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RECOLLECTION OF FLAME HEIGHT AND SMOKE VOLUME IN DOMESTIC FIRES

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ABSTRACT

When a domestic fire occurs, how well do people perceive and recall the fire hazards they encounter? Although much research has been conducted on threat or risk perception and memory for threatening stimuli, to the authors' knowledge no studies have systematically tested how well people perceive and recall the threat stimulus in a fire context. This is an important topic given that domestic fires are usually the main source of fire-related injuries and deaths, and human behaviour is believed to play a significant role in such outcomes. Moreover, eyewitness testimonies play a significant role in subsequent fire, insurance and coroner investigations. The current study – part of wider research on human behaviour in domestic fires, called LIFEVID – sought to address the gap in knowledge by conducting an online experiment testing participants' (a) memories for the size of the flames and smoke witnessed in a mock kitchen fire, and (b) reported willingness to engage with the fire hazards. Participants' behaviours and attitudes in relation to other risky activities and control over events were also measured. The results revealed that accurate recollections of flame height and smoke volume can be obtained from members of the public, in certain cases. Accuracy was negatively impacted when the flames and smoke witnessed were larger in size. The size of the fire hazards also had an impact on participants' willingness to engage with the hazards, moderating the number who stated that they could have successfully extinguished the flames or would have entered the room with the smoke. Although there were signs that many participants recognised the risks posed by the larger hazards, a not inconsiderable number were still willing to engage with them. Being someone who takes greater risks in a health/safety domain and believing in one's ability to control what happens to oneself did not explain this finding. There is a clear need for a deeper investigation into people's perceptions of fire hazards in a domestic fire context and their associated behaviours and fire outcomes.

INTRODUCTION

LIFEVID (Lessons In Fire & Evacuation Behaviour In Dwellings) is a research project led jointly by the University of Greenwich and Kent Fire & Rescue Service and conducted in partnership with other UK fire and rescue services¹. The project's aim is to understand how people respond when faced with a domestic fire. This research stems from the fact that domestic fires are the leading source of all fire-related injuries and deaths, not just in the UK² but also in many other parts of the world^{3,4}. They also carry costs in terms of property damage and, moreover, this kind of loss can also cause psychological distress⁵. Yet, despite the multiple risks posed to the public by domestic fires, these incidents have received a disproportionately low amount of attention from researchers over the years. Although some studies have been conducted to look at pre-existing factors that might increase the chances of a person experiencing a domestic fire⁶, being killed or seriously injured in a domestic fire⁷, or undergoing psychological distress in the wake of a domestic fire⁸, the issue of what surviving occupants do during the incident, as the event unfolds, and how that impacts outcomes remains understudied. The few large-scale studies of behaviour during such fires that have been undertaken were conducted over 30 years ago^{9,10,11}. This seems particularly surprising given that accidental domestic fires continue to most frequently commence through human actions, e.g. the misuse of equipment or appliances (more often than not cooking appliances²) and that the occupants will, in effect, be the "first responders" as it will take the fire and rescue services some time to arrive at the scene, and only after an emergency call has been made. Thus, the outcomes of a domestic fire, in

terms of the severity of the harm to the occupants and to the property, will largely be in the hands of the occupants, at least initially.

Occupant Responses to a Domestic Fire

In the 1970s, two important studies were conducted examining occupant behaviour during fires in buildings including residential properties. Wood's survey data from UK fires⁹ revealed that the most frequent initial activity taken by participants in response to a fire was to try to tackle the fire. The likelihood of this activity being undertaken was associated with the participant's age, gender and prior fire experience. Additionally, the more serious the participant perceived the fire to be, the less likely they were to try to tackle it. However, there were some issues with Wood's dataset regarding overlapping categories of activities and the inclusion of fires in different types of buildings; reclassification and the removal of non-residential buildings produced different results regarding which activities were most frequently observed. Nevertheless, this study was seminal, and a few years later Bryan sought to replicate and extend it by conducting a survey of US building fires¹⁰. In this sample, notified others was the most common initial activity taken in response to the fire, while attempting to tackle the fire was less frequent. However, Bryan's dataset, like Wood's, also contained several overlapping categories of activities and (to a lesser extent) non-residential properties.

