# Fire emergencies and people

**How we behave in a fire can be due to many factors such as familiarity with the building and its alarm systems as *Michael Spearpoint*, Department of Civil and Natural Resources Engineering at the University of Canterbury explains:**

## Introduction

In designing buildings we need to understand how people are likely to behave in fire (and other) emergency situations. The study of human behaviour in emergencies and the design of escape routes involves the interaction between psychologists, sociologists, engineers and other professionals.

The behaviour of people depends on many factors such as the person's age; education, experience and training; culture; mental and physical capabilities; whether they under the influence of drugs or alcohol; social situation; and responsibilities of individuals and groups. The particular behaviour of individual persons may depend on whether they are at home, at work or part of the general public. Their behaviour might be further influenced by whether they are on their own, with their family, with work colleagues or with a group of strangers. The time of day, the activities that the person is involved in or their mood will also have an influence on their behaviour.

Children often behave differently to adults in fires. The very young have no understanding of the threat from fire or knowledge of what to do when an alarm sounds, and anyway they may not be physically capable of escape. Slightly older children may try to hide from fire and smoke rather than evacuate. It is not unknown to find young fire fatalities hidden under beds or in cupboards. Having a home evacuation plan for a family is a good idea where children are in a house.

## Fire product interaction

Much of our experience of fire comes from bonfires or fires that are relatively safe where we are not likely to be exposed to heat and smoke in an enclosed space. However fires in buildings are quite different to those we normally experience. A fire emergency is a rapidly changing event that most people only rarely experience in their lifetime.

When people in a building fire are intimate with smoke and flames they are put in a stressful and unfamiliar situation. There is often the need for rapid decision making which requires the people to quickly assess information that is available. To an outsider this information collection and decision making process might appear to indicate 'panic'. However research has shown that in most cases people do not panic but act in a logical and often altruistic manner. Panic may occur when people are under immediate and extreme life threatening conditions.

Often if there is a fire in a building it is possible that the majority of the occupants will not come into contact with the flames and smoke. The design of many large commercial and public buildings tries to avoid the need for people to escape through smoke by providing alternative escape routes, physical barriers between areas of the building or measures to remove smoke from affected spaces. This remoteness from the effects of fire will result in behaviours that differ from those in which people are intimate with fire products.
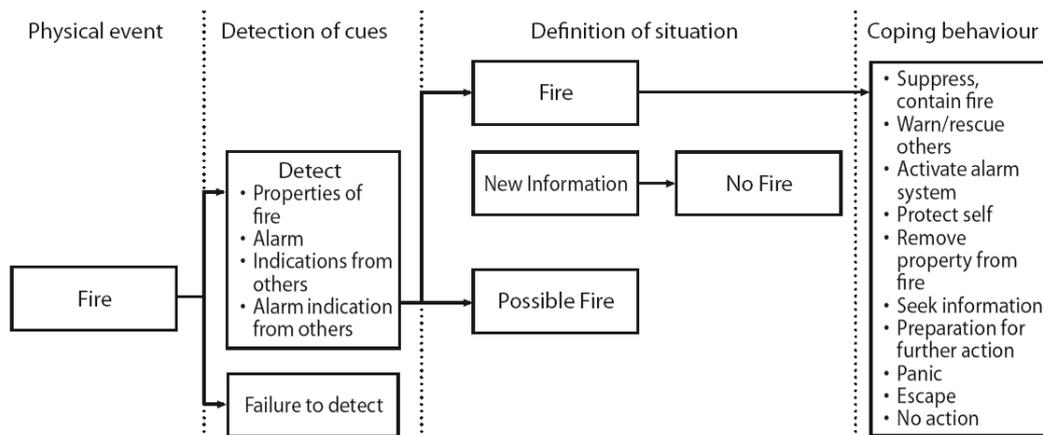
| Physical event | Detection of cues | Definition of situation | Coping behaviour |

*Figure 1 : Conceptual model of human behaviour in fire (Bickman et al.).*

**Evacuation process**

When we consider a building evacuation we can break it down into several overlapping stages: awareness stage, pre-evacuation stage, evacuation stage and post-evacuation in which each stage has particular behavioural aspects to consider.

*Awareness stage*

This is the stage in which people become aware that a fire emergency is occurring. People may be able to see the fire or the smoke, they might hear unfamiliar sounds or smell something unfamiliar, they might be alerted by an automatic alarm system or alerted by other people. In some instances the awareness cues are obvious but in many other cases they might be ambiguous. For example, visible cues of a fire might not initially be obvious that they are due to a fire. The sound of breaking glass might not be associated with a fire and not everyone is familiar with a particular fire alarm sound in a building.

The type of alarm notification can have a significant influence on the behaviour of building occupants and public address systems have been found to be more effective than bells.

