cues are ambiguous, for example only hearing the tone of a fire alarm, people tend to seek more information to confirm that it is an emergency or not. [9.] Some other variables discussed in previous research are:

- The type and location of the fire alarm
- Group belonging and social behaviour
- Personal authority and responsibility

In apartment buildings the most important variables to start an evacuation are the clarity and position of the fire alarm. Fire drills in apartment buildings have shown the efficiency of having complementary lower sounding fire alarm inside every apartment instead of only having a loud alarm system in the staircase. Gender and age have been shown to have no significant influence on the evacuation time and movement. [10.]. It is important to note that this study analysed the behaviour of households. Therefore the

set of people were well-acquainted with each other and sometimes on their own. The study does not show how the proportion of gender affects the group behaviour. For example: females may act differently in male dominated surroundings where there is less knowledge about the other group members and vice versa. There were no other cues presented than the fire alarm. In real fire events it has been shown that women are more concerned about the safety of people, including themselves than men and are therefore more likely to leave the building [11.].

The group setup has been shown to have significant influence of people in settings where people are less acquaintance with each other. Latané & Danley (1970) conducted experiments to investigate how people's behaviour affected their surroundings and vice versa. The experiment was conducted with male university students that were asked to fill in a form in a room. Smoke started to enter the room after a while. They had three different settings; the participant alone in the room, with two other participants or with two persons that knew about the experiment. The two persons that knew about the experiments in advance were told to ignore the smoke that came in to the room. The results from the experiment showed that a person alone is more willing to take action and report smoke than a person that is with others. 75% of the participants that were alone took positive action and 38% when they were with others. The participants were even less likely to take action if they were with other persons that ignored the smoke; it happened only 10% of the times. [12.]

In certain circumstances, usually in public buildings, people do not seem to evacuate until an authority or staff-member tells them to do so. It may be because of hesitation or the fact that the person does not want to lose his or hers face by overreacting. [13.] This hesitation and insecurity in public buildings may be reduced with well-trained staff that can give clear directives in emergency situations. Experiments have shown that the safety-education for the staff was the most important factor to decrease the pre-movement time in retail stores [14.]. Real fire events, such as the one in London's King's Cross Underground Station in 1987, has also shown that people usually modified their behaviour when they were told so by an authority.[15.].

People's roles and responsibilities during ordinary conditions had been shown to maintain even during serious emergency events. This was one factor which delayed the prevention of the fire in London's King's Cross Underground Station. Junior attendants first arrived to the scene and called for senior investigators before any decisions were made. The roles of wives and husbands have also been shown to be consistent in fire events. [15.]

Research suggests different approximated pre-movement times depending on the current settings, see Table 3. Proulx and Sime (1991) conducted 5 unannounced fire drills in underground stations with the equal number of different fire alarms. The results showed the strength of spoken messages and educated staff, where the participants did not have to take time to investigate what was happening or what to do. For an ambiguous signal, in this case an alarm bell without any staff-member nearby, the pre-movement time was estimated to 8 min 15 sec – 9 min. In this scenario, the participants

were not as familiar with the emergency procedure, or the building which may have prolonged the pre-movement time compared to offices and schools where people are more familiar. [16.]. Suggested pre-movement times for warehouses with a fire alarm bell is approximately 3 min 30sec. The time derives from a Delphi investigation where 21 experts from Fire Safety related services individually estimated a pre-movement time for warehouses with fire alarm bells. [17.]. The method contains limitations, because it is a subjective estimation of the experts, but may give an approximation of the pre-movement time. Evacuations are a complex phenomenon with many different depending variables, and hence it is hard even in the most precise research to estimate an exact pre-movement time. It is therefore important to take the uncertainty of the data into account when conducting Fire Safety Planning to have the margin on the right side.

**Table 3. Pre-movement time in different types of buildings with an ambiguous alarm (in general a bell or tone).**

| Type of building             | Pre-movement time (min:sec) |
|------------------------------|-----------------------------|
| Underground station          | 8:40                        |
| Warehouses and retail stores | 3:30                        |
| Smaller offices and shops    | 1:00*                       |

\* From Frantzych (2005), alarm type not mentioned but the alarm is inside the room.

#### 1.4 Recognition of the fire alarm

To *recognise* the fire alarm is vital in an emergency situation. In today's society, the fire alarms are getting more advanced with different alert levels, tones or spoken messages. These advanced models are usually produced to make it easier to discern the fire alarms from other kind of sounds; but are they all suitable and recognised by the population?

The National Building Code of Canada introduced 1995 a standard 3-pattern tone (T-3), which later also has been required by the NFPA 72 to simplify the identification of the fire alarm. The sound is defined according to the ISO 8201 standard. Proulx et. al (2001) conducted a study to identify in which extent the participants were familiar to the T-3 signal, and compared the results with 5 other signals. The examined signals were a car horn, reverse alarm, a buzzer, T-3, bell and a slow whoop. Three hundred and seven participants listened to each alarm for 12 seconds and answered three different questions; *"Have you heard this sound before?"*, *"What do you think this sound means?"* and *"How urgent do you feel this sound is on a scale from 1-10. 1 means the sound is not urgent at all and 10 means it is extremely urgent"*. Three different presentation orders were used to identify if the order of the alarms had an effect on the participants' recognition. The fire alarms, T-3, bell and slow whoop were defined correctly when the participant associated it with either a fire or evacuation. To eliminate the possibility that the participant had guessed the correct answer, a correct identification was summarized together with an earlier recall from the participant, see Table 4. Even though the T-3 had been a standard for 6 years, and installed in many warehouses when the study was conducted, only 4 %

recalled and identified the signal correctly. This can be compared with a fire alarm bell were 38 % recalled the signal correctly. [19.]

**Table 4. Number of Occupants who Correctly Recalled and Identified Each Signal\*, Fire Alarms are coloured.**

| Signal        | Percentage |
|---------------|------------|
| Car horn      | 96 %       |
| Reverse Alarm | 69 %       |
| Bell          | 38 %       |
| Slow Whoop    | 14 %       |
| T-3           | 4 %        |
| Buzzer        | 1 %        |

\* Data from Proulx et. al (2001), p. 18

Regarding the level of urgency, the bell received the highest perceived urgency of the three fire alarms with an average score of 7.17. The T-3 signal received the lowest perceived urgency of the fire alarms with a total mean of 3.97. The Slow Whoop got a score in between with an urgency level of 6.01. [19.]

### 1.5 Cross-cultural studies in evacuation scenarios

In a poll of Japanese and Brazilian schoolchildren, made in cooperation between the University of São Paulo (Brazil) and Aichi Institute of Technology (Japan), participants were asked questions about how they would react in a fire emergency situation, and what knowledge they had about fire scenarios. In Japan, fire drills are conducted annually in schools, even though they are always led by the teachers so it is hard to identify individual differences within the groups. In Brazil fire drills occur rarely. One of the questions that the pupils would answer was how they would react if a fire emergency situation took place during a break. Among the Japanese pupils in 6<sup>th</sup> grade, 54 % answered that they would wait for further instructions from their teacher. The corresponding proportion of Brazilian pupils in 6<sup>th</sup> grade was only 16 %. On the contrary, 37 % of the Brazilian pupils answered that they would try to help and warn others, which can be compared to 16 % of the Japanese pupils' answers. [20.] The study did not look at previous experiences instead the pupils had to predict their future reactions. Therefore it is hard to say if that actually is the way they are going to react in a real fire emergency. The results may indicate that Brazilian pupils are more independent than Japanese pupils but do not show how quick they would respond to a fire alarm.

Comparisons between polls, answered by American and British citizens who have experienced a fire situation were made during the late 1970's. Examples of the questions that were asked are: what made them react to danger, and in which order their actions

occurred. On the question of what was their first action they had 18 alternatives to choose from. Fifteen per cent of the Americans answered that they would notify others, which was compared to only 8.1 % of the British citizens. Instead, 14.9 % of the British citizens answered that they tried to fight the fire, which can be compared to 10.4 % of the Americans. In the comparison, notice was taken of the type of fire, the building, the age- and gender distribution between the countries, and also the type of earlier fire experience the participants had. [21.]

The discussion for the study between American and British citizens concluded that it is not possible to determine whether the presented differences depend on cultural variation. There might be other factors involved, for example gender. In the study the American participants consisted of more females than males while the British study had more males than females and that could have influenced their actions. [21.] The study is almost 30 years old, and people's views and perspectives may also have changed in the society of today.

The results from the polls above may indicate that variations in group behaviour in an evacuation situation between different populations can depend on cultural variations. However, it is hard to distinguish the effects of cultural variations from other varying variables, and thus further investigation in the area is considered to be relevant for a more valid picture of how people would react in an evacuation situation.



## 2 Research aims and purposes

The aim of the project is to study the importance of cultural differences for human behaviour in an evacuation scenario. Primarily the study will identify if the pre-movement time differs between people from different national cultures, namely Sweden and Australia.

The study will also aim to identify characteristic behavioural patterns, if they exist, in an evacuation situation between the different national cultures. This could include the group dynamics, and what kind of associations one has when hearing a fire alarm.

The collected data also aim to give an overview how research of human behaviour in fires is transferable between different cultures.

### 2.1 Research questions

The study aims to answer these questions:

- How does the pre-movement time differ between the two countries?
- What do the people from the two countries associate when they hear the fire alarm?
- In what degree will the fire alarm be taken seriously by the people from the two cultures?
- Are there any distinguished differences in the group dynamics between the people from the two countries?

### 2.2 Hypotheses

For a quantitative analysis, the following hypotheses are stated:

Hypothesis 1: The level of seriousness, regarding their associations to the fire alarm, will differ between the two populations.

Hypothesis 2: The level of seriousness, regarding their feelings during the fire drill, will differ between the two populations.

Hypothesis 3: The pre-movement time will differ between the two populations.

The Null hypothesis for each statement is that there is no significant difference between the two populations. If any of the hypotheses are supported another aim will be to explore how and why such differences exist.

### 2.3 Purpose

The purpose of the study is to investigate if pre-movement times commonly used in simulation programs for evacuation are acceptable. Today data is commonly utilized between countries. This study may show if results from national studies are applicable

in a global sense. Since the extent of the study is relatively limited, another goal is that the study can be used as foundation for further research in the area.

The collected associations and degree of seriousness from the experiments will indicate how severe people from different cultures interpret a fire alarm. This can lead to further understanding of how information about fire evacuation systems should be delivered in different countries, e.g., which types of alarms that are appropriate and which information to provide at tourist facilities.

## **2.4 Delimitations**

The study will not investigate the influence on socio-economic background. The results from this study are extracted under certain conditions, namely an academic environment and are therefore only valid for these. How the results are transferable to other areas is not investigated.

The study is based on data from two Western cultures, namely Australia and Sweden which may have more similarities compared with other countries of the world. Conclusions about insignificant influence of culture are therefore only valid for the cultures of this study. Cultural aspects may have an influence when two countries with more diverse societies are compared.

## **2.5 Disposition**

The introduction chapter will provide the reader with a literature review of previous research and background information to this project with explanations of terminology used in this report. The report will after that be divided in the following chapters:

3. Method – Description of the rooms, fire alarms, participants and the data collection's features and methods. The analysis of the data is not included in this chapter. The chapter starts with an introduction of the settings followed by a presentation of each method.

4. Data Analysis – Description of the tools and analysing methods used for the collected data. The chapter is divided after the character of the data (quantitative or qualitative) as well as the measured variable.

5. General description – A general description over the course of event for each fire drill to provide the reader with an overview over the scenarios.

6. Results – Presentation of the results from the quantitative data, as well with the qualitative, where personal reflections are clearly marked. The chapter is divided into sections based on measured variables except the results from the interviews which are a separate section.



7. Discussion – Discussion about the validity, limitations, and deviant responses from the results as well as personal reflections. Future research areas are also suggested.

8. Conclusions – A brief summary of the most important findings from the results and discussions together with overall conclusions.



### 3 Methods

Unannounced fire drills in naturalistic settings were conducted during tutorials at universities in Sweden and Australia. The project started in 2006 and finished in 2007. The goal was to attain as uniformed experiments as possible to facilitate the comparison between the data from the two countries. In total, 7 experiments were conducted in Sweden 2006 and 6 in Australia 2007. Each participating tutorial class is in this report defined as a separate fire drill even if the fire drill was conducted simultaneously with other classes.

#### 3.1 Participants

The participants of this study have consisted of 257 first year undergraduate university students or TAFE students, age range approximately 18-40 years old, both males and females. The participants were selected from either Lund University of Technology, Sweden or Victoria University, Australia. Out of the 257 participants, 105 were from Sweden and 152 from Australia. Thirty eight per cent of the Swedish participants were females compared to 62 % females among the Australian participants. The detailed gender distributions for the two countries are presented in Table 5 and Table 6. All the Swedish participants studied engineering, whereas the Australian participants mainly studied engineering or nursing.

In Sweden, the recruiting procedure started with an investigation of the gender proportions in the different classes, and classes with the most uniform distribution were selected for further analysis. Some classes were recruited because the location of the classroom was very suitable, for example in the same corridor as two already selected classrooms. Lecturers and tutors for the selected classes were contacted to get their verbal consent to conduct the drills during their tutorial.

In the Swedish fire drills approximately 9 % of the participants were born in Asia and 2 % in another European country than Sweden. The rest of the participants were born in Sweden.

**Table 5. Gender proportion from the Swedish experiments**

| Fire drill nr     | 1         | 2         | 3        | 4         | 5         | 6         | 7         | Total      |
|-------------------|-----------|-----------|----------|-----------|-----------|-----------|-----------|------------|
| Number of females | 9         | 9         | -        | 9         | 3         | 4         | 6         | <b>40</b>  |
| Number of males   | 4         | 8         | 6        | 9         | 12        | 13        | 13        | <b>65</b>  |
| Total             | <b>13</b> | <b>17</b> | <b>6</b> | <b>18</b> | <b>15</b> | <b>17</b> | <b>19</b> | <b>105</b> |

In Australia, the recruiting procedure was restricted to fit the Occupational Health and Safety Unit's (OHSU) routine fire drill schedule. Date and location were decided by the OHSU. Tutors in suitable buildings were contacted and a time arrangement was made

in co-operation with the tutors. The Australian tutors signed a written consent form which they could withdraw during any time of the study, see Appendix A.

In the Australian fire drills approximately 51 % of the participants were born in Australia, 27 % in Asia, 12 % in Europe, 6 % in Africa, 2 % in South America and 1 % in another Oceania country.

**Table 6. Gender proportion from the Australian experiments**

| Fire drill nr     | 8         | 9          | 10        | 11       | 12       | 13        | Total       |
|-------------------|-----------|------------|-----------|----------|----------|-----------|-------------|
| Number of females | 46        | 48         | 0         | 0        | 0        | 0         | <b>94</b>   |
| Number of males   | 11        | 10         | 11        | 5        | 8        | 11        | <b>56</b>   |
| Total             | <b>57</b> | <b>60*</b> | <b>11</b> | <b>5</b> | <b>8</b> | <b>11</b> | <b>152*</b> |

\* Two participants did not fill in gender

### 3.1.1 Previous experiences and expectations of evacuation procedures

The participants were asked if they had taken part in a fire drill at their respective University. Fifteen point two per cent of the Australians had at least once experienced a fire drill at their University, whereas the comparative number from Sweden was only 6.7 %.

The Australian participants had also more experienced from fire related services or real events than the Swedish participants. Fire drills were not included in this question, rather experiences from the fire brigade, fire safety responsibilities at workplace or been through a real fire event. If the participants filled in during 'other experience' that they been through a fire drill, this was regarded as no previous experience. Seventy seven per cent of the Australians had no previous experience of this kind compared to 91.4 % of the Swedish participants. The most common experience in Australia was to have the responsibilities for the safety procedures at a workplace or school (15.1 %). Three Australian participants had also been through a real fire event or war, which none of the Swedish participants mentioned.

## 3.2 Fire alarm design and location

The fire alarm that was used in the experiments was different in Sweden and Australia; see Table 7 for an outline of the experiments. The reason why different systems were used is because the fire alarm standards vary between the countries. Previous Canadian research has shown that the country's standard do not necessary have to be the most recognised fire alarm signal; [19.] but since no similar study has been found from Sweden or Australia, it is regarded more inappropriate to use a signal the participants are not familiar with at all. It was also important to benefit the participants since they did not sign a consent form prior the fire drill. It was therefore important to give the participants the information and practice of how the safety procedure works at their

respective University. The participants may also be confused in a future real emergency if another alarm system was used in the experiments.

In Sweden mobile fire alarm bells were used with a sound level of about 95 dB 1 meter away from the alarm bell. The sound was a pulsating ring tone. In the Swedish experiments, the bell was placed in two different locations, either in the hallway outside the classroom or inside the classroom. There were three experiments with the fire alarm inside the classroom (fire drills 1-3) and four with the fire alarm placed outside in the hallway (fire drills 4-7). Fire drills 4-7 were conducted simultaneously with two fire alarms in the hallway that connected all of these tutorials. The sound level from the Swedish experiments, when measured in the centre of the classroom, was approximately 55-65 dB when the fire alarm bell was outside in the hallway.



Figure 1. Fire alarm bell and transformer which were used in Sweden.

At Lund University of Technology, the fire alarm bells are usually placed in the hallway with complementary fire alarms inside the classrooms. In the case when an existing permanent fire alarm was installed inside the classroom and the mobile fire alarm would be placed in the classroom as well, the mobile fire alarm was hidden. The alarm was hidden either under the ventilation system or behind a locker. If there were no other alarm inside the classroom, the mobile alarm was placed visible close to the door. When the mobile fire alarm was placed in the hallway, all classrooms were also equipped with a permanent alarm bell inside the classroom which belonged to the authentic evacuation system. This bell did not sound during the experiment and was not concealed. It was considered more suspiciously to conceal the fire alarm than to leave it the way it was.

Victoria University, Australia has a dichotomized alarm system, with an alert signal and an evacuation signal. The instructions for the alert signal is to pack valuables but stay in the classrooms to wait for further instructions whereas the evacuation signal refers to direct evacuation of the building according to the protocol. The alert signal is a beeping sound whereas the evacuation signal is an electronic siren. The alarm goes through a PA-system which was connected to all the classrooms in this study.

In fire drill 8 and 9, the alarm went straight to the evacuation signal. This is since it is more similar to the Swedish experiments. In fire drill 10-13, the building was occupied

by other non-participating classes as well whereas the normal procedure of an evacuation with an alert signal and an evacuation signal was utilized. The alert signal was activated for 42 seconds and the evacuation signal for another 3 minutes and 30 seconds.

**Table 7. Outline over the experiments**

| Fire drill | Country | Educational course        | <i>Location of the fire alarm</i> |
|------------|---------|---------------------------|-----------------------------------|
| 1          | SWE     | Engineering               | Inside the classroom              |
| 2          | SWE     | Engineering               | Inside the classroom              |
| 3          | SWE     | Engineering               | Inside the classroom              |
| 4          | SWE     | Engineering               | Outside in the hallway            |
| 5          | SWE     | Engineering               | Outside in the hallway            |
| 6          | SWE     | Engineering               | Outside in the hallway            |
| 7          | SWE     | Engineering               | Outside in the hallway            |
| 8          | AUS     | Nursing (TAFE)            | PA-system with only evac.         |
| 9          | AUS     | Nursing (TAFE)            | PA-system with only evac.         |
| 10         | AUS     | Fitting a machine (TAFE)  | Dichotomized PA-system            |
| 11         | AUS     | Engineering (TAFE)        | Dichotomized PA-system            |
| 12         | AUS     | Mechanical diploma (TAFE) | Dichotomized PA-system            |
| 13         | AUS     | Engineering (TAFE)        | Dichotomized PA-system            |

The two Swedish settings both differed from the Australian regarding location or sound level of the fire alarm. The sound level for Swedish participants with the alarm inside the classroom was markedly higher than the Australian alarm. However, the alarm sounded inside the classroom which may clarify the level of emergency in the situation. In addition, the sound level was more similar for the Swedish participants who had the fire alarm outside in the hallway and the Australian participants. Though, some information may have been lost for the Swedish participants since the alarm did not sound inside the classroom and therefore be interpreted as more diffuse.