In the late 1970s to early 1980s, Canter and colleagues conducted a survey of human behaviour in UK building fires, in addition to several case studies, and went on to be the first to systematically differentiate behaviour according to the setting¹¹. When participants' responses in domestic fires, i.e. single-occupancy dwellings, were looked at specifically, Canter concluded that the investigation of fire cues will be a common early activity, and this activity will tend to result in a direct encounter with fire hazards. Canter further concluded that behaviour will be strongly influenced by place roles, which will be associated with the occupant's gender, e.g. males will be more likely to try to tackle the fire while females will be more likely to notify others.

The main message from these three early research studies is that, when a fire occurs in a home, occupants tend not to immediately evacuate out of harm's way. Wood and Canter's research instead suggest that occupants may first engage in activities that will take them closer to the fire, thereby increasing the chances of exposure to fire hazards such as flames and smoke. The latter hazard in particular is of concern as it is the most frequent cause of fire-related injuries, fatal and non-fatal². In addition, it would seem that factors relating to the person, e.g. whether the occupant is male or female, may influence behavioural responses. These findings present an obvious need for further research yet, for several decades now, little follow-up has been conducted. One such piece of research was carried out recently via a survey with residents in Kent, UK who had experienced a domestic fire¹². This study once again found that evacuation was typically not the immediate response to the fire. The majority of participants got closer to the fire and just under half attempted to tackle it. The most frequently cited reason for leaving the room with the fire was due to the effects of the flames/smoke. Thus, it would appear that occupants may be putting themselves at further risk of injury during the initial stages of their response to a fire in the home. However, what is not clear from these studies is how serious the fire was when the occupants first approached it, or when they attempted to tackle it or eventually left the room of fire origin. UK fire and rescue services routinely record the seriousness of the fire observed at each domestic fire they attend but this measure is based on the conditions once they have arrived at the scene. As fires can grow rapidly, it is difficult to determine the size of the fire (i.e. height of flames, volume of smoke) prior to the arrival of the fire and rescue service and, more importantly, at the various points of occupant-fire interaction. It is therefore difficult to know whether occupants fail to assess the risks to themselves, make an incorrect risk assessment, or recognise the risks but accept them in order to achieve some other goal (e.g. minimise the threat to property and/or others' lives). It is also worth noting that, in some cases, the risks might not actually be that great (i.e. small fire, with little smoke, that can be safely extinguished with ease by members of the public without needing to involve the fire and rescue service) and so approaching the fire might not be an unwise behaviour in certain circumstances.

Perception and Memory for Threats

The first question the current study sought to address was whether recollections of the size of the hazards witnessed during a domestic fire could be obtained from members of the public and, more importantly, whether those recollections would be accurate. If occupants are able to correctly perceive and describe the size of the fire then this would not only be informative for researchers; such recollections could better assist fire and insurance investigators and coroners' officers in their own inquiries too. Yet, to the authors' knowledge, no study has systematically examined people's memories for fire hazards. If a reasonably true account of aspects of fire hazards, such as their size, can be obtained from occupants then a better understanding can be gained about occupants' subsequent behavioural responses to the fire. This, in turn, would increase fire safety professionals' understanding of how to address these behaviours and, together with the public, achieve the best possible outcomes in fires.

Findings from a few studies conducted in fields unrelated to fire do raise questions concerning whether the public will always perceive and/or recall aspects of fire hazards, such as the height of the flames or volume of smoke, correctly. For example, one piece of research demonstrated that visual perception of spatial properties such as distance and height (i.e. how close one is to a looming stimulus, how high up one is in relation to the ground) may be distorted when the situation is threatening (i.e. the stimulus is a live tarantula, participants are prevented from holding onto a handrail), especially when participants' belief in themselves is depleted¹³. Another piece of research has noted that memory for threatening scenes may also be distorted, that is, more spatially focused, so that the stimulus depicting danger (i.e. slide showing the gruesome outcome of a traffic accident or a knife attack) is recalled in "close up" form¹⁴. Therefore, if members of the public were to come across taller flames or a larger volume of smoke during a fire, which should represent a greater threat, one likely beyond their control, might their subsequent descriptions of the hazards be distorted?