Alarm notification mechanisms also have to consider members of the population who might be deaf and/or blind and be selected appropriately. Strobe lights and vibrating pads are two methods used to alert people with such disabilities.

*Pre-evacuation stage*

Once people are made aware of a fire, they then enter the pre-evacuation (or sometimes referred to as the pre-movement) stage. This stage may last anywhere from a few seconds to several hours. During this stage people assess the information available and decide upon what actions to take such as they may wait for further cues before taking further action, they may decide that the alarm is due to a nuisance source and ignore it, or they may consider the fire to be non-life threatening. The range and order of behaviours during this stage is very complex and a subject of continued research.
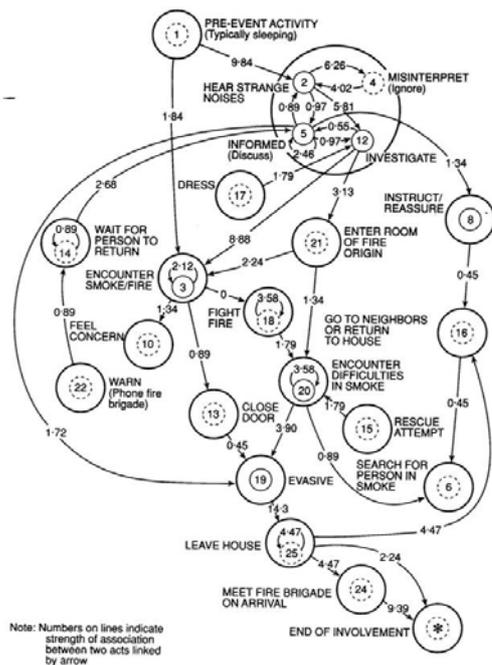
Figure 2 : Behaviour in domestic fires (Canter et al.).

The response of people at this stage can be quite different depending on circumstances. If people can see the fire or smoke then they are more likely to respond immediately. However, there are many documented cases in which the visible cues associated with a fire were not sufficient for people to respond.

The decision to begin evacuation is influenced by group behaviour and people are sometimes reluctant to be seen to be the first person to start to leave. The presence of authority figures or people with specific training can reduce this reluctance. Similarly, previous experience, training and preparedness will likely reduce the reluctance to evacuate.

In some cases people will first complete their current actions before starting to consider escaping. For example people might finish eating their meal in a restaurant or pay for goods in a shop before deciding to make their way out. The likelihood of carrying on their current actions depends on their level of commitment to that activity.

Where cues are ambiguous or the person suspects that there is a false alarm a likely response is for people to investigate the source of the fire cue. This investigation might involve moving towards the visual, audible or olfactory cue. Investigation might also involve seeking out further information from other building occupants.

Other activities during this stage might include warning other building occupants, contacting the fire service or attempting first-aid fire fighting using hand held extinguishers, hose reels or other non-conventional methods. Men have been found to be more likely to try to tackle a fire whereas women will try to gather family members or call for assistance. (However, these findings are as the result of research that is now several decades old and cultural roles may have shifted since then.)

*Evacuation stage*
Once the decision has been made to evacuate, then movement is not always immediate. In domestic situations people will first get dressed if they have been asleep. In office situations people will pack bags and put on outdoor clothing. People often move in social groups and will wait for the slowest member of that group. Family groups are an obvious social group and there are documented cases in which adults will move counter to the evacuation flow in order to collect other family members.

The use of escape routes is also subject to behavioural aspects. Exit route signage is often provided in buildings by means of reflective signs, lighted signs or other means. In buildings unfamiliar to occupants, people are more likely to exit by the same route as they came in even where alternative routes such as fire exits are available. Where people are familiar with a building they are likely to be aware and know the various alternative pathways out of the building due to those routes being used in normal activities.

If people encounter fire or smoke they will then need to decide whether to continue moving along their chosen route, consider an alternative route if any are available or retreat and wait for rescue. The decisions

to travel through smoke and to consider retreat are dependent on the individual's perceived level of threat and other behavioural aspects.

## Post-evacuation stage

Human behaviour plays a role in what people do once they have reached a place of safety. It is not uncommon for people to attempt re-entry to collect personal belongings, particularly in domestic situations. If people have evacuated in response to an automatic alarm and have not been exposed to signs of a fire then they may decide it is safe to re-enter.

## Conclusion

The study of people's behaviour in fire is very complex and not fully understood. Building designers must therefore consider the types of people that will be present, provide appropriate means of alarm notification, sufficient escape route options and separation from fire products. However, the evacuation of a building also requires that occupants take reasonable steps to guard their own safety by responding to alarms, following designated escape routes and not putting themselves into danger by fighting fires that are too large, moving through thick smoke or re-entering a building while it is not safe to do so.

## References / suggested reading

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