### 3.3 Data collection

The project started in Sweden with a literature review that was continuously developed during the project to get information and comparative data. To evaluate any possible cultural differences in an evacuation scenario, similar experiments have been conducted in both Australia and Sweden. The experiments were performed in groups of 5-60 university or TAFE students from each country. In order to create an everyday situation the experiments were conducted in classrooms during regular tutorials, see Appendix B for room descriptions and Figure 2 and Figure 3. To decrease the influence of the tutor's role on the students' behaviour, the tutor was not presented when the alarm activated. The tutor either left the classroom on a pre-arranged point or when one of the researchers knocked on the door to the classroom.

The rooms in Fire Drill 1-7, 10-12 were regular tutorial classrooms for approximately 20-30 people. Fire Drill 8 was conducted in a small lecture theatre for approximately 60 people and Fire Drill 9 was in a large tutorial classroom for 60-100 students. Fire Drill 13 was conducted in a computer lab.



Figure 2. Large tutorial classroom in Australia



Figure 3. Swedish tutorial classroom

The time for the experiment was during a double period with a break midway through. To decrease the level of disruption, the experiment took place in close connection with the break. The Swedish students were not given any information before the fire drill. To get ethical approval for conducting fire drills in Australia a vague e-mail was sent to all students from the Occupation Health and Safety Unit. The e-mail gave the information that fire drills will occur during the up coming weeks, but building and time were not revealed. The drills ceased after approximately 2 min 30 sec if the students have not left the classroom already at that time. The researcher was placed outside the classroom and told the participants as soon as they had left the classroom that it was a fire drill. All participants stayed outside until everyone had left the classroom or after 2 min 30 sec.

Three different methods were used to collect the data. Firstly, video recordings were used to collect information about the pre-movement time and social behaviour. Secondly, anonymous questionnaires were distributed to all participants after the experiment to get a deeper understanding about their associations to the fire alarm and how severe they experienced the fire drill, see Appendix A. Thirdly; one participant from each trial was randomly approached for an interview. The purpose of the interview was mainly to fill in the gaps in the data from the questionnaires.

All the students received verbal information afterwards together with an information paper with an explanation of the study and their roles in it, see Appendix D. The information paper also included contact details to the researcher for questions or further assistance. Students at Victoria University also received information about Victoria University's emergency plan, and how they are supposed to react in real conditions.

### 3.3.1 Video recording

All experiments were documented by a concealed video camera to improve the analysis of the experiments. Different methods were used to conceal the video camera. In Sweden, the video camera was hidden either in a computer bag with a transparent side or concealed in white fabric and hidden next to the ventilation system. In Australia, the video camera was concealed in boxes with a hole for the camera lens, see Figure 4. The purpose of the recordings was to study group dynamics and pre-movement times. The recordings had a low resolution to minimize the possibility to identify individual participants, and because high resolution was not necessary for the aim of this study. In the Swedish experiments, the cameras were placed in the front of the classrooms while in the Australian experiments in the back of the classroom to further decrease the risk for identification.



Figure 4. Video camera hidden in a paper box

Afterwards all participants received information about the video camera surveillance and had the opportunity to disapprove, see consent form Appendix E. If any of the participants disapproved, the video tape from that experiment was erased without further analysis. In Sweden 1 out of 7 experiments were disapproved for further analysis. Another Swedish experiment was not recorded because of technical difficulties. In Australia, recordings from 2 out of 6 experiments were disapproved for further analysis. One Australian fire drill was also not recorded because of technical difficulties. The participants did not have the opportunity to view the video recordings afterwards because of ethical perspectives.

Some of the experiments were timed with a stopwatch by one of the researchers, in case the use of the recordings would be rejected or technical difficulties would occur. The experiments that were timed were those where each of the two researchers only had one tutorial classroom to observe. If the tutorial rooms had glassed walls or doors, the researcher tried to identify when the first and last person stood up. When there was no visibility in to the classrooms, the researcher recorded an average evacuation time and subtracted a plausible movement time. The movement time was calculated as an average distance from the door with a walking speed at 1.3 m/s [18].



### 3.3.2 Questionnaire

After each experiment all the participants were asked to fill in a questionnaire, see Appendix C. The questions were general and non-directive to gain a better understanding of the participant's associations and previous experiences of similar situations. The questionnaires also investigated how serious the participants thought the situation was. Questionnaires were deemed to be the best major method of collecting data regarding associations, because of the large amount of data and time limitations. It also simplifies the process for the participants' confidentiality.

The questionnaires went through a pilot study, where different people in the age group of the participants read through them and pointed out the difficulties in understanding they found. These participants were only told the scenario in the classroom and were therefore not undergoing an unannounced fire drill. This was mainly because of time- and resource limitations for the project, but the main reason for the pilot study was also to clarify the language in the questionnaires.

### 3.3.3 Interview

A small number of semi-structured interviews were conducted with randomly approached volunteers who participated in the experiment. A semi-structured interview is when the interviewer has an interview schedule using it as a *guideline*. The interviewer is not strictly tied to the schedule which gives the interviewer the freedom to follow up subjects that may be of further interest [22.]. Since the questionnaires are restricted to pre-arranged questions, semi-structured interviews are seen as a good compliment to fill in the gaps because of its flexibility. The interviews were also a way to cover the scenario inside the classroom if the video recordings were not allowed for further analysis. The questions were mainly open-ended and non-directive to gain as reliable and non-biased data as possible, see Appendix F.

To increase the understanding for the interview questions, two persons were asked to participate in a pilot-study. They were told the settings of the fire drill and then had to imagine how they would have responded. They also had the opportunity to fill in with questions or probes they thought would be interesting to know more about.

Examples of open-ended questions include:

- Can you describe the scenario in the classroom when the alarm went off?
- How high was the credibility of the experiment?
- What was your first spontaneous thought when you heard the alarm?

Some questions also included "probes" whose purpose is to explore responses in more detail. Examples of "probes" include:

- What in the experiment distinguished that?
- How did you think then? / Can you please elaborate a little bit...
- Did your train of thought change during the experiment?

Overall, 6 interviews were conducted in both Sweden and Australia, see Table 8. Both in Sweden and Australia, 2 of the interviewees were females and the rest were males. The interviewer was one of the two student researchers. The interviews were either recorded or written by hand during the interview. Recording was viewed as the optimal method to collect the data but because of technical limitations it was not always possible for each interview. All the Australian interviews were tape recorded and one of the Swedish participants. The rest of the Swedish interviews were written by hand during the time of the interview and transcribed the same day.

**Table 8. Outline over the interviewees**

| Fire drill | Country | Educational course        | Gender |
|------------|---------|---------------------------|--------|
| 1          | SWE     | Engineering               | Male   |
| 2          | SWE     | Engineering               | Female |
| 3          | SWE     | Engineering               | Male   |
| 4          | SWE     | Engineering               | Female |
| 5          | SWE     | Engineering               | Male   |
| 6          | SWE     | Engineering               | -      |
| 7          | SWE     | Engineering               | Male   |
| 8          | AUS     | Nursing (TAFE)            | Female |
| 9          | AUS     | Nursing (TAFE)            | Female |
| 10         | AUS     | Fitting a machine (TAFE)  | Male   |
| 11         | AUS     | Engineering (TAFE)        | Male   |
| 12         | AUS     | Mechanical diploma (TAFE) | Male   |
| 13         | AUS     | Engineering (TAFE)        | Male   |

The participants were fully informed of the purpose of the interview and area of interest of the study and reassured about the confidentiality of their interviews and transcripts. The Australian participants for the interviews signed a consent form prior the interview, see Appendix G, to reach ethical demands. The interviews took approximately 10 minutes and were undertaken at a suitable time decided by the participant. All of the interviews were conducted on the same day as the fire drill. The reason for the short time of each interview was firstly to decrease the level of disruption for each participant. Since the participants did not have the possibility to sign consent form prior the experiment they were not assumed to spare too much time on the research project. Secondly, the area of interest for the interviews is narrow and the amount of time does not necessary have to be long.

## 4 Data analysis

To analyse the data, both a quantitative and qualitative approach were utilized to increase the trustworthiness of the results. Statistical quantitative methods were deemed to be the best analysing tool since it facilitates and clarifies the comparison between the data. Since cultural identity is multifaceted, an exclusively quantitative approach may have simplified the matter of this study and furthermore the results. Qualitative analyses were considered a good compliment because of the complexity surrounding the topic and to deeper evaluate the participants' interpretation of the fire alarm.

When analysing the data, the importance of high reliability and validity are essential, especially for the quantitative analysis. *Reliability* describes that another independent researcher will find the same results using the same methods while the *validity* is a term which describes that the methods actually are measuring what they are aimed to. [23.]. Each section in this chapter will enlighten how high reliability and validity are established for each of the used methods. The validity is also discussed in chapter 7 where method triangulation (similar pattern irrespectively of method) and consistency with previous research is seen as strengthening the validity.

### 4.1 Quantitative analysis

Statistical tests were used for the pre-movement time, associations and level of seriousness to investigate if the results were of statistical significance and not arose by chance. To study if the results were significant the significance level ( $\alpha$ ) was set to 0.05 [23.]. The statistical tests that were used varied depending on the level of measurement and other properties of the quantitative data; see Appendix H for further descriptions of the tests and level of measurements. The measured variables will in this section be presented in the order of their level of measurement. SPSS (originally, Statistical Package for the Social Sciences) or hand calculations were used to process and calculate the tests.

After selecting a test, the first step in the analysis was to determine if the hypothesis was supported or not. Since the settings for Sweden and Australia differed slightly the assumptions that the two Swedish settings together (with the alarm inside and outside) reflected the Australian sample the best. This is partly since the sound level was more equal for Sweden (outside) and Australia, partly since the location of the fire alarm was equal in Sweden (inside) and Australia. This simplification is regarded as the most plausible since it is difficult to determine whether or not it is the location or the sound level of the alarm which affects the results the most. This simplification also facilitates the comparison between the two countries, but the limitations of the results will also be discussed in chapter 7. The hypothesis was regarded as supported if it was significance difference between Australian and Swedish and rejected if there was no significant difference between the Australian and Swedish responses, see Figure 5.

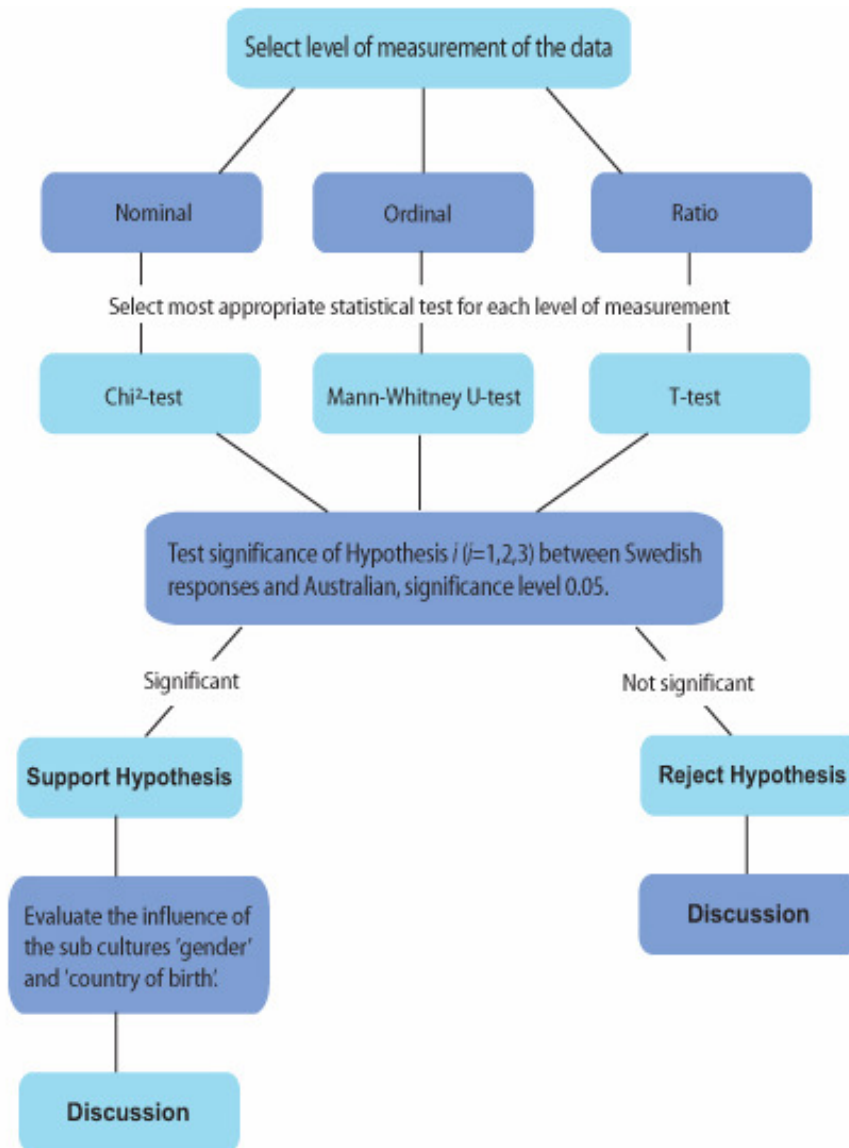


Figure 5. The analysing process of the quantitative data.

#### 4.1.1 Recognising the sub cultures

Since sub cultures always exist in a group of people, the described procedure is a generalisation of the reality. To analyse if the national culture may affect the behaviour of the participants, it is of equal importance to identify if there are any characteristic differences within the group regarding i.e. gender and ethnicity. If there was a statistical significance between Sweden and Australia, a brief analysis was made of the sub cultures within and between each group, if enough data was available for that particular variable (i.e. associations and feelings). The two sub cultures that were considered as the most important to study further were:

- Country of birth
- Gender

The Australian sample was very culturally diverse, where almost half of the participants were born in another country. To assume them as a homogenous sample is regarded as a simplification of the subject of matter and an analysis was therefore made for participants born in Sweden, Australia and Australians born in Asia. No consideration was taken to the fact if the participant was an exchange student or not. Some of these participants may therefore not have Australian citizenship. Participants who were born in any other countries were excluded from this part of the study since the numbers in these sub cultures were too few, e.g. was a Swedish participant born in Germany excluded. The simplification of summarising all the Asian nations was to get enough quantity of data for the comparison. There was no collected data for how long time the participant had been in Australia, and consequently it is difficult to tell the dependent factors if the behaviours differ. However, the results may be a guideline for how Asians in Australia respond to Australian fire alarms and may furthermore explain the differences to Sweden, if there are any. For these samples, the number of participant in each sub culture is presented in Table 9.

**Table 9. Number of participants in the studied sub cultures.**

| Country of birth | Total | Females | Males |
|------------------|-------|---------|-------|
| Australia        | 71    | 46      | 25    |
| Sweden           | 89    | 35      | 54    |
| <b>Asia</b>      | 38    | 25      | 13    |

Gender has been shown to have an influence on how people experience fear [7.] and react in real emergencies [11.]. It is therefore seen as a considerable variable to study further. The three sub culture samples (divided after country of birth) were hence also divided in the responses from females and males.

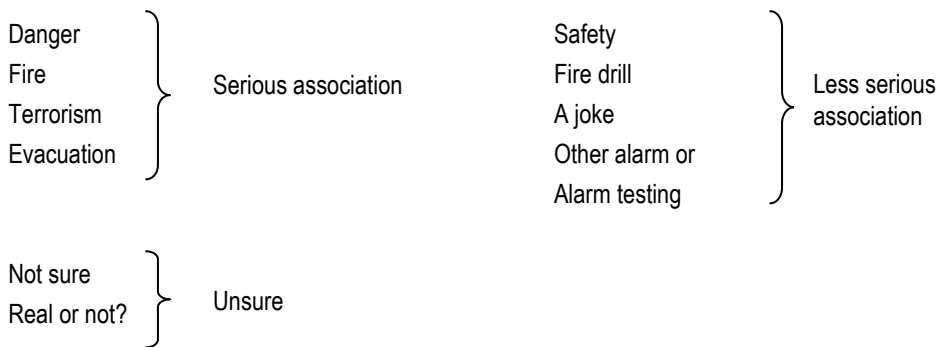
#### 4.1.2 Associations

The associations are on a *nominal* scale where the non-parametric  $\chi^2$ -test (chi-square test) is the only statistical test available. [23.] A  $\chi^2$ -test for consistency in a 2\*K table was used, which means it is used for comparison between two samples in K classes [24.], see Appendix I for calculation procedure. It is important to emphasize that the test is not statistical strong, but it will give a direction for a trend, if there exist any.

The participants had the possibility to fill in their first association and other associations to the fire alarm in the questionnaires, see Appendix C. The pre-fixed alternatives were: 'Danger', 'Safety', 'Fire', 'Terrorism', 'Evacuation', 'Fire Drill', 'A joke' and 'Other associations' where the participants had the space to fill in a description. If a participant

chose an alternative twice, it was only counted one time and that was for the first association.

The associations were partly summarized for each of the different alternatives, partly categorised in different groups. To clarify how serious the participants took the fire alarm regarding to their *first* association, the alternatives 'Danger', 'Fire', 'Terrorism' and 'Evacuation' were summarized under the category *Serious*, whereas the alternatives 'Safety', 'Fire Drill' and a 'Joke' were summarized under the category *Less serious*. Participants who filled in 'Other associations' were divided depending on the answer. Fire alarm testing, burglary alarms and other types of alarms (i.e. car, elevator) were put under Less serious. People who where not sure or struggling whereas it was a fire drill or for real were put under the category *Unsure*. The participant who filled in many different examples was put in the category. If the participant wrote an emergent event under 'Other associations', these responses were put under *Serious* association.



The other associations the participants had were not categorised and hence only summarized for each of the 8 alternatives. The first association was regarded as the key association. Since there was no ranking of the other associations, it is hard to distinguish in to what extent the participant associated the alarm with that particular alternative. A participant may have had one of the alternatives in mind for a long time and another for just a quarter of a second. The other alternatives were designed only for visualisation of how many associations the participant had and if the associations were serious or not. No statistical test was processed for the other associations were the results are not considered as statistical significant.

#### 4.1.3 Degree of seriousness

To be able to investigate how serious the participants felt the situation was, three statements were asked and a rating scale was used to show what attitude they had towards the statements. The three statements that were used were:

- I felt very insecure when I heard the alarm.
- I felt a lack of information when I heard the alarm.
- I felt very scared when I heard the alarm

The rating scale consisted of the following alternatives; 'agree completely', 'agree partly', 'neither agree nor disagrees', 'disagree partly' and 'disagree completely. Respondents were asked to tick the alternative that best reflected how they experienced the statement.

The level of seriousness is therefore having an *ordinal* scale which is suitable for a Mann-Whitney U-test (also called Wilcoxon's rang-sum test). The Mann-Whitney U-test is a non-parametric test and assumes independent samples [25.].  $\chi^2$ -test is also usable for an ordinal scale, but since this test is quite weak and there is a possibility to rank the data, the Mann-Whitney U-test is regarded as a stronger test. The disadvantage of the Mann-Whitney U-test is the decreasing trustworthiness when the numbers of ties increase, which is a recurrent phenomenon for this data [25.]. However, it is still regarded as more reliable than a  $\chi^2$ -test.