The second question the current study sought to systematically investigate was how willing members of the public might be to approach, to engage with, flames and smoke, given the fire hazards' size? If it were found that people were only willing when the hazards were small, or were at least perceived to be small, then it would suggest that some form of risk assessment does take place initially. However, if it were found that a not inconsiderable proportion of people were willing to engage with the hazards even when they were (at least perceived to be) large in size, then it would suggest that either the risks are deemed worth taking to achieve some other benefit or perhaps an inflated belief in one's ability to control events is present.

Therefore, an experiment was designed to test participants' memories of flames and smoke witnessed – trialling several different recall methods since no "best practice" exists yet – and also their willingness to engage with the fire hazards. The size of the witnessed hazards was manipulated. In addition, some established measures of risk-taking behaviours and attitudes connected to whether or not people can control events were included in order to provide better insight.

METHOD

Participants

Please note, the results presented here were derived at the time of writing the paper. The experiment has continued with additional participants, however their results are not reported in this paper.

A total of 66 participants (59% male, 41% female), aged from 23 to 68 years old (Mean = 45 years), voluntarily took part in an online experiment advertised as measuring perceptions of certain (unspecified) life events, as well as behaviours and attitudes to those events. The majority of participants (86%) resided in the UK or other countries where the official language is English and all were educated to at least secondary school level. Almost half (48%) had a job related to fire (i.e.

either worked for a fire and rescue service or worked in/studied fire safety engineering or fire safety sciences) and 53% had prior personal experience of a fire.

Two-thirds of the sample reported having a visual impairment; however, the vast majority of these impairments (96%) were of the kind that could be easily corrected with lenses, which participants were asked to wear before starting the experiment. No incentives (e.g. payment) were offered for taking part.

Procedure and Materials

The experiment began with two short video clips depicting a mock domestic fire set in a kitchen. The scene was filmed from the doorway to the room and the fire was situated in the right-hand corner. The video camera was placed at approximately 1.6m above the floor to represent the view a person would have as they entered the room. In the first video (see Figure 1) flames were visible (emanating from the pot on the stove and/or the tea towels laid to its side), while in the second video (see Figure 2) only smoke was visible (emanating from the tall pedal bin located just under the kitchen top where the tea towels had been). The video clips were deliberately short (i.e. lasted for just over two seconds each) so as to only allow participants to form an immediate impression of the fire hazards, as if they had just discovered them. Participants were split equally across three experimental conditions so that 22 saw the flames and smoke at an early stage in the fire's development, 22 saw the fire hazards at a mid stage, and 22 saw the hazards at a later stage. The height of the flames and the volume of smoke varied across the stages from small to moderate to large.



Immediately after viewing the videos, all participants were asked to complete a series of filler tasks. These included the DOSPERT scale on risk-taking in relation to ethical, financial, health/safety, recreational and social activities¹⁵, and Rotter's locus of control scale on people's beliefs about whether they can control events that happen to them¹⁶. The former task required participants to rate their likelihood of engaging in various risky activities; ratings were made on a 7-point scale (where 1 = *Extremely Unlikely* and 7 = *Extremely Likely*) and were subsequently summed to give scores for

each of the five aforementioned domains. The health/safety domain was the one of most interest in this study. A higher score (from a possible range of 6-42) represented a greater propensity for taking risks in that domain. The latter task involved participants reading a number of pairs of statements about different types of life events and then selecting the one statement from each pair that they most agreed with. Statements that described an external locus of control (i.e. suggested that the events were determined by outside sources, such as figures of power or luck) were subsequently assigned 1 point if selected, while 0 points were assigned if the opposing statement was selected. These scores were then summed (into a possible range of 0-23), with a higher overall score representing a belief that one has little control over life events and a lower overall score representing an internal locus of control, i.e. a belief that one can largely control what happens to oneself.