To make the comparison between the two cultures, the alternatives in the analysis were reduced to three. 'Agree completely' and 'agree partly' were combined as well as 'disagree partly' and 'disagree completely'. This is since the results may otherwise be ambiguous, since the statistical significance only shows that it is a difference between the two samples but not in which direction it goes. It may be the case that, for example Australians tend to select alternatives in the middle whereas Swedish participants select one of the two extremes. In that case, it is almost impossible to draw any conclusions even if the difference is statistical significant.

#### 4.1.4 Pre-movement time

The pre-movement time was extracted from the recordings for each participant in each experiment where the recordings had been permitted for further use in the analysis and were technically available. The recognition time finished when someone did a 'major' preparation to leave the room. Such preparation includes either:

- Gathering belongings
- Standing up
- Getting dressed

The recognition time may, according to its definition, finish when people are stopping their ongoing work because of the alarm, this can also be turning around looking for information and discussions. Though, it is hard to distinguish whether a person turns because of the alarm or would have done a similar action under normal circumstances. Because of the limitations in the video cameras audio recording, in most cases the topic of the discussions were difficult to discern and were hence also included in the recognition time. The response time finished when the participant took its first step towards the exit. If the participant was just outside the picture when the recognition time occurred but became visual while leaving the classroom, and approximation with an average walking velocity of 1.3 m/s [18.] was subtracted to get the total pre-movement time.

The pre-movement times are on a *ratio* scale and therefore suitable for parametric tests. It is assumed that the two populations' distributions are equal and since the numbers of participants from each country are more than 30, a normal distribution is deemed to be valid. A t-test is therefore considered to be the best statistical test in this matter. The t-test assumes that the two populations variance is unknown but equal [24.]. If the populations are normally distributed the test is more precise and if not it will give an approximation [24.]. The test also assumes that the two populations are independent of each other [26.], and it investigates the significance of the differences between the two populations' means. The statistical significance level of 0.05 was chosen [23.] and if the p-value is above, the null hypothesis has to be rejected. That means that there is a difference in pre-movement times between the two cultures. The t-test also calculates the value of standard deviation for each population.

The limitation surrounding the test is that it assumes that the variables are independent. The social behaviour within each classroom is therefore not regarded in the analysis and should be discussed further. A Mann Whitney U-test could also be used for the mean pre-movement times from each fire drill. The problem that then arises is the limited amount of data in the analysis i.e. that relatively few fire drills were performed. Hence is the t-test regarded as the stronger of the two, so that as little data as possible will be lost. The t-test will therefore use individual times and the mean values from the drills where a stopwatch has been used will therefore not be counted in the statistical tests. These times will be included in the discussion when comparing the pre-movement times, if they follow or discern from the possible trend.

## 4.2 Qualitative analysis

The qualitative analysis includes the interviews and the study of group behaviour from the video recordings.

### 4.2.1 Content analysis of semi-structured interviews

The interview analysis was aimed to answer the following research question as a compliment to the questionnaires:

*Will the fire alarm be taken seriously by the participants from the two different countries?*

To be able to analyse the interview transcripts a content analysis was conducted. This procedure is used to break down the interviews and take out major themes from them. [27.]. A cross-analysis was also conducted to prevent any bias. The data was analysed by reading and re-reading of the transcripts and making notes along the side of the pages. Through evaluating the notes, themes could be generated. The interviews had two functions to ensure validity, one internal and one external. Both were established by triangulation [28.]. The internal function was that each interview transcript was read by both of the researchers while performing the content analysis. This procedure decreases the risk that interviewer bias influences the results. The interviews also increased the validity by method triangulation since they could be compared with results from the



questionnaires or the video recordings. If similar responses are interpreted the validity of the results increases.

#### 4.2.2 Observation

The group behaviour was studied through an observational approach. It therefore aimed to answer the following research question:

*Are there any distinguished differences in the group dynamics between the two countries?*

The observed data was collected from the video recordings and the researcher had therefore no interactive participation in the observation. An observational method was deemed to be the only suitable method to analyse the group behaviour. This is since the subjectivity over the results may have been overwhelming using any other qualitative methods, for example interviews, where the individual has more focus than the group. A group is in this analysis defined as setup of more than one person.

The characteristics of the observation were that it occurred in a naturalistic environment and were analysed in a descriptive, reflexive and analytical way. A purely descriptive observational study was conducted for each video recording and is presented in chapter 4 to give a general overlook over the scenarios in each classroom.

To compare the group behaviour between Sweden and Australia a more analytical and reflexive (with personal reflections) observation study was employed [28.]. The procedure started with an analysis of the different fire drills by each of the two researchers individually. The researcher took notes on the following behaviour while observing the recordings:

- *Group influence.* Did the participants respond individually or in groups? Are the individual behaviour inhibited or strengthened by the group?
- *Discussions.* How did the participant communicate with each other?
- *Search for information.* How do the participants search for information?

The observational study omitted the weight of the participants' emplacement in the room and age. These parameters were regarded as less important in the study of cultural differences. The study did also not concern the level of seriousness (e.g. if the participant was scared or not), since the questionnaires and interviews are deemed to give more accurate results than the subjective opinion of the researcher. Gender was only studied briefly since there was no Australian data for females.

The participants were assumed to respond in groups if they went out with people who sat next to them or waited for people to come with them. If it was a continuous flow (with no breaks in between) the participants were assumed to respond all together. On the other hand, if the participants left the classroom more scattered, this was seen as an individual response.

In some cases it was possible to discern if the participants were discussing the alarm or not, while observing the video recordings. In other cases, concerns were taken to changes in the sound level prior and after the alarm. If it was an increasing number of discussions, or if the discussions were combined with information searching behaviour (e.g. looking around at different persons which they did not talk to earlier or at the door) this was regarded that the discussions probably were connected to the alarm.

After the note taking, the researchers filled in a scheme of statements separately to facilitate the comparison, see Appendix K for the scheme. Fifteen statements were used which the researcher could 'agree' to, be 'neutral' to or 'disagree' to. The recordings were reviewed to ensure the reliability of the interpretations. The two researchers' observations were compared and an *observing reliability* was calculated according to (translated from Swedish): [29.]

"Number of agreed observations divided with the (Agreed observations + Disagreed observations) = the grade of reliability between the two researchers." p. 390

This procedure was to increase the reliability of the results. If the observing reliability is over 70 %, the observations are regarded as reliable. If a reliable observational reliability (>70%) was received, the reason for why these observations may exist and the connection between them were discussed.

## 5 General description of how the participants reacted

A descriptive observation analysis was made from the video recordings to be able to give an account of how the participants reacted to the fire alarm. The description focused on if the participants were turning around, discussions and a general understanding of the course of events in the experiments. For a more analytic and reflexive observation of the group behaviour, see Section 6.4.

### 5.1 Description of the fire drills in Sweden

Five of the Swedish fire drills (2, 3, 4, 5, 7) were video recorded, and it was therefore possible to describe the scenarios from these in more detail. Fire drills 2 and 3 had the alarm bell inside the classroom while the remaining fire drills had the alarm bell outside in the hallway.

#### 5.1.1 Fire drill 2

Immediately when the fire alarm goes off one of the males stands up and the others are turning towards the sound. They are moving around on their chairs, looking around in the classroom. The students are looking at the person sitting next to them. After 5 seconds two others (male and female) stands up and start to pack their things together. They are sitting in the front of the classroom next to each other. Straight after a female sitting behind them follows them and pack up her things. After that, everyone seems to gather their things to prepare themselves to leave the classroom. The first one to start walking towards the exit door is a male after 22 seconds. After that everyone seems to begin to move towards the door. No one is in a hurry and they take their time to collect their belongings and they move slowly towards the door.

#### 5.1.2 Fire drill 3

When the fire alarm goes off they all jolt and look towards the sound. The male in the front line turns around and looks at the ones behind him. They all look around at each other and some are talking to each other. After 19 seconds the male in the front line stands up and walks towards the door, the male sitting behind him does the same. After 21 seconds 4 out of 6 have started to move towards the door and after 37 seconds they all are moving towards the door. Most of the participants left their belongings in the classroom except the last two to leave who brought their jackets.

#### 5.1.3 Fire drill 4

The reaction when the fire drill goes off is calm and some are turning towards each other and one in front turns around to face the back of the classroom. They are talking to each other. This goes on for 29 seconds, this is when one male sitting in the middle stands up, and a male sitting two chairs away from him follows him at once. The female sitting in front of him (she had earlier turned around facing the boy sitting behind her), does the same, this is after 33 seconds. These three move slowly towards the door. One

of the males walks out from the room (this is after 52 seconds) and then the other two that had been standing sits down again. He comes back to the room after 58 seconds. The others in the room keep looking at each other some starts to gather their things. After 78 seconds a male takes his jacket and walks towards the door, another male in the back of the classroom is preparing to leave the room as well. After 93 seconds, half of the students are packing their things together and get ready to leave the classroom. Everyone is slowly making their way to the door.

#### 5.1.4 Fire drill 5

The two males in the front of the classroom closest to the camera turn around towards the camera and looks straight in to it a couple of times. Then the fire alarm goes off and there is no reaction at all in the classroom. They keep working without looking up from their books. After 7 seconds some are starting to turn and look at the others. After 10 seconds the male in the front that are facing the room stands up and grab his jacket and packs his books. The others follow him and also start to gather their variables. Around 15 seconds after that the alarm went of, almost everyone is packing up to leave the room. After 36 seconds the first student walks towards the door. The others follows him soon after.

#### 5.1.5 Fire drill 7

There was no immediate reaction. Some are looking up from their book, like stretching. After 10 seconds a male stands up and walks towards the door. He goes outside. The others are not taking any notice of it and keep on working. The male comes back after 43 seconds. At that time another male stands up and starts to pack up his things. No one leaves the classroom.

## 5.2 Description over the fire drills in Australia

Three of the Australian fire drills (10, 12, 13) had video recordings and the course of events are in this section described in more detail. Fire Drill 8 and 9 will only briefly be described here since they did not have any video recordings and are therefore rely on the observations made by the researcher outside the classroom through glassed windows.

### 5.2.1 Fire drill 8

All security staff in the hallway was not aware of the drill and therefore acted naturally by searching for information and running back and forth. The classroom in Fire drill 8 had visibility through a window on the door and some saw the security staff outside (confirmed by interview). Most of the participants responded very quickly to the alarm (around 16 seconds) and they left the classroom in a continuous flow. When the participants left the classroom they were very concerned about what was going on, which was concluded since almost all of them asked the researcher what kind of alarm it was.

### 5.2.2 Fire drill 9

The participants were in general responding to the alarm very quickly (approximately 20 seconds). Most of them just had a quick look around and then started to leave the classroom alternatively pack their belongings. A few participants stayed longer in the classroom.

### 5.2.3 Fire drill 10

When the alert signals goes off, one of the males turns straight away in to the industrial lab. One of the males in the middle clap his hands in the air and stands up. After a second he sits down again. A male in the back look out through the window to the industrial lab to see what the other people are doing (this is confirmed from audio). He then tells his classmates that people are evacuating and some of the other males therefore turn around as well. One male in the front starts to walk towards the door and the male who looked out through the window stands up but stay still.

The participants are calmly leaving the room when the evacuation signal goes off. The male in the back who told the others about that people are evacuating starts almost directly to walk towards the door without taking any belongings with him. A male in the middle leaves straight away but come back again after 20 seconds to get his bag and belongings. A male in the front stretches before he gets dressed and leaves the room. He collects smaller belongings like a walkman but leave books and bag. One male in the front goes to the door where he feels on his breast pocket and the return to his seat. Almost all participants had started to walk towards the door after 30 seconds from the initial evacuation signal. Some are collecting the belongings and some let them be. The last participant to leave was the male who felt his breast pocket. He left the room after approximately 1 minutes and 10 seconds and collected his bag when he returned to his seat.

### 5.2.4 Fire drill 12

During the alert signal all the participants continue with their ongoing schoolwork. No one is looking up or paying any attention to the alert signal. The door to the classroom is opened. The alert signal is activated for 42 seconds and after that the evacuation signal begins. There is no direct reaction for any of the participants they are continuing with there schoolwork. After 19 seconds from that the evacuation signal went on, one of the males sitting in the middle starts to turn around and looking out through the windows. One of the other males looks up from his books and looks straight a head at the same time. Both of them go back to their work again. After 55 seconds the two males in the front have stopped working and are looking through the door opening. They are turning towards the back of the classroom after 70 seconds and are talking to the ones sitting behind them. After this everyone are turning and making small moments on there sits and after 90 seconds one of the males in the fronts stands up. Soon after that two other male follows him. They are walking out of the classroom. They are at the same time talking to the other ones still sitting down. Two other males follow them after 105 seconds. They are not in a hurry, they takes their time to move

towards the door they are stretching their arms in the air. After 115 seconds almost everyone is standing up and slowly moving towards the door. It is only one of the males that took time to gather some of his stuff. Everyone is out of the classroom after 140 seconds.

### 5.2.5 Fire drill 13

When the alert signal goes off, one of the males looks out through the windows and then back to his computer screen. There is no other activity in the classroom; the others keep working on their computers.

Once the evacuation signal goes off the two males standing up are talking to each other. One of the males that is working on the computer looks up towards the ceiling after 5 seconds. There is no other reaction. They keep working on their computers until a female knocks on the windows and opens the door. This is 97 seconds after that the evacuation signal was activated. After this point the participants stand up and start to gather their belongings. The two first ones to take a step towards the door do this after 98 seconds. Everyone else follows these two. Some stays a bit longer to gather their things before leaving the room. The last one to take a step towards the door does so after 140 seconds.

## 6 Results and Findings

The disposition of this chapter is that the sections are mainly divided after the measured variable or topic (pre-movement time, degree of seriousness and group behaviour). Each section will have a summary at the end. Since the interviews contain large amounts of data which overlap different sections and are analysed in the same way independently of the topic, it is a separate section in this chapter. The interviews will in the end of this chapter be embedded and compared with the results from the other analysing methods in a summary. For a general description of the course of events, see chapter 5. To see the procedure of summarizing and processing the raw data for the analysis, see chapter 4.

### 6.1 Degree of seriousness from associations

The questionnaires (Appendix C) outlined a few questions to evaluate how serious the participants saw the situation regarding to their associations. The following hypothesis was stated to test the quantitative data:

Hypothesis 1: The level of seriousness, regarding their *associations* to the fire alarm, will differ between the two populations.

The participants associations may show how the alarm was interpreted. People who think it may be a real emergency can act differently from those who think it is a joke or a drill. This chapter will partly compare the participants' first association partly compare the total number of associations made by participants.

The participant's first association is compared in Figure 6 and the number of participants is presented in Appendix L. Only one association was supposed to be selected per participant.

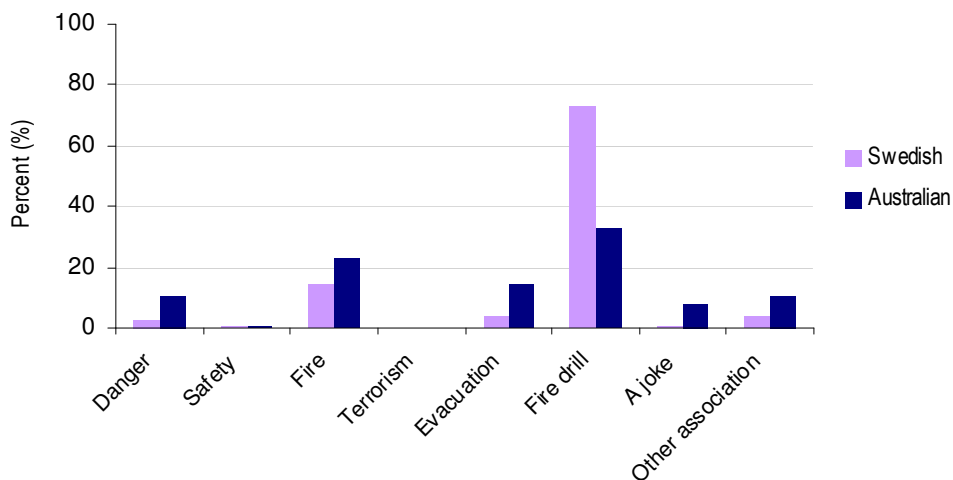


Figure 6. Comparison of first association between Sweden and Australia

The Australian answers were more spread between the different alternatives compared to the Swedish ones, where 'Fire Drill' was the dominated first association. 'Fire Drill' was the most selected associations for both countries but the distribution was very different. Seventy three point three per cent of the Swedish participants chose 'Fire Drill' as their first association to the fire alarm compared to 33.0 % of the Australian responses. 'Other associations' that were mentioned in the questionnaires were elevator or electrical malfunction. Some also associated it with a fire alarm test but without evacuation; see Appendix L for how the participants associated in more detail.

The participant also had the availability to state all the other associations they had to the fire alarm. These associations were not ranked and will therefore just give a general idea of the results. Each Australian participant mentioned on average 2.18 different associations whereas the average Swedish participant stated 2.16 (all including their first association). Swedish participants who had the fire alarm inside the classroom stated more alternatives (2.45) than those with the fire alarm outside in the hallway (2.01). The summary of all associations, including the participants' first association is presented in Figure 7. The raw data is presented in Appendix L.

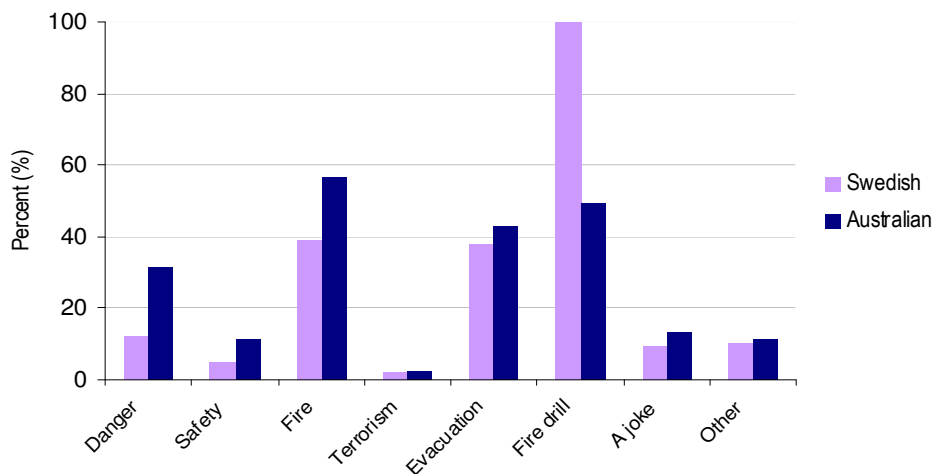


Figure 7. The proportion of participants who selected a certain association in total.

The alternatives that resulted in the largest variation between the two countries were 'Danger', 'Fire' and 'Fire Drill'. All Swedish participants associated the fire alarm, at one stage during the evacuation with a 'Fire Drill'. The same number of Australians was only 49.3 %. A larger number of Australians associated the alarm with a 'Fire'; 56.6 % of the Australian associated the alarm with a fire compared to 39.0 % of the Swedish participants. The Australian participants also associated the alarm with 'Danger' in a greater extent than the Swedish participants. Thirty one point six per cent of the Australian participants associated the alarm with 'Danger' compared to 12.4 % of the Swedish participants. 'Safety', 'Terrorism', 'A joke' and 'Other Association' were all mentioned by less than 15 % of the participants from both Australia and Sweden and are therefore not regarded as any dominant associations.



As described in chapter 4, the 8 pre-fixed alternatives were divided into three categories while testing Hypothesis 1, which only concerned the first association. ‘Danger’, ‘Fire’, ‘Terrorism’ and ‘Evacuation’ were set under the category *Serious* association whereas ‘Safety’, ‘Fire Drill’, ‘A joke’ and most of the ‘Other associations’ were combined under *Less serious* association. Some ‘Other associations’ were also put under the category *Unsure*; see Table 10 for the results. The number of participants that selected a certain category is presented in Table 11.

**Table 10. Seriousness depending on first association, rounded off to one decimal (percentage)**

| Country   | Serious (%) | Less serious (%) | Unsure (%) |
|-----------|-------------|------------------|------------|
| Australia | 48.0        | 48.0             | 3.9        |
| Sweden    | 21.0        | 78.1             | 1.0        |

**Table 11. Seriousness depending on first association (number of participants)**

| Country   | Serious (nr) | Less serious (nr) | Unsure (nr) |
|-----------|--------------|-------------------|-------------|
| Australia | 73           | 73                | 6           |
| Sweden    | 22           | 82                | 1           |

To ensure validity of the presented results, a test of hypothesis was conducted to see if the differences were statistical significant. For this matter, a  $\chi^2$ -test for consistency in a 2\*K table was used [24.], see Appendix I for calculation procedure. The critical  $\chi^2$ -value was read in the  $\chi^2$ -table for 2 degrees of freedom (Df) and a statistical significance level ( $\alpha$ ) at 0.05 [24.]. The difference is statistical significant if the  $\chi^2$ -value exceeds the critical  $\chi^2$ -value, see Table 12.

**Table 12.  $\chi^2$ -test results for First Association,  $\alpha < 0.05$**

| Compared samples     | $\chi^2$ -value | Df | P-value | Stat. significant |
|----------------------|-----------------|----|---------|-------------------|
| Sweden and Australia | 62.1            | 2  | <0.05   | Yes               |

The differences between Australia and Sweden were according to the  $\chi^2$ -test statistical significant. Hypothesis 1 is therefore supported by the data, that there is a difference between the two populations. A comparison is therefore made for some of the sub cultures, see section 6.1.1. Why such difference may exist is discussed in chapter 7.

### 6.1.1 Recognizing and comparing the sub cultures

To see if the differences between the two populations are caused by culture, the samples are categorised further. For this comparison, the selected participants are those born in Sweden, Australia or Australian participants born in Asia since they all contained enough data. All of these three samples were also divided in responses from females respectively males, see Appendix M for the raw data.

This study only compares the sub culture’s first association, since that is considered to be the major one. The results indicated that the gender did not have a big influence on

how the participants born in Sweden and Australia associated. The differences were only a few percent between males and females within each of these two sub cultures. The results varied more for people living in Australia who were born in Asia. The biggest difference was that Asian females were unsure to a greater extent than Asian males about what was going on. Participants born in Asia had the highest frequency of a serious first association, irrespectively of gender while the Swedish had the lowest, see Figure 8.

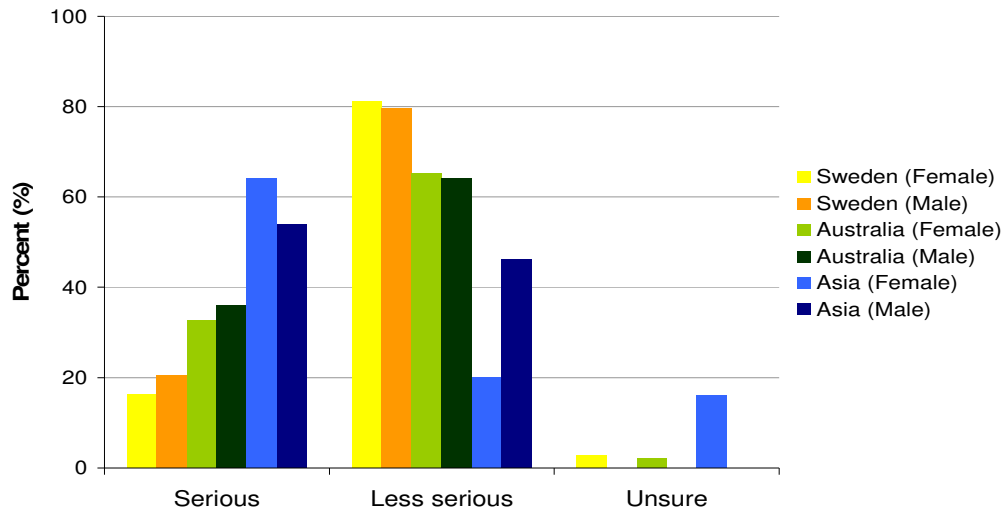


Figure 8. First association for different county/continent of birth and gender

For the Asian-born participants, there was no collected data for how long time they have been in Australia. It is also a simplification to gather all Asian-born students under the same category. These data are therefore not considered to be as strong as those for Australian respectively Swedish participants, but will give an idea about the distribution.

### 6.1.2 Summary

Australians associated the fire alarm in a greater extent with a serious association than the Swedish samples. An equal number of Australians (48 %) selected a serious association compared with a less serious association. The same numbers for the Swedish responses were 21 % for serious associations and 78.1 % for less serious associations. Gender did not seem to influence to the same extent as other factors between the Australian and Swedish-born samples. Asian-born students living in Australia showed a bigger difference, but the sample size was smaller, less concrete and the number of years that the participant had lived in Australia was not recorded.

Hypothesis 1 is supported by the quantitative data.

## 6.2 Degree of seriousness from feelings

This section aim to explore the significance of the following hypothesis:

Hypothesis 2: The level of seriousness, regarding their *feelings* during the fire drill, will differ between the two populations.

To investigate how serious the participants took the alarm signal regarding to their feelings, three statements were used in the questionnaires (Appendix C) which the participants either could: ‘agree completely’, ‘agree partly’, ‘neither agrees nor disagrees’, ‘disagree partly’ or ‘disagree completely’. The three statements were:

- I felt very insecure when I heard the alarm.
- I felt a lack of information when I heard the alarm.
- I felt very scared when I heard the alarm.

The alternatives ‘agree completely’ and ‘agree partly’ were combined as well as ‘disagree partly’ and ‘disagree completely’ to facilitate the comparison, see Table 13 for the percentage of each selected alternative.

**Table 13. Percentage of the responses on the different alternatives for the statements.**

|                     | Agree (%) | Neither agrees nor disagrees (%) | Disagree (%) |
|---------------------|-----------|----------------------------------|--------------|
| <b>Australia</b>    |           |                                  |              |
| Insecurity          | 45.0      | 26.5                             | 28.5         |
| Lack of information | 61.6      | 16.6                             | 21.9         |
| Fear                | 20.4      | 16.4                             | 63.2         |
| <b>Sweden</b>       |           |                                  |              |
| Insecurity          | 15.4      | 27.9                             | 56.7         |
| Lack of information | 54.3      | 19.0                             | 26.7         |
| Fear                | 2.9       | 12.4                             | 84.8         |

Table 14 presents instead the number of participants who selected a certain alternative. In general all the participants answered these statements with one or two falling off for a few of them.

**Table 14. Number of the responses on the different alternatives for the statements.**

|                     | Agree | Neither agrees nor disagrees | Disagree |
|---------------------|-------|------------------------------|----------|
| <b>Australia</b>    |       |                              |          |
| Insecurity          | 68    | 40                           | 43       |
| Lack of information | 93    | 25                           | 33       |
| Fear                | 31    | 25                           | 96       |
| <b>Sweden</b>       |       |                              |          |
| Insecurity          | 16    | 29                           | 59       |
| Lack of information | 57    | 20                           | 28       |
| Fear                | 3     | 13                           | 89       |

To evaluate the statistical significance, the Mann-Whitney U-test for ordinal scale was used with a significance level ( $\alpha$ ) at 0.05. The comparison with the Australian results is presented in Table 15. Both insecurity and the level of fear had significant differences between the two populations.

**Table 15. Results from the Mann-Whitney U-test about the participants feelings between Sweden and Australia,  $\alpha < 0.05$**

| Feelings            | U-value | Z      | P (2-tailed) | Stat. significant |
|---------------------|---------|--------|--------------|-------------------|
| Insecurity          | 4967.5  | -5.311 | <0.001       | Yes               |
| Lack of information | 7376    | -0.976 | 0.329        | No                |
| Fear                | 6092.0  | -4.088 | <0.001       | Yes               |

Hypothesis 2 is therefore supported by the statistical test, when it comes to *emotions* like insecurity and fear. There is no significant difference between Sweden and Australia when it comes to the feeling of lack of information. Further results for lack of information are therefore not presented in this chapter, but raw and summarized data can be found in Appendix L.

The level of insecurity was distributed as in Figure 9. Australians agreed to a greater extent with the statements compared to the Swedish participants. Almost 45 % of the Australians agreed with the statement while a vast majority of the Swedish participants either disagreed or neither agreed nor disagreed.

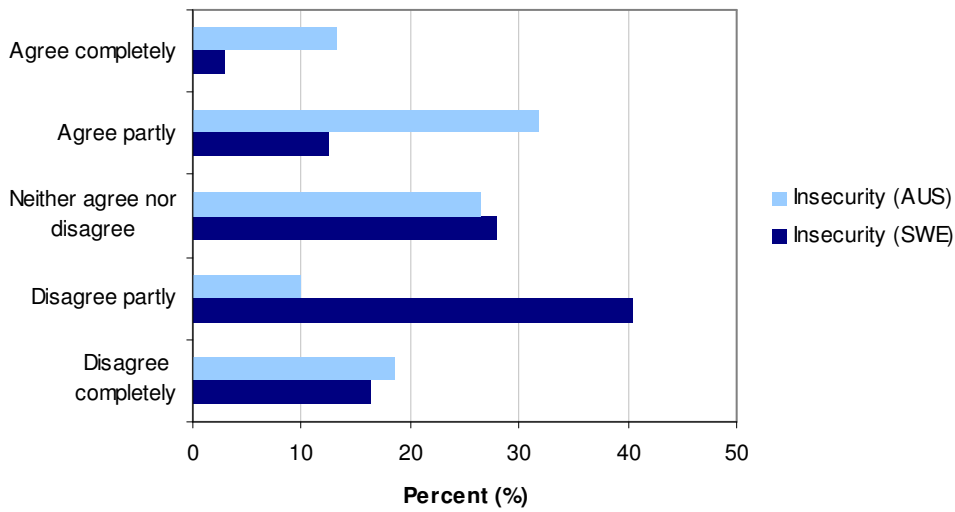


Figure 9. The distribution of the insecurity between the different alternatives.

Most of the participants, both Swedish and Australians did not feel very scared during the fire drill, though more Australians agreed on the statement than Swedish participants, see Figure 10. 20.3 % of the Australian agreed completely or partly with the statement compared with 2.9 % from the Swedish sample.

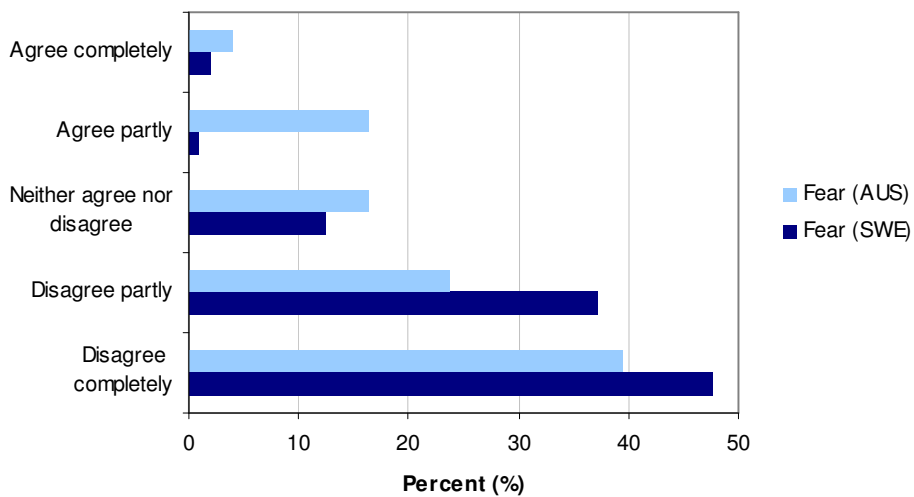


Figure 10. The distribution of the fear between the different alternatives.

### 6.2.1 Recognizing and comparing the sub cultures

Since both the feelings of insecurity and fear showed a significant difference between Sweden and Australia, a further analysis of the sub cultures within these two samples was conducted. The samples are divided after the participants' country/continent of

birth. Participants born in Sweden, Australia and Asia (living in Australia) were selected for further analysis. These new categories were also split up depending on gender.

The level of insecurity felt by the participants varied according to Figure 11. Gender was not contributing to the differences to the same extent as county of birth within the samples of participants born in Sweden or Australia. Participants born in Asia showed more legible differences between gender. Australian participants were quite equally distributed between the three alternatives, while the Asians and Swedish were each others contradictions. Asian females agreed the most to the statement (72 %) whereas the Swedish females agreed the least (11 %). The responses from Asian-born males were more distributed between the different levels and disagreed with the statement in a bigger extent than Australian-born females and males. A majority of the Swedish participants disagreed with the statement irrespectively of gender.

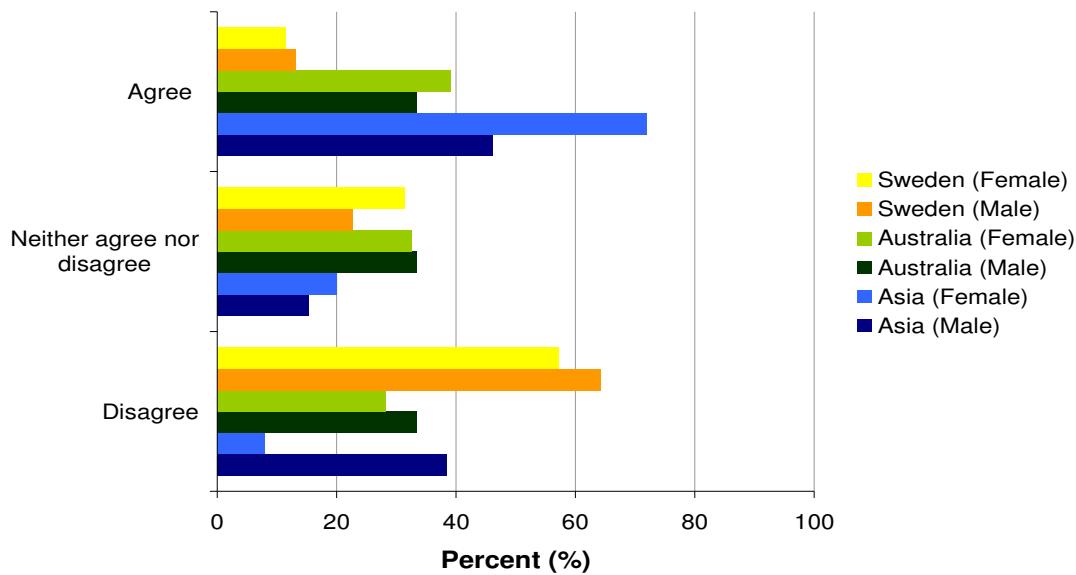


Figure 11. Level of agreement to the statement 'I felt very insecure' for different country of birth and gender.

A majority of all the samples disagreed in some extent to the statement that they felt very scared during the fire drill. The participants that experienced the highest level of fear were Asian females followed by Asian males and Australian females. The other groups did not agree with the statement to any great extent. The Swedish, both males and females, experienced the lowest level of fear followed by Australian males, Asian males, and Australian females. The Asian males therefore varied the most between agreeing and disagreeing with the statement.

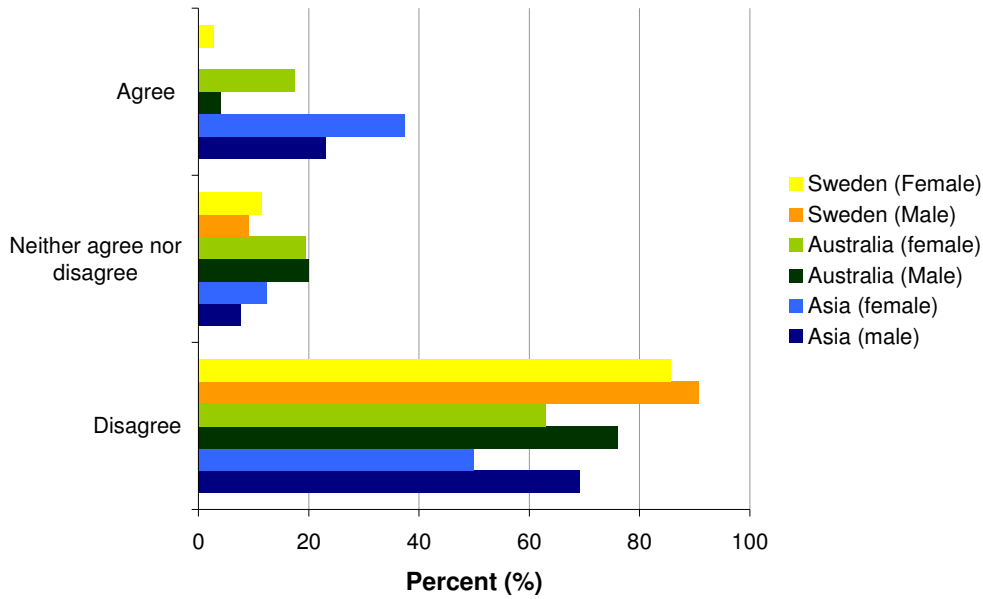


Figure 12. Level of the agreement 'I felt very scared' for different country of birth and gender.

### 6.2.2 Summary

There is a significant difference between the two populations when it comes to the emotions of fear and insecurity and hence Hypothesis 2 is supported when it comes to emotions. Australians agree to a greater extent to the statements than the Swedish participants, even though a majority of the both country disagreed partly or completely with the statement that they were very scared. The feeling of lack of information seems to be more linked to the type and location of the fire alarm than to differences between the populations.

The study of sub cultures also shows a difference between Swedish and Australians. The group that stands out within the Australian sample are females born in Asia who experienced a higher level of insecurity and fear. Asian males responded similar to Australian-born participants, while the Swedish participants, irrespectively of gender, were the least insecure and scared.

### 6.3 Pre-movement time

To analyse the quantitative data from the video recordings and measured times from the stopwatch, the following hypothesis was stated:

Hypothesis 3: The pre-movement time will differ between the two populations.

In the Swedish part of the study, fire drills nr 2, 3, 4, 5 and 7 had available video recordings, see Table 16 for results. In fire drill nr 7, only one participant left the classroom during the time of the drill. This participant returned to the classroom and told everyone that it was a fire drill. A researcher was placed with a timer outside the classroom in fire drill nr 1. The presented time, 35 seconds, is an estimation of the

walking speed and distance to the door which was subtracted from the total time of evacuation.

In Australia, fire drill 10, 12 and 13 were documented by a video camera and accepted for further use. Fire drill 8 and 9 were timed outside by one of the researchers. The people in the tutorials were seen through glass windows in the doors. These times are not as accurate as the video recordings but will give an estimate of the pre-movement time. An approximate time for the first and last person to take a step towards the exit was written down and the mean between these two times were calculated.

The average pre-movement time from the Swedish experiments was 69 seconds and for Australia 79 seconds, see Table 16. Fire drill 8 was the fastest to evacuate, the total pre-movement time was 16 seconds and the second fastest was fire drill 9 with a pre-movement time of 20 seconds. Both these two fire drills had the alarm straight to evacuation signal. To compare this with the fastest Swedish total pre-movement time this was in fire drill 1 and 2 both of 35 seconds. These two had the alarm inside the classroom.