Once the filler tasks were completed, participants were surprised with a test of their memories for the flames and smoke witnessed earlier. Memories were tested in three ways: first via free recall, where participants were asked to describe what the hazards looked like using their own words; then via selecting one out of a choice of five text descriptors that best matched their memories; and finally via selecting one out of a choice of five picture descriptors that best matched their memories (see Tables 1 and 2 for the descriptors).

Table 1. Text and Picture Descriptors for the Height of the Flames




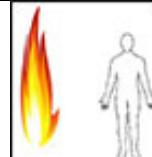
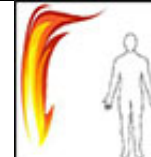
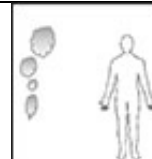




	A	B	C	D	E
Text	The height of the flames was about the size of a hand	The height of the flames was about the length of an arm	The height of the flames was about as tall as an adult person	The height of the flames meant they just reached the ceiling	The height of the flames meant they were running along the ceiling
Picture					

Table 2. Text and Picture Descriptors for the Volume of Smoke

	A	B	C	D	E
Text	There were puffs of smoke coming from the item that was burning	The smoke had formed a thin layer up at the ceiling, but well above head height	The smoke had formed a thick layer under the ceiling, down to just above head height	The smoke had formed a deep layer under the ceiling, down to around shoulder level	The room was full of smoke
Picture					

Finally, participants' willingness to engage with the fire hazards was assessed by asking them to rate whether they believed they could have safely extinguished the flames and would have entered the room given the smoke that was present. Ratings were made on a 5-point scale (where 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Not Sure*, 4 = *Agree*, and 5 = *Strongly Agree*), which was subsequently reversed and collapsed into a 3-point scale (*Yes*, *Not Sure*, *No*). Socio-demographic information was also collected.

RESULTS

Size of Fire Hazards: Free Recall Accuracy

The participants' descriptions of what the flames and smoke looked like, using their own words, were coded as either *Accurate* (recalled correctly) or *Not Accurate* (either failed to describe the hazards in sufficient detail to make any judgement about accuracy, or recalled them incorrectly). Only 41% of the sample were accurate when freely recalling the height of the flames. Even fewer participants, just 21%, were accurate when freely recalling the volume of smoke. The majority of those who were not accurate when freely recalling the hazards had failed to provide sufficient detail rather than had provided incorrect details.

Size of Fire Hazards: Recall Accuracy Using Text Descriptors

When selecting from the text descriptors, 61% of the sample picked the correct descriptor for the height of the flames seen in the video, while 52% picked the correct descriptor for the smoke volume. Because all participants made a selection, it was possible to break down their answers by the different fire stages witnessed. As Table 3 shows, some participants were actually far more accurate than the above statistics suggest. Specifically, participants seeing the fire during the early stage of its development, i.e. when the hazards were smaller in size, were able to select the correct descriptor in the majority of cases. This was especially true for the flames. However, participants seeing the fire at subsequent stages in its development were less accurate. For the flames, accuracy was at its worst when the hazard was witnessed at the late stage; for the smoke, accuracy was worst when the hazard was witnessed at its mid stage.

Table 3. Percentage of Participants Selecting Each Text Descriptor by Fire Stage (*correct answer)

Flame Height					
Stage of Fire	A	B	C	D	E
Early	*95%	-	-	5%	-
Mid	14%	*59%	18%	9%	-
Late	-	9%	9%	55%	*27%
Smoke Volume					
Stage of Fire	A	B	C	D	E
Early	*77%	18%	-	-	5%
Mid	18%	55%	*27%	-	-
Late	-	5%	41%	*50%	5%

Size of Fire Hazards: Recall Accuracy Using Picture Descriptors

Overall, recall accuracy using the picture descriptors was almost identical to that when using the text descriptors: 62% of the sample picked the correct descriptor for the height of the flames while 53% picked the correct descriptor for the smoke volume. However, when broken down by the different fire stages (see Table 4), it became clear that, once again, accuracy was actually much higher than that if the fire was witnessed during the early stage of its development; especially for the flames.