**Table 16. Mean and standard deviation (within brackets) for the pre—movement time**

| Fire drill   | Country    | Recognition (sec)      | Response (sec)           | Total pre-movement time (sec) | <i>Time until the drill was terminated (sec)</i> |
|--------------|------------|------------------------|--------------------------|-------------------------------|--|
| 1            | SWE        | No video               | No video                 | 35 (by timer)                 | -  |
| 2            | SWE        | 5 (2.9)                | 30 (10.0)                | 35 (9.8)                      | -  |
| 3            | SWE        | 43 (3.1) <sup>1</sup>  | -                        | 43 (3.1) <sup>1</sup>         | -  |
| 4            | SWE        | 88 (33.0)              | 31 (28.8)                | 120 (28.9)                    | 155  |
| 5            | SWE        | 12 (4.3)               | 41 (7.9)                 | 53 (10.1)                     | 155  |
| 6            | SWE        | No video               | No video                 | No timing                     | 155  |
| 7            | SWE        | *                      | *                        | 155 (0)*                      | 155  |
| <b>Tot 1</b> | <b>SWE</b> |                        |                          | <b>73.5 (51.2)</b>            |  |
| <b>Tot 2</b> | <b>SWE</b> |                        |                          | <b>90.7 (51.7)</b>            |  |
| 8            | AUS        | No video               | No video                 | 16 (by timer)                 | -  |
| 9            | AUS        | No video               | No video                 | 20 (by timer)                 | -  |
| 10           | AUS        | 7 (6.7)                | 15 (19.8)                | 22 (21.6)                     | 155  |
| 11           | AUS        | No video               | No video                 | No timing                     | 155  |
| 12           | AUS        | 82 (14.1) <sup>2</sup> | 9 (6.9) <sup>2</sup>     | 91 (14.7) <sup>2</sup>        | 155  |
| 13           | AUS        | 49 (51.6) <sup>3</sup> | 63.3 (56.8) <sup>3</sup> | 113 (19.4) <sup>3</sup>       | 155  |
| <b>Tot 1</b> | <b>AUS</b> |                        |                          | <b>52.4 (46.0)</b>            |  |
| <b>Tot 2</b> | <b>AUS</b> |                        |                          | <b>79 (43.7)</b>              |  |

**Tot 1** The total mean from the means of the pre-movement times from both video recordings and timers

**Tot 2** The total mean pre-movement time for all individual times from each available video recording.

<sup>1</sup> The participants leaved the classroom without taking any of their belongings.

<sup>2</sup> Time is from when the evacuation alarm activated. The total time from the alert signal is 42 seconds longer.

<sup>3</sup> Participants were sitting still in the classroom until someone told them to evacuate after 100 seconds from the evacuation alarm.



\* All the participants were sitting still in the classroom during the entire drill except one who went out and looked around after 20 seconds.

There are two pre-movement times that are quite much longer than the others, one in each country. Fire drill 4 has a time of 120 seconds and this is the longest time in the study. The second longest time is 113 seconds in fire drill 13. Fire drill 2 has the fastest recognition time of 5 seconds and the second fastest is fire drill 10 with 7 seconds. The fastest response times were in fire drill 10 with 9 seconds and the second fastest was in fire drill 12 with 15 seconds. The results are therefore mixed between Australian and Swedish responses.

The comparison with the Australian and Swedish results is presented in Table 17. There was no significant difference between the Swedish participants and Australian participants. The test showed a P-value of 0.292 with a degree of freedom of 85.

**Table 17. Results from the t-test of pre-movement time (included fire drills: 2, 3, 4, 5, 7, 10, 12, 13)**

|                      | t-value | Df | P (2-tailed) | Stat. significant |
|----------------------|---------|----|--------------|-------------------|
| Sweden and Australia | -1,06   | 85 | 0.292        | No                |

The hypothesis was therefore rejected in the comparison between Sweden and Australia.

### 6.3.1 Summary of pre-movement time

The hypothesis was rejected since the difference between the two populations was not significant. Chapter 7 will further discuss the validity and possible views on the presented results since different aspects may occur.

## 6.4 Group behaviour

The video recordings were the main resource to study the group behaviour. In the analysis of the recordings the three main themes were *group influence*, *discussions* and behaviour to *search for information*. The two researchers' positions to different statements were compared and are presented in Appendix N. The observational reliability (see section 4.2.2) was calculated to 75 % and the results were therefore regarded as reliable. The results of the observations are presented in this section and further reflexive and analytical discussion why these differences may exist together with the limitations is presented in chapter 7.

The Swedish participants left the classrooms in bigger groups than the Australians, who more often evacuated individually. However, the general interpretation was that Australians were more inhibited by the group than the Swedish participants. This was concluded since many Australian participants took very long time to react to the alarm, even though some of them saw people evacuating outside. Australians also went back

to a greater extent to leave their belongings or to collect them depending on how their classmates reacted. The interpretation about the absence of reaction may also be because the Australians interpreted the alarm as less dangerous. However, this is not concluded from the questionnaires. All Australians had some visibility out to the hallway and some saw other people evacuating. The influence from these people seemed to vary but the general interpretation was that the co-participants inside the classroom had influenced more than the ones evacuating outside.

It was sometimes difficult to separate if the participants were talking about the sound or other school related subjects, but the general interpretation was that the Swedish participants also discussed with each other to a greater extent than the Australians. One way to interpret this is that there were differences in group constellations and sound level that occurred after the fire alarm activated.

In general, all participants in a classroom either packed their belongings or left them inside the classroom. Swedish participants usually brought their belongings along with them whereas the Australians left them inside the classroom. The extent of group influence is hard to distinguish, but the group often followed the behaviour of the first participant to leave the classroom. By packing their belongings, the Swedish participants usually had a longer response time than the Australians, see Table 16.

It is important to underline that the studied Australian samples were only consisting of males. The observations made from Fire Drill 8 and 9, where there was a mix of males and females, showed a more similar pattern to the Swedish results in the sense that people left in groups rather than individually. However, the Australian participants from these two drills were interpreted as more stressed and concerned than the Swedish participants.

#### 6.4.1 Summary of the group behaviour

Swedish participants seemed to evacuate in groups more often than Australians which more often evacuated individually. However, the general interpretation was that the Australians were more inhibited by other participants inside the classroom.

Swedish participants had more discussions which seemed to concern the sound or what to do next than the Australians. Swedish participants seemed to search for information by discussing the scenario whereas the Australians looked out through a window or door. In two of the Swedish fire drills, one participant left the classroom to investigate what was going on.

### 6.5 Interviews

The interviews were mainly a compliment to the questionnaires and aimed to answer the research question:

*Will the fire alarm be taken seriously by the participants from the two different countries?*

Complementary questions were regarding their associations to the fire alarm and how the group dynamics were understood by the interviewee. The interviews thereby explored the three themes, participants' *actions*, train of *thought* and *associations* to the fire alarm for a deeper analysis. Every transcript was read through and analysed, individually by the authors. Keywords associated with the three themes were drawn out and summarized, see Appendix J. The most common keywords from the interviews were selected for further analysis. The two analyses were then compared and similar interpretations were seen as strengths. Deviant comments were also seen as valuable to give additional perspectives to the analysis. A discussion of why these responses may exist is presented under in chapter 7. The Australian and Swedish responses will first be presented separately with a comparison and summary in the end of this section.

### 6.5.1 Australian participants

The description of the physical scenario during the fire drill was similar from most of the interviewed participants. People were looking around and discussed with their classmates to search for information. Discussed topics were what they should do and if it was serious or not. People were in general laid back and packed their stuff during a calm evacuation. Many of the interviewed participants gave the impression that they would act differently depending on if it was a real emergency or not. Some participants were worried about their belongings and were struggling with if they should bring them or not. The general impression was that they would have left them if it was a real emergency but brought it with them if it was a joke or a drill.

*"...I thought, oh my goodness, should I take my bag? Leave it? Eh... But I really shouldn't take my bag... but if it is a drill I've got all my stuff there, \*laughing\* you know." (Fire Drill 8)*

Many participants felt a lack of information, both precautionous information about Victoria University's emergency procedure, assembly points and so forth, but also from staff and the fire alarm. The participants were, in general, expecting directives either from a fire warden or staff member. The expectation usually came from that it is a common emergency procedure in Australia to have a guiding authority.

*"We were a little bit clobbered, no one really knew what was going on, whether to, everyone was discussing, should we go, should we stay, should we go, and then we saw security and we thought... maybe we need to go." (Fire Drill 8)*

Most of the participants associated the fire alarm with a fire drill. People were in general laid back and some explained it with that they did not see any other threat in the situation, for example smoke or the actual fire whereas other thought the people usually have a very laid back nature. Some of the participants felt a little bit insecure since there was no announcement during the drill which actually told them that it was only a drill.

*“...you take all the fire evacuations the same, fire drills the same, it’s just like, you look around and see if there is any smoke or anything like that. If the threat is not there then you just start to pack your stuff up and get out.” (Fire Drill 10)*

Not all participants did interpret the alarm as a fire alarm, rather like some kind of burglar alarm. Some of the participants had never heard the fire alarm at the university before and thought it was hard to tell what type of alarm it was. However, these interpretations differed between the participants. At one of the campuses the participants were reflecting over that false alarms or test of the alarm system happened quite often.

*“Well, usually if you have a fire signal, as I’m aware of, it would signal similar to either a bell or in a sequence of three or four steps and then you know there is an alarm, but this one was changing tones as well as melody so then you were surprised, didn’t know what was going on, it just sounded like a car alarm, seriously.” (Fire Drill 12)*

The interviewers’ personal reflections from the interviews were mixed depending on the interviewee. In general, the nursing students gave a more nervous impression and regarded the alarm as more serious than the students from technical courses. Students from technical courses were perceived as quite calm.

### 6.5.2 Swedish participants

Since only one of the six Swedish interviews was tape recorded, exact quotes are not presentable in the same quantity as for the Australians.

The participants’ description of the physical scenario during the fire drill was quite similar for most of them. They describe it with that people were not reacting to the alarm and that they were questioning where the alarm came from. The fact that the teacher was not in the room was mentioned by almost everyone. The participants who had the fire alarm inside the classroom often mentioned that they went out because of the alarm was so loud. The other half with the alarm outside in the hallway took it very slowly and often sent someone out to check if it was a real fire alarm or not but also to look for the teacher.

*“In general did everyone know that you should leave as fast as possible but some got a little bit frightened and others just took it easy, it was a mix of everything but everyone knows that you should take it seriously” (Fire Drill 1)*

There were participants that had not received any information about how the fire alarm sounds like at Lund University of Technology (LTH) or what you are supposed to do in an emergency. No one of the interviewees had taken part in a fire drill before at LTH. They however mentioned that they had taken part in fire drill in high school and middle school. The participants gave the impression that they knew how to respond in an emergency even if LTH had not provided them with this kind of information.

Most participants first associated the alarm to a fire drill. Some of them mentioned that it could have been the elevator alarm. They often said that because they did not smell any smoke, it was probably just a fire drill.

*"People in the room started to question what type of alarm it was. They thought that it was an alarm from the lift that was on." (Fire Drill 7)*

In general the Swedish participants gave the impression that they were very calm and did not believe that something serious was going on.

### 6.5.3 Summary and comparison between the two national cultures

The main difference between the two populations is that the Australian participants were more concerned about that it may have been a real fire alarm. However, the Australian nursing students, with the fire alarm straight to evacuation were perceived as more worried than the Australian participants from technical courses (with a dichotomised alarm system). This insecurity could come from the fact that they felt a big lack of information. Swedish participants seemed to question where the alarm came from and if they were concerned. They often responded by sending out one in the class to investigate the source of the sound further. The Australians waited for a warden to come and tell them to leave the class room. Both of the populations mentioned that they had not got any information about what the fire alarm sounded like.

The Swedish participants gave the impression that they knew what to do in a real situation but Australians' were more concerned about how to react in a real situation. One thing that the two populations had in common is that they both were searching for more information before making the decision to evacuate the classroom. The Australian participants were talking to each other about the alarm and what to do. The Swedish participants on the other hand did send one of their classmates out in the corridor to see where the alarm came from. The Swedish participants thought it might have been the elevator alarm. The populations also share the first association, fire drill, even if the Australians had some difficulties to recognise the alarm.

## 6.6 Summary of the results (Overall comparison)

Hypothesis 1 is supported by the data. Australians associated the fire alarm in a greater extent with a serious association than the Swedish samples. An equal number of Australians (48 %) selected a serious association compared with a less serious association. The same numbers for the Swedish responses were 21 % for serious associations and 78.1 % for less serious associations. Gender did not seem to influence to the same extent as other factors between the Australian and Swedish-born samples. Asian-born students living in Australia showed a bigger difference, but the sample size was smaller, less concrete and the number of years that the participant had lived in Australia was not recorded. These findings are also supported by the interviews but not as distinct as the results from the questionnaires. Most of the interviewed participants, regardless of country of birth, associated the alarm at some stage with a fire drill, usually

as their first association. The Australians were however more concerned about if it may be a real emergency or not.

There is a significant difference between the two populations when it comes to emotions of fear and insecurity and hence Hypothesis 2 is supported regarding these emotions. Australians agreed to a greater extent to the statements than the Swedish participants, even though a majority of the both country disagreed partly or completely with the statement that they were very scared. The study of sub cultures also shows a difference between Swedish and Australians. The group that stands out within the Australian sample are females born in Asia which experienced a higher level of insecurity and fear. Asian males responded similar to Australian-born participants, while the Swedish participants, irrespectively of gender, were the least insecure and scared. This is also supported by the interviews where the Australians were perceived as more worried, even though this was most clear for Fire drill 8 and 9 which consisted of classes with nursing students.

The feeling of lack of information did not show a significant difference between the two countries. Lack of information seems to be more linked to the type and location of the fire alarm than to differences between the populations. This pattern is also shown by the pre-movement time. The Swedish fire drills with the alarm inside the classroom respectively the Australian fire drills with the alarm straight to evacuation signal responded more quickly than their compatriots. Hypothesis 3 was furthermore rejected.

Swedish participants seemed to evacuate in groups more often than Australians who more often evacuated individually. However, the general interpretation was that the Australians were more inhibited by other participants inside the classroom based on the observational study of the video recordings.

Swedish participants had more discussions which seemed to concern the alarm or what to do next than the Australians. Swedish participants seemed to search for information by discussing the scenario whereas the Australians looked out through a window or door. However, some of the Australians mentioned in the interviews that they had discussions about the alarm. This was particularly clear for the participants taking nursing courses and they were therefore not as included in the study of group behaviour (since the lack of video recordings). It may also be the case that the Australians discussed in pairs with the person next to them rather than in bigger groups which did occur in Sweden.

In two of the Swedish fire drill, one participant left the classroom to investigate what was going on. It is concluded from the interviews that these two participants left the classroom to search for more information and also see where the tutor was. Some Australians expected a warden or other authority to come and tell them to leave the class room.

## 7 Discussion

This chapter will in an analytical and reflexive way discuss the findings of the data. Special consideration is taken to the validity of the results and comparisons with previous research (all of them are presented in more detail in chapter 1) but also a discussion about deviant behaviour and responses if they occurred.

The data will be discussed in two different sections depending on the connections between the studied variables. It is regarded as natural that a person who associates the alarm to something serious will also feel more concerned during the event of an evacuation. The degree of seriousness regarding associations and feelings are therefore combined in a joint discussion. The group behaviour has been shown in previous research to have a large impact on the pre-movement time [12.]. These two measured variables are therefore also combined under the same section since they often overlap each other.

There are also two added sections about the researchers' personal reflections about the subject before the data were collected and also a section with suggestions for future research.

### 7.1 Degree of seriousness regarding associations and feelings

Both Hypothesis 1, regarding the participants' associations and Hypothesis 2 regarding the participants' emotional feelings were supported by the data. The Australians associated the alarm to a greater extent with something serious and they also felt a higher level of fear and insecurity than the Swedish participants. The limitations and other angles for why these differences may exist are discussed further in this section.

However, the feeling for lack of information did not show a significant difference and it is therefore considered that other variables may have a bigger influence. The design and emplacement of the alarm may be a major factor for why there was no significance between the countries. It may be regarded as more necessary to search for information if the alarm is unclear.

#### 7.1.1 Deviant behaviour and responses

The Australian sample showed some differences within the group depending on the type of education. The interpretation from the interviews was that the Australian nursing students were more stressed about the situation than their counterparts at the technical faculty. Both of the nursing students in the interviews were females whereas all the technical course students were males. There may therefore be an expectation that Australian females are more stressed than Australian males. This assumption is however not supported in the study of sub cultures from the responses in the questionnaires. Australian females and males tended to answer according to a similar pattern. Another explanation may therefore be that Australian men, in a masculine dominated country as Australia is [4.], are more concerned to radiate a secure and cool attitude than

Australian females. It may also be the influence from the educational background, since people who apply for a nursing course may be more interested in the care for other people and themselves.

Gender did not show a major impact on the level of fear or insecurity for participants born in neither Australia nor Sweden. However, Asian born showed a larger variation between females and males. The conclusions are on the other hand not as concrete since the Asian sample was more heterogeneous and smaller than the Australian and Swedish counterpart. This is since Asia is a big continent and the simplification of combining all the countries to add up to enough data may have affected the results. No consideration was taken to how long the Asian participant had lived in Australia. A person who has just arrived to the country can e.g. feel more insecure than someone who grew up in the country. The general conclusion is therefore that gender does not seem to have a large impact, at least for Australian and Swedish born participants.

Two Australians did also mentioning 'bomb threat' as a plausible cause of the alarm, one did it in the interview and one in the questionnaire (not the same person). This was never brought up by any of the Swedish participants and no statistics has been evaluated how often bomb threats occur in respectively country. Therefore it is difficult to say if it is previous experience or a higher level of fear that a few Australians did associate it with a bomb threat. One of the interviewed Australians did also not connect the alarm to a fire alarm at all, rather to some kind of burglary alarm. The other interviewed Australians did not seem to share this interpretation. There may be many reasons, but one is that the interviewee did not have gone through primary school in Australia. He may therefore not be used to the fire alarm standard. However he did mention that he had been through fire drills at work places in Australia and that this alarm differed.

### 7.1.2 Comparing the results with previous research

Previous Canadian research shows a significant higher interpretation of emergency for an alarm bell than the Canadian standard emergency sound (a T-3 signal). [19.]. A limitation of the results may therefore be the different standards for the two countries regarding the fire alarm design. The Canadian study is not directly transferable to these settings since the T-3 signal was not used. It does however show that the fire alarm bell received a high level of perceived urgency and was often linked to a fire alarm. A plausible supposition is therefore that the Swedish participants will regard the signal as more urgent than the Australians and furthermore also as more serious.

However, the results from this study show a significant difference between Australia and Sweden where the Australians regard the situation as more serious. The differences in fire alarm type may therefore not have influenced the results in the same extent as the cultural differences or other variables. Previous research has shown that Australians dislike uncertain situations more than Swedish [4.], and this may be an explanation (among others) for these results. Previous research did not show a significant difference on the level of perceived fear between the Western cultures Australia and the United



States of America [8.]. This may also indicate that the differences regarding the settings in Australia and Sweden may have affected the results in the extent that a significant difference occurred. However Hofstede & Hofstede (2005) present a more equal cultural structure for Australia and the United States of America than Australia and Sweden. Cultural differences and societal structures may therefore influence on the interpretation of the fire alarm and furthermore the level of insecurity and fear.

All the associations 'Fire', 'Fire Drill' and 'Evacuation' are corresponding with recognising the alarm as a fire alarm, even though the situation is interpreted as more or less urgent. These alternatives were also the most common first associations for the two countries. Australia had slightly more other associations' responses than Sweden which may depend on the alarm type which to some extent was harder to recognise. The interviews also show a slightly more diffuse interpretation of the alarm for Australians than Swedish students. However, this difference is regarded as small considered the total distribution and the type of fire alarm did not seem to vastly affect the recognition in this study.

### 7.1.3 Limitations and validity of the results

To ensure validity it is of great value that the results show a similar direction, irrespectively of the utilized method and statement. It is also important that the results are analogous with previous research (if these achieve high validity). Previous researches do support the findings, even though they do not concern exactly the same complex of problems. The interviews showed slightly different responses for Swedish and Australian participants, where Australians were more worried about what kind of alarm it was. However, this was clearer for Australian nursing students than the Australian students who took technical courses.

A limitation with questionnaires is that the participants are aware of the outcome when they are filling them in. It is therefore difficult to say how trustworthy the participants' answers were since they may have consciously or unconsciously changed their opinion after they have seen the results. E.g. they may have thought it was an emergency from the beginning but when they later found out that it was a fire drill they automatically change their first association to a fire drill. It is difficult to settle, to what extent it affected the results and if it varies between the two countries. It is however not possible to receive a higher level of 'less serious' attitudes than those presented in this report.

It has been complex to isolate different cultures in the study. The Australian sample was very heterogeneous with approximately half of the participants born in another country. This is more than the national mean of young people in the age-range 19-24 where 19.4 % were born overseas [5.]. One explanation may be that universities are an international environment with many international students. International students may not be aware of the hosting countries emergency procedures and may therefore be more worried than e.g. resident Australians. The study of the sub cultures show that Australian participants born in Asia in general interpreted the alarm as something serious to a greater extent than both participants born in either Australia or Sweden.

Whether this is because they had stayed in the country for a short period of time or that there is a greater difference between a non Western culture and a Western culture is difficult to conclude.

This research has not analysed how much experience the participants had of fire drills above those which had been conducted at the University in question. An assumption is that people with experience and knowledge about what to do in an emergency would feel less stressed than those who have a lack of experience. However, that is not shown by the data collected in this study where Australians in general had been through more fire drills than the Swedish participants at their respective University. Swedish participants may nonetheless have more experience from fire drills in the past, but it can not be concluded from this study.

The settings in the two countries were slightly different since the fire alarm standard varied and also the room design. The type of fire alarm may have affected the results, but as discussed in section 7.1.2, it may not seem to affect the results in a great extent. The Australians in general had some visibility to the hallway and some of them saw people evacuating. This extra information may have increased the trustworthiness and therefore also strengthened the interpretation of the situation as more serious. However, the other people who evacuated were aware of that it was a fire drill and acted very calmly, except for Fire Drill 8 where some security staff was not aware of the procedure. Some participants saw them through the windows and may therefore have regarded the situation as more serious.

Overall, the differences between Australia and Sweden may be regarded as cultural but may on the other hand be biased by differences in the settings and gender-setup. However, while briefly studying the impact of gender, the differences were bigger for participants with different country of birth than their gender, especially for Australian and Swedish born participants. While studying people's interpretation of an emergency situation some caution may therefore be necessary when transferring this kind of data between different countries.

## **7.2 Pre-movement time and group behaviour**

There were some tendencies which seemed to vary between Australian and Swedish behaviour. Swedish participants evacuated more often in groups than Australians but did on the other hand not become as inhibited by the group's behaviour as the Australians did. These two observations may depend on many reasons and can be regarded as contradict. The difference in the pre-movement time was on the other hand not significant and Hypothesis 3 was therefore not supported by the data. The questions to answer are therefore how and why they did occur and which limitations the result has.

### 7.2.1 Deviant behaviour and responses

Deviant responses have been noticed in the two fire drills with Australian nursing students as participants. Even if the times from these fire drills have been timed from outside the classroom they show that the nursing students have a noticeable shorter pre-movement than those taking a technical course. A reason could be that the nursing classes felt more insecure than the students taking a technical course, see 7.1.1 for further discussion why that may be. The nursing students also showed slightly different group behaviour since most of them evacuated in groups rather than individually. Group-oriented constellations may therefore encourage rather than inhibit certain behaviour, in this case an evacuation. The nursing students also had the fire alarm directly to evacuation signal whereas the participants taking a technical course had an alert signal prior the evacuation signal. This may have influenced the results, where the evacuation signal may be regarded as more serious.

Within the Australian sample, two fire drills did also show a contradictive behaviour. Both in Fire Drill 10 and 13 were other evacuating people in the hallway visible from the classroom, in general through windows. However, in Fire Drill 10, this seemed to have a positive effect with a quick response to the alarm. Fire Drill 13 on the other hand had the longest pre-movement time of all the Australian drills. The classmates inside the classroom did in this case seem to inhibit the behaviour more than the others outside were encouraging an evacuation. The participants in Fire Drill 13 seemed to be less relaxed than those in Fire Drill 10, whereby one aspect may be that the participants in Fire Drill 10 knew each other better. The influence of people evacuating outside the classroom may therefore vary depending on other variables, e.g. how well the participants inside the classroom know each other.

There was a difference in the behaviour within the Swedish sample with regards to the location of the fire alarm. Participants with the fire alarm inside the classroom did turn their heads towards the alarm and not towards each other in the same extent as those with the fire alarm in the hallway. They also packed their belongings and evacuated more quickly. The participants who had the fire alarm in the hallway did on the other hand often send out a person to the hallway to investigate where the sound came from. However, there were no such differences within the sample when it came to evacuating in groups or not. Most of the Swedish participants left the classroom in groups or the entire class at the same time, irrespectively of the location of the fire alarm. The location of the fire alarm may therefore have affected the information searching behaviour for Swedish participants and furthermore the pre-movement time. The location did on the other hand not influence how the constellation of people looked like while evacuating.

In Sweden there was also a fire drill where the participants never made the decision to leave the classroom before the fire drill was completed. An explanation may be that one of the participants left the classroom to investigate where the alarm came from and later returned. The participants may have got the indication that it was a practise and this may have influenced them to stay in the classroom.

### 7.2.2 Comparing the results with previous research

Previous research has shown that familiarity with the environment is of importance for how long the pre-movement time will be. Earlier results have given an approximated pre-movement time of 60 seconds for people evacuating from a smaller office building [18.] which also corresponds with this study's results. This may show that the participants were recognising the fire alarm and that it was a familiar environment. It may also indicate that the cultural influence on the pre-movement time is not significant between Australia and Sweden.

Both Australia and Sweden are regarded as very individualistic countries where an individual standpoint is well accepted [4.]. Australia shows slightly higher score than Sweden. This is consistent with that the Australian participants are evacuating individually to a greater extent than the Swedish participants. On the other hand, it does not explain why Australians would be more inhibited by each other than Swedish participants; it rather should be the converted. Inhabitants in individualistic societies may maybe be more afraid of making a fool of themselves than group-oriented countries, which may be an explanation to the results. However, Australia has also been shown to have slightly more hierarchical structure than the Swedish society [4.], which may lead to a bigger dependence on authority, in this case the tutor or a fire warden. Victoria University also have a well-developed system with fire-wardens which correspondence does not exist at Lund University. As discussed in section 7.2.1, it may also be that group-oriented constellations are less afraid of losing their face than those who acts individually.

### 7.2.3 Limitations and validity of the results

It is important to be aware that there are some weaknesses of the results of the pre-movement times. First of all, the insignificance is only valid for the settings of this study together with participants from Australia and Sweden. A comparison between other cultures and settings may show a cultural difference between cultures. It is also important to emphasize that the fire drills have been conducted in an academic environment. This means that only a specific group of people have taken part in the study. However, there are also some internal limitations regarding the insignificance.

The principally aspect is that there were quite few fire drills conducted in Australia with video recordings that could be used for further analysis, and it is hence difficult to say if the results are reliable or not. The pre-movement time varied quite much within the two countries. Sweden had a variation between 35 and 120 seconds whereas Australia varied between 16 and 113 seconds (these are results from the fire drills that have been video recorded). Each study of the group behaviour showed new findings and sometimes contradicting patterns. These results are therefore also not considered as saturated.

Another aspect is that the pre-movement time might be influenced by the location and type of fire alarm. The Swedish participants did for example respond quicker if they had the alarm inside the classroom instead of outside in the hallway. This may also be the reason for why the Australian nursing students did respond quicker than the Australians

taking a technical course, since they had the fire alarm straight to the evacuation signal. Since the feeling of lack of information also were showed to be insignificant there is a plausible correlation between lack of information and pre-movement times. If the alarm system is clear and easy to recognise this may shorten the pre-movement time in a greater extent than cultural variations.

It is important to emphasize that the participants came from different courses at the Universities. All the Swedish participants were engineering students and in Australia the participants were nursing students or student from a technical course. This might also have influenced the results. It is hard to tell how much it depends on the fact that there were classes which were dominated by male students and some of female student. People who may choose to study a nursing subject may be more caring and want to put themselves in a safe position more than a technical student. These thoughts are not proved or analysed further in this study.

The Swedish participants had more discussions before evacuating than the Australians and may therefore decide before leaving what to do next. This may lead to a more uniform evacuation and rather to inhibit the behaviour, promote an evacuation. However, the amount of discussions may also vary depending on different variables, apart from cultural influence. The study did not investigate how well the participants knew each other; even though most of them were 1<sup>st</sup> year students and can therefore only have known each other for a short period of time. However, this may affect the amount of discussions and also inhibit the participant's response. The Australian participants were also more spread out in the classrooms than the Swedish participants who tended to at least sit in smaller groups. Even when it was plenty of space in the classroom, Swedish participants were more grouped than the Australians. The distance between the participants may also encourage or inhibit the amount of discussions. It may have been a cultural aspect that Australians prefer more space, or the fact that they did not know each other as good as the Swedish participants did.

The discussions in Sweden often lead to that one participant left the classroom to search for more information (only when the alarm was placed in the hallway). This participant later returned to the classroom and informed the others about the settings. This behaviour may be common since there was no visibility in to the hallway. In Australia, more participants tended to look out through a glassed wall/window or an open door. It is hence difficult to say if Australians would use a similar behaviour if the visibility to the surroundings were limited.

Because of all the limitations surrounding the topic, more research is considered as necessary to draw clear and reliable conclusions about pre-movement times and group behaviour during an evacuation in different cultures. However, the results from this study may give a direction to explore the area further.

### 7.3 Personal reflections

It is important to underline the researchers' preconceived notion to the phenomenon since it can affect the interpretation of the results, especially the qualitative data. However, the preconceived notion did differ between the two researchers. One of the researchers thought the similarities between the two cultures (i.e. Sweden and Australia) was too small to find any characteristic differences in the behaviour and psyche. If a certain direction of the hypothesis had to be proclaimed, the Australians may take it more seriously, basically based on that the Swedish people in general are very used to fire drills. The other researcher did on the other hand expect distinctive differences between the two cultures with few variations within each population. This researcher's standpoint was that the Australians should be more concerned than the Swedish participants and hence respond more quickly.

With the awareness of these preconceived notions, the data were analysed in the most objective way. The researchers often analysed the data separately and later compared each others results to decrease the level of researcher bias.

### 7.4 Suggestions for future research

Further research may in more detail map out how to interpret data from different cultures. How is Chinese research transferable to a Swedish society? This study may be an outline for further research in the area which may give a more detailed picture of the different variables presented in this study. Experiments are regarded as a good way to collect data but the participants should also be selected outside the universities. This is to get a better mix of people to represent each national culture. Other features are to further control the group sizes and gender distribution, especially while studying group dynamics and pre-movement times.

Many public buildings, airports and accommodation facilities are often visited by a multi-cultural mix of people. Tourist resorts are during peak season crowded with foreigners who may not be aware of the destination's alarm system or evacuation procedures. Previous research has shown that the education level of the staff is an essential part to reduce the pre-movement time in public buildings [14.], [15.]. However, it may also be interesting to investigate how different alarm systems are interpreted by different cultures to see what kind of apparatus and signal that should be used at these kinds of facilities. Should tourist facilities adjust their safety procedures after their customers or their country's security standards? Is it necessary to inform the travellers about the visited country's standards (if they exist) when it comes to evacuation and fire alarms? In addition, it is also of importance to investigate the best way to distribute this kind of information.

Evacuation signs are also an essential part in many cultures when planning the fire safety in buildings. In Europe, the signs are in general green whereas they are red in the United States. Do different cultures therefore interpret colours differently and how may this impact on an evacuation?

#### 7.4.1 Method proposal

To conduct a good study in this area, future research teams should consider the following matters in this chapter. These are matters which during this research appeared to be essential variables that had a big impact on the final results.

Future research should include more countries from different societal structures. However, it is still necessary that each participating country conduct the study under similar conditions. The research team should have specialists in psychology and human behaviour to further analyse *why* national cultures may act differently. It may be easier to notice cultural differences if the researcher is from another country than those countries where the study is conducted.

When selecting participants for the study, there are a number of variables to take into account. As mentioned above, the participants should be selected outside the university area to get a better mix of people but also to select people who do not know each other in advance. This is since this parameter is difficult to extract and concretize how big impact it has on the behaviour. To study group behaviour and pre-movement times, a suggestion of the minimum number of participants is around 100 participants. This is to get a more valid picture of the behaviour. The participants should also be divided in smaller groups of approximately 10-20 participants, to get a reasonable number of trials.

Interviews are regarded as a good way to collect data to analyse why national cultures may act differently. More participants from each fire drill should be selected for interviews. The interviews should also be more detailed about their background, interpretations and expectations to get a better understanding of their behaviour. An example of background information may be the number of fire drills the participant has experienced during a life time and also how these fire drills were conducted.





## 8 Conclusions

This study has shown that there is a significant difference between Australia and Sweden in what people associate the fire alarm with and also how insecure and scared they felt during a fire drill. The Australians in general interpreted the situation as more serious than the Swedish participants. Many different variables can have an important role in why these differences occurred, but it may indicate that Australians regard their standard alarm as more serious. It is therefore important to be cautious when generalising this kind of data from other cultures. Further research is valuable partly to investigate differences between how the same culture interprets different types of fire alarms and partly to continue a comparison with other cultures as well. A small study of the sub cultures showed that the Asians differed to a greater extent within their group with a larger difference between males and females. They also differed more, as a group, compared with Australians and Swedish students. Studies between Western and Eastern cultures might therefore show an even clearer pattern of differences.

The result from the study shows that there was no significant difference in the pre-movement time between the two samples. It is possible this were from the influence of the group dynamics rather than a cultural difference. It is hard to tell if the results are reliable since the settings and the sample sizes for this part of the study was limited. Even though there may not be any cultural differences regarding the pre-movement time between Australia and Sweden it is possible there are still differences between other cultures, as noted above.

The limited sample sizes also concerned the group behaviour and the reliability of this result is therefore uncertain. However, Australians tended to evacuate more individually but were also more inhibited by the group than the Swedish counterparts. Further research is required before it can be concluded that cultural difference is the reason for the difference in the group behaviour.

This study shows that if data is used from another country it is important to be aware that there may be differences between countries. They might not always be substantial differences but they may still exist and therefore the generalisation of data across countries has to be made with care.



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# Appendices



## Appendix A. Consent from lecturer/tutor

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### Information about the research

In cooperation with the Occupational Health and Safety Unit, a research study will be made during the routine fire drills at VU.

You are invited to participate in a fire drill for the study entitled “Cultural differences in an evacuation scenario”. The study is a part of a student research project for the students Kristin Andree and Beatrice Eriksson. They are supervised by Dorothy Bruck at Victoria University.

The study aims to explore if cultural differences exist in an evacuation scenario by conducting almost identical experiments in Sweden and Australia. The studied differences are the time of reaction and decision, but also which associations people get to a fire alarm. The experiments will be undertaken in tutorials and be unannounced for the students. All experiments will be video recorded. The study will also provide valuable information to the Occupational Health and Safety Unit to increase the safety level at VU.

Your role in the experiment will be to, at a given signal, leave the classroom until the experiment is terminated. This is because your authority may influence the way the students will act. You will get information in advance about which day the experiment is going to be conducted. The date will be decided by the Occupational Health and Safety Unit together with the researchers and yourself. The chosen date will try to suit your schedule as far as possible. A suitable date is when the tutorial is during a double period with a break midway through. To decrease the level of disruption, the experiment will take place in close connection with the break. Therefore, students will not miss out so much of the information provided at the tutorial. It is important to underline that you may place your level of trust at risk to the students and that they may see you as responsible for the fire drill. We will provide them information afterwards and debriefing possibilities which hopefully adequately decrease this risk.

After the experiment the students will get brief verbal information about the safety procedures at Victoria University, but also an information sheet will be handed out to the class. Time is also needed for students to sign consent forms about the video recordings. All the students will have the possibility to fill in a questionnaire. Students from your class will be randomly approached to participate in an interview, one at a time, until one gives permission to be part of a 10 minutes interview with one of the researchers. The interview is conducted at a certain time arranged together with the student but preferable in close connection to the experiment.

### Consent

I hereby give my permission for an experimental fire drill to be conducted in my class, as arranged with the students Kristin Andree and Beatrice Eriksson. I'm aware of that my students will not get any information about the experiment in advance and that their actions will be observed in a fire evacuation scenario. I understand I can withdraw this permission at any time.

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Date

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Signature





## Appendix B. Room descriptions

In Sweden all the fire drills were conducted in tutorial classroom, where desks and chairs were movable. The classrooms were suitable for approximately 30 persons and had only one exit. All classrooms except Fire Drill 2 had solid walls and doors, with no visibility out in the hallway. The tutorial room in Fire Drill 2 had solid walls but a glassed door. However, the hallway outside this tutorial was in the basement and rarely trafficked. The exit was placed either on one of the sides in the classroom or in the back. The tables were usually on a row but refurbishment occurred. In some classes, the tables formed smaller groups (Fire Drill 5 and 7).



Figure 14. Permanent fire alarm in Sweden (not used in the drills)



Figure 13. Tutorial classroom in Sweden

In Australia, the room design varied slightly. Fire Drill 8 was conducted in a small lecture theatre (60 people) whereas Fire Drill 13 was a computer lab with computer islands of four computers each. Fire Drill 9, 10, 11, and 12 were conducted in regular tutorial classrooms with moveable chairs and tables. However, all of these seats were arranged in lines at the time of the fire drill. Fire drill nr 9 (60-80 people) was in a larger tutorial classroom with three exits, whereas Fire Drill 10, 11 and 12 (10-20 people) were conducted in smaller tutorials with 1 or 2 exits. All the participating room had at least glassed doors except Fire Drill 12 which had no visibility to the surroundings inside the building. Fire Drill nr 8 and 9 only had visibility through glassed doors. Fire drill 10, 11 and 13 also had visibility through glass walls in to the industrial lab. Fire Drill 10 and 13 also had some other wallsections to the hallway glassed.



Figure 15. Small Australian lecture theatre



## Appendix C. Questionnaire

Fire drill nr \_\_\_\_\_

**Gender:**  Male  Female  
**Age:**  -20  21-30  31-

**Country of birth:** \_\_\_\_\_ **Yr first enrolled at VU:** \_\_\_\_\_

### What was your *first* thought when you heard the alarm?

Only cross *one* alternative:

- Danger
- Safety
- Fire
- Terrorism
- Evacuation
- Drill
- A joke
- Other: \_\_\_\_\_

### What other associations did you have with the alarm?

Cross one or more alternatives:

- Danger
- Safety
- Fire
- Terrorism
- Evacuation
- Drill
- A joke
- No other associations
- Other: \_\_\_\_\_

*To what extent do you agree (or disagree) with the following three statements (X in one box only)*

#### **I felt very insecure (uncertain) when I heard the alarm.**

- Agree completely
- Agree partly
- Neither agrees nor disagrees
- Disagree partly
- Disagree completely

#### **I felt a lack of information when I heard the alarm.**

- Agree completely
- Agree partly
- Neither agrees nor disagrees
- Disagree partly
- Disagree completely

**Turn>>**

**I felt very scared when I heard the alarm.**

- Agree completely
- Agree partly
- Neither agrees nor disagrees
- Disagree partly
- Disagree completely

**What was the main reason for you to leave the classroom?**

Only cross *one* alternative:

- Investigate why the alarm rang
- The alarm signalled evacuation
- Other people in the room started to evacuate
- Someone told me to evacuate
- I never left the classroom**
- Other: \_\_\_\_\_

**Where did you sit in the room?**

Put a cross on the place you sat. If the furniture was moved, draw your place or make a sketch on the side.