Table 4. Percentage of Participants Selecting Each Picture Descriptor by Fire Stage (*correct answer)

Flame Height					
Stage of Fire	A	B	C	D	E
Early	*91%	5%	-	5%	-
Mid	14%	*68%	18%	-	-
Late	-	9%	36%	27%	*27%
Smoke Volume					
Stage of Fire	A	B	C	D	E
Early	*82%	14%	-	-	5%
Mid	27%	46%	*27%	-	-
Late	-	14%	32%	*50%	5%

Also as before, accuracy decreased for the subsequent fire stages, being worst when the flames were witnessed at the late stage and when the smoke was witnessed at its mid stage.

Size of Fire Hazards: Other Variables Relating to the Person

Correlation tests (see Table 5) revealed negative correlations between health/safety risk-taking scores and the perceived size of the hazards. However, the relationships were extremely weak and not statistically significant. Likewise, the positive correlations between the locus of control scores and the perceived size of the hazards were also weaker and non-significant. In other words, participants' perceptions of the size of the flames and smoke did not appear to be linked to their propensity to undertake risky activities relating to health/safety, nor to their beliefs surrounding control over events.

Table 5. Spearman Correlation Coefficients for Study Variables

Variable	2	3	4	5	6	7
1	.85***	-.43***	-.36**	-.09	.17	-.01
2		-.38**	-.46***	-.03	.22	-.07
3			.44***	.07	-.10	.02
4				-.01	.05	.21
5					-.04	-.31*
6						.07

Notes: 1 = Perceived Flames Size, 2 = Perceived Smoke Size, 3 = Extinguish Flames, 4 = Enter Smoky Room, 5 = Health/Safety Risk Taking Score, 6 = Locus of Control Score, 7 = Age; * $p < .05$, ** $p < .01$, *** $p < .001$

Additional statistical tests were conducted to check whether accuracy across any of the three methods of recall differed according to socio-demographic variables (i.e. Gender, Age, Prior Fire Experience, Fire Related Job); no significant differences were detected.

Willingness to Engage with the Flames and Smoke

Overall, most participants stated that they could have safely extinguished the flames they saw (Yes: 62% vs. Not Sure: 26% vs. No: 12%). Likewise, the majority stated that they would have entered the room with the smoke (Yes: 58% vs. Not Sure: 18% vs. No: 24%). Willingness to engage with the fire hazards decreased as the size of the fire hazards witnessed increased (see Table 6). Nevertheless, even when the fire hazards were at their largest (i.e. at the late stage in the fire's development), more than two-fifths of the sample reckoned they could have put the flames out or would have entered the room with the smoke. A further 41% and 27% respectively were not definitely against engaging with the flames and smoke when they were at their largest.

Table 6. Participants' Willingness to Engage with the Hazards by Fire Stage

Extinguish Flames			
Fire Stage	Yes	Not Sure	No
Early	82%	14%	5%
Mid	59%	23%	18%
Late	45%	41%	14%
Enter Smoky Room			
Fire Stage	Yes	Not Sure	No
Early	77%	14%	9%
Mid	55%	14%	32%
Late	41%	27%	32%

As not every participant correctly recalled the size of the fire hazards, a correlation test was conducted to look at the relationship between willingness and fire hazard size replacing the actual size (Fire Stage) with the perceived size of the hazards (the descriptors selected by the participants – for the sake of space in this paper, only the results using the picture descriptor data is included; the text

descriptor data produced the same findings). This test revealed significant negative relationships between the variables (see Table 5) thereby replicating the above finding, i.e. that willingness to engage with the fire hazards decreased as the (perceived) size of the hazards increased.