*Outline of the classroom provided*

**Do you have any experience from any emergency or fire services?**

- No
- Yes, I've been working at the fire brigade / other place of work as a fire fighter / fire protection engineer or similar
- Yes, I did the military service in the rescue service
- Yes, I've been responsible for the safety on a place of work / school
- Other: \_\_\_\_\_

**Have you earlier participated in a fire drill at Victoria University?**

- Yes, more than once
- Yes, one time
- No, never

**Have you heard about other fire drills that have occurred at Victoria University, the last few months?**

Yes

No

**Other comments:**

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**Thank you for your participation!**

# Enkätundersökning (Swedish questionnaire)

## Utrymningsövning nr. \_\_

**Kön:**  Man **Ålder:**  -20  
 Kvinna  21-30  
 31-

**Födelseland:** \_\_\_\_\_ **Inskrivningsår:** \_\_\_\_\_

### Vilken var din första association när du hörde larmet?

Kryssa endast i *ett* alternativ:

- Fara
- Säkerhet
- Brand
- Terrorism
- Utrymning
- Övning
- Ett skämt
- Annat: \_\_\_\_\_

### Vilka övriga associationer fick du till larmet?

Kryssa i ett eller flera alternativ:

- Fara
- Säkerhet
- Brand
- Terrorism
- Utrymning
- Övning
- Ett skämt
- Inga andra associationer
- Annat: \_\_\_\_\_

Ange i vilken utsträckning du håller med om följande fem påståenden:

**Jag kände mig mycket osäker när jag hörde larmet.**

- Instämmer helt
- Instämmer delvis
- Varken instämmer eller tar avstånd
- Tar avstånd
- Tar helt avstånd

**Jag kände stor brist på information när jag hörde larmet.**

- Instämmer helt
- Instämmer delvis
- Varken instämmer eller tar avstånd
- Tar avstånd
- Tar helt avstånd

**Vänd >>**

**Jag kände mig mycket rädd när jag hörde larmet.**

- Instämmer helt
- Instämmer delvis
- Varken instämmer eller tar avstånd
- Tar avstånd
- Tar helt avstånd

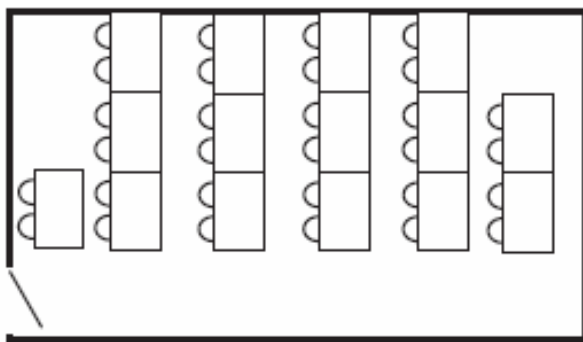
**Vilken var orsaken till att du lämnade övningssalen?**

Kryssa endast i *ett* alternativ:

- Undersöka varför larmet gick
- Larmet signalerade utrymning
- Larmsignalen var irriterande
- Andra människor i lokalen började utrymma
- Någon sa till mig att utrymma
- Jag lämnade aldrig övningssalen
- Annat: \_\_\_\_\_

**Var satt du i lokalen?**

Sätt ett kryss på den platsen du satt. Om det är ommöblerat, rita till platsen eller gör en skiss på sidan om.



**Har du tidigare erfarenheter av brandrelaterad tjänst?**

- Nej
- Ja, jag har arbetat inom räddningstjänsten/annan arbetsplats som brandman/brandingenjör eller motsvarande
- Ja, jag gjorde lumpen som räddningsman
- Ja, jag har varit ansvarig för säkerheten på en arbetsplats/skola
- Annat: \_\_\_\_\_

**Har du tidigare deltagit i en utrymningsövning på Lunds Tekniska Högskola?**

- Ja, mer än en gång
- Ja, en gång
- Nej, aldrig

**Har du under den senaste månaden hört talas om att det pågår utrymningsförsök på Lund Tekniska Högskola?**

- Ja
- Nej

**Övriga kommentarer:**

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**Tack för din medverkan!**



## Appendix D. Information for Participants (AUS)

### Cultural differences in an evacuation scenario; - a study comparing Australian and Swedish responses

#### *Information for Participants*

Our names are Kristin Andrée and Beatrice Eriksson, and we are studying our last semester in the course of Fire Protection Engineering at Lund University in Sweden. The fire drill you have just participated in forms part of our thesis, which is similar to an Honours thesis. The aims of the fire drill are to study how long it takes for people to make a decision and react in an evacuation scenario, and what associations people make with a fire alarm. We have conducted similar experiments in Sweden and aim to compare Australian and Swedish responses to the evacuation scenario to identify any cultural differences regarding alarm association and evacuation time.

The information from the research will also lead to improved data and understanding about how people react to different locations of the fire alarm. We will conduct two different experiments, one where the fire alarm is placed in the hall way outside the classroom, and one where the fire alarm is placed inside the classroom. Approximately half of the studied fire drills will have the alarm inside the classroom and the other half outside in the hallway.

During the fire drill we took safeguards to manage any risks associated with student anxiety. These safeguards included having researchers, VU fire drill personnel and your teaching staff member outside to monitor if anyone was distressed and to ensure safety as much as possible. The researcher was equipped with emergency telephone number and knowledge in first aid. After each drill, a debriefing session will be conducted where you have the possibility to ask questions and get information about the emergency plan at VU. The drill was ceased as soon as possible. Your lecturer had knowledge about the experiment in advance and since he/her has a duty of care for you, it is important with his/hers participation in the subsequent debriefing.

For this study, there will be **no identification** of individual participants - the project aims only to study **group** behaviour. However, video recordings will show students in the classroom, see further information below. We will use several methods to collect our data for further analysis.

Firstly, the experiment will be video recorded. However the aim of the recording is to study only group dynamics and the time it takes for decision and reaction. The resolution of the video recording is low to prevent the risk of identification, and will only be seen by Kristin Andrée and Beatrice Eriksson, together with our supervisors (Håkan Frantzich and Daniel Nilsson) from the Department of Fire Protection Engineering at Lund University, Sweden and Professor Dorothy Bruck from the School of Psychology at Victoria University. The video cameras were placed in the back of the classroom to minimize the exposure of your faces. The video recordings were terminated after the experiment had been conducted. The only reason to video tape the class before the time of experiment is because of the limitations in technology. The pre-experiment time will be edited away after the experiment has been conducted and only the time of experiment will be studied for further analysis. After the analysis is completed the contents of the video recording will be erased. You will have the opportunity to sign a consent form regarding the video recordings or to withdraw consent. If you have an objection to be on the video we will erase that video before analysis.

Secondly, we ask you to complete an anonymous questionnaire to get a deeper understanding about your associations to the fire alarm. We would appreciate if you could fill

it in, but it is completely voluntarily. By filling in the questionnaire you will give your consent to use it in further group analysis.

Thirdly, one person from each experiment will be randomly approached to participate in an interview. The purpose of the interview is mainly to fill in the gaps in the data from the questionnaires. The interview is voluntarily and a consent form will be signed by the participant before the interview is conducted.

You may choose to what extent you would like to participate in the data collection process. You may chose to be part of **all, some or none** of the following:

- agree with the use of the video recording of your movements
- fill in the questionnaire
- agree to be interviewed (only some students will be approached for this aspect).

When the report is finished it will be published on the faculty of Fire Protection Engineering's homepage, [http://www.brand.lth.se/publikationer/projektarbeten\\_bi\\_exjobb/](http://www.brand.lth.se/publikationer/projektarbeten_bi_exjobb/). The report is due to be completed in December 2007. If you would like to have the final report sent to your e-mail, please notify us by sending an e-mail to: [beatrice.eriksson.981@student.lth.se](mailto:beatrice.eriksson.981@student.lth.se).

If you have you further questions, or feel concerned regarding your participation in this study, please don't hesitate to contact any of us. The contact information is at the bottom of this page.

**We are very thankful for your participation!**

Any queries about your participation in this project may be directed to the researcher Dorothy Bruck, 03 9919 2336 or Kristin Andree, 0431854787, Beatrice Eriksson 0432 879 710. If you have any queries or complaints about the way you have been treated, you may contact the Secretary, Victoria University Human Research Ethics Committee, Victoria University, PO Box 14428, Melbourne, VIC, 8001 phone (03) 9919 4710

## Appendix E. Consent for video recordings

Fire drill nr. \_\_\_\_

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### Information about the experiment

This study is a part of a student research project for the students Kristin Andree and Beatrice Eriksson. They are supervised by Dorothy Bruck at Victoria University.

The study aims to explore if cultural differences exist in an evacuation scenario by conducting almost identical experiments in Sweden and Australia. The studied differences are the time of reaction and decision, but also which associations people get to a fire alarm. All experiments are going to be video recorded. The video recordings will give valuable data to the analysis since it provide the researchers information about reaction- and decision time, but also the dynamics within the group. These parameters are important when the fire protection in a building is evaluated. The aim of the recordings is therefore only to study group behaviour and no individuals will be identified. The material is therefore completely confidential.

The resolution of the video recording is low to prevent the risk of identification, and will only be seen by Kristin Andrée and Beatrice Eriksson, together with our supervisors (Håkan Frantzich and Daniel Nilsson) from the Department of Fire Protection Engineering at Lund University, Sweden and Professor Dorothy Bruck from the School of Psychology at Victoria University. The video cameras were placed in the back of the classroom to minimize the exposure of your faces. After the analysis is completed the contents of the video recording will be erased.

If any of the participants do not want us to use the recordings in further analysis, the recordings will be deleted after the experiment and not used to gain data to the study.

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### Consent

I certify that I am at least 18 years old and that the video recording may be used for analysis in the study "*Cultural differences in an evacuation scenario: A study comparing Australian and Swedish responses*".

I do not want the video recording to be used in the analysis and should therefore be deleted.

---

Date

---

Signature



## Appendix F. Interview questions

Introduce your self one more time and ask the interviewee if it is possible to use a dictating machine. If the dictation machine is allowed talk in “the number of fire drill” before the interview begins.

Can you describe the scenario in the classroom when the alarm went off?

How high was the credibility of the experiment?

- What in the experiment distinguished that?

What was your first spontaneous thought when you heard the alarm?

- How did you think then? / Can you please elaborate a little bit more on that.

Did your train of thought change during the experiment?

What idea did you get of what your other classmates thought when they heard the alarm.

- Can you describe what you saw?
- How much did the people around you influence you?

How did you act when you heard the alarm?

- What did you think?

If the person left the room:

What made you make the decision to leave the room?

Have you taken part in a fire drill before?

- Was this fire drill different from the others?
- Can you give examples what was different?

Have you got information about what to do if you hear a fire alarm here on Victoria University?

Do you think it is a good idea to run fire drills like this one?

Thank you for participating in this project!



## Appendix G. Consent form for interviews

### Consent form for interview

Fire drill nr. \_\_\_\_\_

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#### Information about the experiment

This study is a part of a student research project for the students Kristin Andree and Beatrice Eriksson. They are supervised by Dorothy Bruck at Victoria University.

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The study aims to explore if cultural differences exist in an evacuation scenario by conducting almost identical experiments in Sweden and Australia. The studied differences are the time of reaction and decision, but also which associations people get to a fire alarm. To get data for further analysis about people's associations all participants will be asked to complete a questionnaire. To get a deeper understanding one person from each experiment will be randomly chosen to participate in an interview. The participation in the interview is completely voluntary and confidential. No identification is needed for this study since the aim is to study group behaviour. The interview will take approximately 10 minutes and you can end the interview at any time you want. You will have the possibility to choose a suitable time for the interview.

#### Consent

I certify that I am at least 18 years old and that the data collected from the interview may be used for analysis in the study "*Cultural differences in an evacuation scenario: A study comparing Australian and Swedish responses*". I also certify that I have been told that all the information I provide in the interview will be kept confidential.

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## Appendix H. Level of measurement and statistical tests

Each quantitative collected datum can be categorised after its level of measurement. There are four different levels of measurements; nominal, ordinal, interval and ratio which all describes the properties of the data and furthermore which statistical test that is the most appropriate to use. [23.]

A *nominal* level of measurement is data which can not be ranked in any specific way, e.g. a person's association to a fire alarm. There is therefore not possible to put the data in a certain order, and this property of the data limits the number of statistical methods to use. The only suitable statistical test for nominal data is the  $\chi^2$ -test (chi-square-test).

An *ordinal* level of measurement is data which can be ranked, but the interval between the data can not be described. This can be the case for the result score (rank) from a marathon. The rank of each contestant can be arranged in a certain order but there is no foundation to say that the first contestant to finish the lap was twice as quick or good as the second contestant. This is also the case with questions from questionnaires where the participant should fill in on a scale from 'disagree completely' to 'agree completely'.

In addition to the  $\chi^2$ -test, statistical tests that considerate the rank of the data may therefore also be used. Wilcoxon's rang-sum test (also known as Mann-Whitney U-test) is an example of a statistical test where the rank of each datum is compared with the ranks from another independent sample/population. If the datum has the same rank as another datum, e.g. if more than one participant selected 'disagree completely' this is called a *tie*. The mean rank between these observations is hence calculated. Many ties make the method less trustworthy. The Wilcoxon's rang-rum test is non-parametric and therefore not assuming that the sample is standard distributed. The test may therefore also be used for interval and ratio variables where the number of data is limited. [25.]

The *interval* variable has all the properties that the ordinal variable has. In addition, the encoded numbers tells something about the intervals between the data. This feature makes it possible to calculate a mean value for the population. An interval scale has an arbitrary zero point. This means that values can be negative, since the zero point does not symbolize complete absence of that particular measurement. This is the case for temperature scales like Celsius and Fahrenheit where the degrees can be either positive or negative. The scale 'disagree completely' to 'agree completely' may be defined as an interval variable if it is assumed that the distance between the different alternatives (e.g. disagree completely-disagree partly) is equal (the possibility to replace the alternatives with numbers, e.g. between -2 to +2). However, this assumption may in many cases simplify the data since no such identification is mentioned in the questionnaires.

The *ratio* variable has all the properties the interval variable has except that the zero point is non-arbitrary. The value zero therefore describes total lack of data. Time is an example of data which are on a ratio scale. For ratio and interval scale there are more

advance statistical methods to utilize. This is since the sample may be regarded as standard distributed if there are enough collected data.

## Appendix I. Calculations procedure for the $\chi^2$ -test for consistency in a 2\*K table

To calculate the significance between two nominal variables, a  $\chi^2$ -test was used for a 2\*K table (illustrated in Figure 16). [24.]

|          | Class              |                         |                   | Total          |
|----------|--------------------|-------------------------|-------------------|----------------|
|          | <i>Serious (1)</i> | <i>Less serious (2)</i> | <i>Unsure (3)</i> |                |
| Sample 1 | n <sub>11</sub>    | n <sub>12</sub>         | n <sub>13</sub>   | N <sub>1</sub> |
| Sample 2 | n <sub>21</sub>    | n <sub>22</sub>         | n <sub>23</sub>   | N <sub>2</sub> |

Figure 16. Illustration of a 2\*K table

### Definition of variables:

N<sub>i</sub> = Total number of sample *i*

n<sub>j</sub> = Number of responses for class *j*

### Formulas:

$$e_{ij} = \frac{N_i \cdot n_j}{N_1 + N_2} \quad (1)$$

$$\chi^2 = \sum_{j=1}^K \frac{(n_{1j} - e_{1j})^2}{e_{1j}} + \sum_{j=1}^K \frac{(n_{2j} - e_{2j})^2}{e_{2j}} \quad (2)$$

A  $\chi^2$ -value was calculated for the samples were Swedish participants had the alarm inside the classroom respectively outside in the hallway and compared with the critical value from a  $\chi^2$ -table with K-1 degrees of freedom (Df), in Kanji, G. (2006) p.195. If the  $\chi^2$ -value exceeds the critical tabulated value, the null hypothesis is rejected and the difference is therefore significant.

**Table 18. Results from the  $\chi^2$ -test about the participants feelings between Sweden (total) and Australia,  $\alpha < 0.05$**

| Samples            | $\chi^2$ -value | Df | Critical $\chi^2$ -value | Stat. significant |
|--------------------|-----------------|----|--------------------------|-------------------|
| Sweden   Australia | 90.8            | 2  | 0.05                     | Yes               |



## Appendix J. Example of content analysis

The content analysis started with extracting themes from each transcript by making comments on the side with key words and interpretations. An example is presented just below. Further down in this appendix is an example of how to summarise the themes and take out the most common ones for further analysis.

### Making comments on an interview transcript

*Can you describe the scenario in the classroom when the alarm went off?*

We were a little bit chocked, no one really knew what was going on, whether to, everyone was discussing, should we go, should we stay, should we go, and then we saw security and we thought... maybe we need to go. Comments: Surprised. Unsure. Discussions.

*How high did you think the credibility of the experiment was or the fire drill?... Did it felt real?*

Yeah we all thought it was something going on, but we were worried like, I think because we saw teachers and security just like walking around, there's something going on, not sure what. Comments: Something is going on → security

*So, what was your first spontaneous thought when you heard the alarm?*

It was just like a fire drill, waiting to hear someone's voice saying, we are testing, yeah so that was what we all were waiting for, but because we didn't hear it... Comments: First drill then something more serious because of security and no message.

*Did it change your train of thoughts?*

Yeah, as soon as we didn't hear anyone saying this is a drill we thought, there's something going on yeah.

*How did you act personally when you heard the fire alarm?*

Well, once I didn't hear anyone's voice, I thought, oh my goodness, should I take my bag? Leave it? Eh... But I really shouldn't take my bag... but if it is a drill I've got all my stuff there, \*laughing\* you know, yeah... Comments: Act differently depending on if it is a drill or real. Bag?

*So you took your bag?*

Yeah I grabbed my bag, yeah and then I think everyone sort of stood up, wait for people to go down the stairs, no one screamed or ran everyone was pretty.... calm, yeah. Comments: Calm evacuation.

*What do you think made you make the decision to actually leave the room? ...Maybe it's a tricky question...*

No, I'll think everyone sort of looked at each other. We didn't hear any voice after we heard, you know, the sound, then we saw security sort of looking around and it's, cause we could see at the doors and that's when there's something going on we need to get

out. Everyone was chatting like, saying this is not right, so yeah... Comments: Discussion + this is not right.

*Had you taken part in a fire drill before?*

Yeah, but not like this really.

*What was different between the two or the others?*

Well, it was just like, it went off and then you would just take n' to wear and you have to evacuate and that was it sort of thing not really... This one made us feel more worried I think. Well you know you can have an alarm you are sort of ready for it and you sort of know it's not serious but this one it was a bit educative it was step more serious this time. Comments: More serious than previous ones, because of no previous information.

*How come?*

I think it was because we didn't know about it...

*Have you got any earlier information what to do if you hear a fire alarm here at Victoria University?*

To be honest, not really, no, NO! When I went out to the front of the building, I was trying to look around to think where the evacuation point was cause I thought it's not near the doors cause if it's a fire where are you gonna go? So I sort of walked around there, not sure, I knew we had to go somewhere, but I knew that wasn't right, but I didn't know where to go, but then the security guy said we got to go to the other side where the evacuation point is, and I remembered there was one there but at the time I didn't just even.. We need signs. We need signs for the evacuation points.

*Do you think the lack of information from Victoria University made you feel more insecure?*

Yeah a little bit, I think when you are in that sort of stage you sort of panic a bit and you know you are gonna be somewhere but you are not sure where, sort of thing, if that makes sense.

*Do you think it is a good idea to run fire drills like this?*

Yes, especially ones that no one knows about, I think that was much better I think. Cause when you know about it you sort of just don't hurry, you take your time and stuff but I think everyone thought there's something going on.

*Do you think there is anything they can improve with the fire drills?*

I think like I said with the signs like evacuation points so they have signs that tell us where it actually is. I think security didn't do much; a lot of them were just walking around I mean, I don't know, there were no directions I think that was a bit scary.

**Thank you!**

## Content analysis of the interviews – Australia.

Here is an example of the content analysis for Australia from one of the researchers. After extracting themes from the transcripts the founded themes were summarized and the most common ones were selected for further analysis. The most common themes are highlighted below.

### Thoughts

|                                       |                                   |
|---------------------------------------|-----------------------------------|
| Surprised                             | 2                                 |
| Didn't know what to do (lack of info) | 3                                 |
| Expecting directives/info (easier)    | 3                                 |
| Worried about belongings              | 2 (depending on if it is a drill) |
| What if it's real or not              | 2                                 |
| No threat (smoke etc.)                | 2                                 |
| No announcement                       | 2                                 |

### Associations

*First associations...*

|       |  |
|-------|--|
| Drill | 4 (e.g. never been through a real one) |
|-------|--|

*More...*

|                 |   |
|-----------------|---|
| Drill           | 2 |
| Stupid (+wield) | 2 |

### Actions

|                  |                        |
|------------------|------------------------|
| Discussions      | 3                      |
| Looking around   | 3                      |
| Calm evacuation  | 4 (e.g. no other cues) |
| Laid back people | 3                      |
| Pack stuff       | 3                      |





## Appendix K. Scheme for group behaviour analysis

| Fire drill nr XXX  | Agree | Neutral | Disagree |
|--|-------|---------|----------|
| <b>Group behaviour</b>   |       |         |          |
| The participant left the classroom in small groups or in pairs               |       |         |          |
| The participants left the classroom all together (a continuous flow)         |       |         |          |
| The participant left the classroom alone (single)                            |       |         |          |
| The participant became affected by the behaviour of the persons next to them |       |         |          |
| The participants influenced each other to bring their belongings             |       |         |          |
| The participants did not influenced each other to bring their belongings     |       |         |          |
| The participant's behaviour was inhibited by other participants              |       |         |          |
| <b>Discussions</b>   |       |         |          |
| Discussions occurred in smaller groups (3-4 people) or in pairs              |       |         |          |
| The majority of the class participated in the discussion                     |       |         |          |
| Very few discussions occurred  |       |         |          |
| <b>Search for information</b>  |       |         |          |
| The participant turned towards other participants                            |       |         |          |
| The participant turned towards the sound                                     |       |         |          |
| The participant turned towards the door/window                               |       |         |          |
| Participant went out to search for information                               |       |         |          |
| Other comments   |       |         |          |



## Appendix L. Raw data for associations

**Table 19. Australians' first association (rounded of to one decimal)**

| Association             | Number | Percent (%) |
|-------------------------|--------|-------------|
| Danger                  | 48     | 31.6        |
| Safety                  | 17     | 11.2        |
| Fire                    | 86     | 56.6        |
| Terrorism               | 4      | 2.6         |
| Evacuation              | 65     | 42.8        |
| Fire drill              | 75     | 49.3        |
| A joke                  | 20     | 13.2        |
| Other association (tot) | 16     | 11.2        |
| Real or not?            | 3      |             |
| No idea                 | 3      |             |
| My belongings           | 2      |             |
| Fire alarm testing      | 3      |             |
| Electrical malfunction  | 1      |             |
| Annoying sound          | 1      |             |
| Practise                | 2      |             |
| Saw video cam           | 1      |             |

**Table 20. Australians' first association (rounded off to one decimal)**

| Association            | Number | Percent (%) |
|------------------------|--------|-------------|
| Danger                 | 16     | 10.5        |
| Safety                 | 1      | 0.7         |
| Fire                   | 35     | 23.0        |
| Terrorism              | 0      | 0.0         |
| Evacuation             | 22     | 14.5        |
| Fire drill             | 50     | 32.9        |
| A joke                 | 12     | 7.9         |
| Other association      | 19     | 12.5        |
| Real or not?           | 3      |             |
| No idea                | 3      |             |
| My belongings          | 2      |             |
| Fire alarm testing     | 3      |             |
| Electrical malfunction | 1      |             |
| Annoying sound         | 1      |             |

|                 |   |
|-----------------|---|
| Practise/joke   | 3 |
| Saw video cam   | 1 |
| Bomb threat     | 1 |
| Get up from bed | 1 |

**Table 21. Swedish first associations (rounded off to one decimal)**

| Association             | Number | Percent (%) |
|-------------------------|--------|-------------|
| Danger                  | 3      | 2.9         |
| Safety                  | 1      | 1.0         |
| Fire                    | 15     | 14.3        |
| Terrorism               | 0      | 0.0         |
| Evacuation              | 4      | 3.8         |
| Fire drill              | 77     | 73.3        |
| A joke                  | 1      | 1.0         |
| Other association (tot) | 4      | 3.8         |
| Elevator                | 2      |             |
| Bungler/Mistake         | 1      |             |
| Burglary or Fire?       | 1      |             |

**Table 22. Swedish total number of associations (rounded off to one decimal)**

| Association       | Number | Percent (%) |
|-------------------|--------|-------------|
| Danger            | 13     | 12.4        |
| Safety            | 5      | 4.8         |
| Fire              | 41     | 39.0        |
| Terrorism         | 2      | 1.9         |
| Evacuation        | 40     | 38.1        |
| Fire drill        | 105    | 100.0       |
| A joke            | 10     | 9.5         |
| Other association | 11     | 10.5        |
| Elevator          | 3      |             |
| Bungler/Mistake   | 3      |             |
| Unsure            | 4      |             |
| Test with cameras | 1      |             |

**Table 23. Difference in association**

| Association       | Australia (%) | Sweden (%) | Difference (AUS-SWE) |
|-------------------|---------------|------------|----------------------|
| Danger            | 31.6          | 12.4       | 19.2                 |
| Safety            | 11.2          | 4.8        | 6.4                  |
| Fire              | 56.6          | 39.0       | 17.5                 |
| Terrorism         | 2.6           | 1.9        | 0.7                  |
| Evacuation        | 42.8          | 38.1       | 4.7                  |
| Fire drill        | 49.3          | 100.0      | -50.7                |
| A joke            | 13.2          | 9.5        | 3.6                  |
| Other association | 11.2          | 10.5       | 0.7                  |

**Sub cultures.** After each ‘Other’ association the number of participant who selected an serious association (s), less serious association (ls) and unsure (u) are marked on the side.

**Table 24. Raw data for the sub cultures’ first association after country of birth and gender.**

|               |            |      |
|---------------|------------|------|
| <b>ASIA</b>   |            |      |
| TOTAL         | NR         | %    |
| Danger        | 8          | 21,1 |
| Safety        | 0          | 0,0  |
| Fire          | 9          | 23,7 |
| Terrorism     | 0          | 0,0  |
| Evacuation    | 6          | 15,8 |
| Fire Drill    | 4          | 10,5 |
| A joke        | 4          | 10,5 |
| Other         | 7 3 ls 4 u | 18,4 |
| <b>38</b>     |            |      |
| <b>MALE</b>   |            |      |
|               | NR         | %    |
| Danger        | 2          | 15,4 |
| Safety        | 0          | 0,0  |
| Fire          | 3          | 23,1 |
| Terrorism     | 0          | 0,0  |
| <b>ASIA</b>   |            |      |
| <b>MALE</b>   |            |      |
|               | NR         | %    |
| Evacuation    | 2          | 15,4 |
| Fire Drill    | 1          | 7,7  |
| A joke        | 2          | 15,4 |
| Other         | 3 3ls      | 23,1 |
| <b>13</b>     |            |      |
| <b>FEMALE</b> |            |      |
|               | NR         | %    |
| Danger        | 6          | 24   |
| Safety        | 0          | 0    |
| Fire          | 6          | 24   |
| Terrorism     | 0          | 0    |
| Evacuation    | 4          | 16   |
| Fire Drill    | 3          | 12   |
| A joke        | 2          | 8    |
| Other         | 4 4u       | 16   |

**25**

**AUSTRALIA**

| TOTAL      | NR               | %    |
|------------|------------------|------|
| Danger     | 4                | 5,6  |
| Safety     | 0                | 0,0  |
| Fire       | 11               | 15,5 |
| Terrorism  | 0                | 0,0  |
| Evacuation | 7                | 9,9  |
| Fire Drill | 38               | 53,5 |
| A joke     | 5                | 7,0  |
| Other      | 6 3ls, 2s,<br>1u | 8,5  |

**71**

**MALE**

|            | NR    | %  |
|------------|-------|----|
| Danger     | 1     | 4  |
| Safety     | 0     | 0  |
| Fire       | 4     | 16 |
| Terrorism  | 0     | 0  |
| Evacuation | 4     | 16 |
| Fire Drill | 14    | 56 |
| A joke     | 1     | 4  |
| Other      | 1 1ls | 4  |

**25**

**FEMALE**

|            | NR          | %    |
|------------|-------------|------|
| Danger     | 3           | 6,5  |
| Safety     | 0           | 0,0  |
| Fire       | 7           | 15,2 |
| Terrorism  | 0           | 0,0  |
| Evacuation | 3           | 6,5  |
| Fire Drill | 24          | 52,2 |
| A joke     | 4           | 8,7  |
| Other      | 5 2ls,2s,1u | 10,9 |

**46**

**SWEDEN**

| TOTAL  | NR | %    |
|--------|----|------|
| Danger | 3  | 3,3  |
| Safety | 1  | 1,1  |
| Fire   | 11 | 12,1 |

**SWEDEN**

| TOTAL      | NR | %    |
|------------|----|------|
| Terrorism  | 0  | 0,0  |
| Evacuation | 3  | 3,3  |
| Fire Drill | 66 | 72,5 |
| A joke     | 3  | 3,3  |
| Other      | 4  | 4,4  |

**91**

**MALE**

|            | NR | %    |
|------------|----|------|
| Danger     | 2  | 3,7  |
| Safety     | 0  | 0,0  |
| Fire       | 7  | 13,0 |
| Terrorism  | 0  | 0,0  |
| Evacuation | 2  | 3,7  |
| Fire Drill | 40 | 74,1 |
| A joke     | 1  | 1,9  |

|               |            |          |
|---------------|------------|----------|
| Other         | 2 2 ls     | 3,7      |
|               | <b>54</b>  |          |
| <b>FEMALE</b> | <b>NR</b>  | <b>%</b> |
| Danger        | 1          | 2,7      |
| Safety        | 1          | 2,7      |
| Fire          | 4          | 10,8     |
| Terrorism     | 0          | 0,0      |
| Evacuation    | 1          | 2,7      |
| Fire Drill    | 26         | 70,3     |
| A joke        | 2          | 5,4      |
| Other         | 2 1 ls 1 u | 5,4      |
|               | <b>37</b>  |          |





## Appendix M. Raw data for feelings

**Table 25. The number of responses for each statement regarding feelings.**

| Number of responses          | Insecurity |            | Lack of information |            | Fear       |            |
|------------------------------|------------|------------|---------------------|------------|------------|------------|
|                              | SWE        | AUS        | SWE                 | AUS        | SWE        | AUS        |
| Agree completely             | 3          | 20         | 31                  | 50         | 2          | 6          |
| Agree partly                 | 13         | 48         | 26                  | 43         | 1          | 25         |
| Neither agrees nor disagrees | 29         | 40         | 20                  | 25         | 13         | 25         |
| Disagree partly              | 42         | 15         | 18                  | 19         | 39         | 36         |
| Disagree completely          | 17         | 28         | 10                  | 14         | 50         | 60         |
| <b>Total</b>                 | <b>104</b> | <b>151</b> | <b>105</b>          | <b>151</b> | <b>105</b> | <b>152</b> |

**Table 26. The percentage for each statement regarding feelings (rounded off to one decimal).**

| Percentage for each statement | Insecurity % |      | Lack of information % |      | Fear % |      |
|-------------------------------|--------------|------|-----------------------|------|--------|------|
|                               | SWE          | AUS  | SWE                   | AUS  | SWE    | AUS  |
| Agree completely              | 2.9          | 13.2 | 29.5                  | 33.1 | 1.9    | 3.9  |
| Agree partly                  | 12.5         | 31.8 | 24.8                  | 28.5 | 1.0    | 16.4 |
| Neither agrees nor disagrees  | 27.9         | 26.5 | 19.0                  | 16.6 | 12.4   | 16.4 |
| Disagree partly               | 40.4         | 9.9  | 17.1                  | 12.6 | 37.1   | 23.7 |
| Disagree completely           | 16.3         | 18.5 | 9.5                   | 9.3  | 47.6   | 39.5 |

**Sub cultures.** The following tables are for the study of sub cultures, where participants born and living in either Sweden or Australia respectively Australians born in Asia are presented.

**Table 27. Raw data (frequency) for comparison of sub cultures and their feelings**

**BORN IN ASIA**

|                            | Insecurity | Lack of info | Fear      |
|----------------------------|------------|--------------|-----------|
| <b>FEMALE</b>              |            |              |           |
| Disagree completely        | 1          | 3            | 7         |
| Disagree partly            | 1          | 5            | 5         |
| Neither agree nor disagree | 5          | 3            | 3         |
| Agree partly               | 12         | 7            | 7         |
| Agree completely           | 6          | 5            | 2         |
| <b>Total</b>               | <b>25</b>  | <b>23</b>    | <b>24</b> |
| <b>MALE</b>                |            |              |           |
| Disagree completely        | 2          | 2            | 4         |
| Disagree partly            | 3          | 2            | 5         |
| Neither agree nor disagree | 2          | 4            | 1         |

|                     |            |              |           |
|---------------------|------------|--------------|-----------|
| Agree partly        | 4          | 1            | 2         |
| <b>BORN IN ASIA</b> |            |              |           |
|                     | Insecurity | Lack of info | Fear      |
| MALE                |            |              |           |
| Agree completely    | 2          | 4            | 1         |
| <b>Total</b>        | <b>13</b>  | <b>13</b>    | <b>13</b> |

|                            |            |              |           |
|----------------------------|------------|--------------|-----------|
| <b>ONLY AUSTRALIAN</b>     |            |              |           |
|                            | Insecurity | Lack of info | Fear      |
| FEMALE                     |            |              |           |
| Disagree completely        | 9          | 1            | 19        |
| Disagree partly            | 4          | 5            | 10        |
| Neither agree nor disagree | 15         | 10           | 9         |
| Agree partly               | 13         | 17           | 7         |
| Agree completely           | 5          | 13           | 1         |
| <b>Total</b>               | <b>46</b>  | <b>46</b>    | <b>46</b> |

|                            |           |           |           |
|----------------------------|-----------|-----------|-----------|
| MALE                       |           |           |           |
| Disagree completely        | 6         | 1         | 14        |
| Disagree partly            | 2         | 1         | 5         |
| Neither agree nor disagree | 8         | 3         | 5         |
| Agree partly               | 8         | 7         | 1         |
| Agree completely           | 0         | 13        | 0         |
| <b>Total</b>               | <b>24</b> | <b>25</b> | <b>25</b> |

|                            |            |              |           |
|----------------------------|------------|--------------|-----------|
| <b>ONLY SWEDISH</b>        |            |              |           |
|                            | Insecurity | Lack of info | Fear      |
| FEMALE                     |            |              |           |
| Disagree completely        | 3          | 4            | 15        |
| Disagree partly            | 17         | 3            | 15        |
| Neither agree nor disagree | 11         | 7            | 4         |
| Agree partly               | 3          | 7            | 0         |
| Agree completely           | 1          | 14           | 1         |
| <b>Total</b>               | <b>35</b>  | <b>35</b>    | <b>35</b> |

|                            |           |           |           |
|----------------------------|-----------|-----------|-----------|
| MALE                       |           |           |           |
| Disagree completely        | 9         | 2         | 21        |
| Disagree partly            | 25        | 12        | 28        |
| Neither agree nor disagree | 12        | 10        | 5         |
| Agree partly               | 6         | 13        | 0         |
| Agree completely           | 1         | 17        | 0         |
| <b>Total</b>               | <b>53</b> | <b>54</b> | <b>54</b> |

## Appendix N. Data from Group behaviour scheme

| Sweden total   | Agree             | Neutral | Disagree |
|--|-------------------|---------|----------|
| <b>Group behaviour</b>   |                   |         |          |
| The participant left the classroom in small groups or in pairs               | 2                 | 1       | 7        |
| The participants left the classroom all together (a continuous flow)         | 6                 | 2       | 2        |
| The participant left the classroom alone (single)                            | 0                 | 0       | 10       |
| The participant became affected by the behaviour of the persons next to them | 7                 | 1       | 2        |
| The participants influenced each other to bring their belongings             | 5                 | 1       | 4        |
| The participants did not influenced each other to bring their belongings     | 2                 | 0       | 8        |
| The participant's behaviour was inhibited by other participants              | 4                 | 0       | 6        |
| <b>Discussions</b>   |                   |         |          |
| Discussions occurred in smaller groups (3-4 people) or in pairs              | 6                 | 0       | 4        |
| The majority of the class participated in the discussion                     | 3                 | 1       | 6        |
| Very few discussions occurred  | 0                 | 3       | 7        |
| <b>Search for information</b>  |                   |         |          |
| The participant turned towards other participants                            | 7                 | 3       | 0        |
| The participant turned towards the sound                                     | 7                 | 0       | 3        |
| The participant turned towards the door/window                               | 0                 | 0       | 10       |
| Participant went out to search for information                               | 4                 | 0       | 6        |
| Other comments   | No other comments |         |          |

| Australia total  | Agree             | Neutral | Disagree |
|--|-------------------|---------|----------|
| <b>Group behaviour</b>   |                   |         |          |
| The participant left the classroom in small groups or in pairs               | 2                 | 0       | 4        |
| The participants left the classroom all together (a continuous flow)         | 2                 | 0       | 4        |
| The participant left the classroom alone (single)                            | 4                 | 1       | 1        |
| The participant became affected by the behaviour of the persons next to them | 4                 | 1       | 1        |
| The participants influenced each other to bring their belongings             | 3                 | 0       | 3        |
| The participants did not influenced each other to bring their belongings     | 3                 | 0       | 3        |
| The participant's behaviour was inhibited by other participants              | 4                 | 1       | 1        |
| <b>Discussions</b>   |                   |         |          |
| Discussions occurred in smaller groups (3-4 people) or in pairs              | 4                 | 0       | 2        |
| The majority of the class participated in the discussion                     | 2                 | 0       | 4        |
| Very few discussions occurred  | 3                 | 1       | 2        |
| <b>Search for information</b>  |                   |         |          |
| The participant turned towards other participants                            | 3                 | 2       | 1        |
| The participant turned towards the sound                                     | 2                 | 0       | 4        |
| The participant turned towards the door/window                               | 6                 | 0       | 0        |
| Participant went out to search for information                               | 0                 | 0       | 6        |
| Other comments   | No other comments |         |          |

Total number of responses: 112

Total agreed: 84

Total disagreed: 28

Observational reliability:  $84/112*100 = 75 \%$