Willingness and Other Variables Relating to the Person

As Table 5 shows, there was only a very weak non-significant positive correlation between risk-taking scores on the health/safety domain and willingness to engage with the flames. Similarly, there was an almost negligible non-significant negative correlation between health/safety risk-taking scores and willingness to engage with the smoke. Put another way, participants who take more risks when it comes to activities related to health/safety were not more likely to state that they could have extinguished the flames, or would have entered the smoky room, than participants who do not take such risks. Similarly, participants with an internal locus of control, and therefore a belief that they can largely control what happens to them, were not significantly more likely to state that they could have extinguished the flames or would have entered the room with the smoke.

Additional statistical tests were conducted to check whether Gender, Age, Prior Fire Experience, and Fire Related Job impacted willingness (see Table 7 for descriptive statistics and Table 5 for correlations) but, as with accuracy, no significant effects of these socio-demographic variables were detected.

Table 7. Participants' Willingness to Engage with the Hazards by Socio-Demographic Variables

	Gender		Prior Fire Experience		Fire-Related Job	
	Male	Female	Yes	No	Yes	No
Extinguish Flames?						
Yes	62%	63%	69%	55%	56%	68%
Not Sure	31%	19%	23%	29%	31%	21%
No	8%	19%	9%	16%	13%	12%
	Gender		Prior Fire Experience		Fire-Related Job	
	Male	Female	Yes	No	Yes	No
Enter Smoky Room?						
Yes	54%	63%	51%	65%	44%	71%
Not Sure	21%	15%	23%	13%	25%	12%
No	26%	22%	26%	23%	31%	18%

DISCUSSION

This preliminary study indicated that accurate recollections of the height of flames and volume of smoke witnessed in a domestic fire can be obtained from members of the public in certain cases. The sample's relatively poor performance on the free recall test suggests that some form of recall aid will be necessary to help access or communicate these memories. This study created two types of recall aid: descriptors firstly in the form of text and secondly in the form of pictures. There was little difference in the participants' performance when using the two types of recall aid, although the picture descriptors seemed to produce marginally better accuracy in general. The picture descriptors would also likely circumvent any language differences or difficulties.

It was notable, nonetheless, that recall accuracy was affected by the size of the fire hazards being witnessed. Memory for the height of the flames in particular was very good when the flames were small but not as accurate when the flames were larger (from around the length of an arm to being as tall as to reach all the way up the wall and start licking across the ceiling). This is consistent with the literature cited earlier that threatening situations can distort visual perception of spatial properties¹³. Memory for the volume of smoke witnessed was also reasonably good when there was little smoke but impaired when the smoke expanded. However, the pattern of recall accuracy performance with the smoke differed slightly to that with the flames: instead of decreasing incrementally as the size of the hazard increased, accuracy dipped to its worst when the smoke had formed a layer under the ceiling and then improved (albeit not to the levels displayed when there was little smoke) when the smoke

was seen to have filled the room down to around shoulder level. The latter volume of smoke would be a greater threat as it would mean, in reality, that the occupant's vision would be obscured and they would be breathing in toxic substances if they remained standing. These results might suggest that there is something particular about smoke that poses a bigger problem when it comes to perception; note that recall accuracy was often lower for the smoke than it was for the flames. It could be related to characteristics such as: colour (flames being of a much brighter colour and therefore perhaps more effective at capturing attention than duller smoke); movement speed (flames flickering in a more rapid motion, again perhaps capturing attention more effectively than something moving in a creeping motion); or movement trajectory (flames travelling in fewer directions than smoke and therefore easier to track). With regards to movement, the smoke was recalled relatively more accurately when it was moving mainly within the central layer of the room, i.e. rising up in puffs from the fire's source or descending back down the room towards the level of the source. Recall was at its worst when the bulk of the smoke was moving up at the ceiling, above the central layer of the room where the fire source was located. Recall for the flames was also at its worst when that hazard was moving along the ceiling, above the central layer where the fire source was located. Thus it could be that vision tends to centre round the seat of the fire and, when hazards move into the visual periphery, they may be missed. Quite a number of studies examining eyewitness testimony have observed attentional narrowing effects, and some research has suggested this can occur during the formation of memories, involving greater elaborative processing of central details¹⁴. However, as participants in the current study were pre-occupied with the filler tasks immediately after seeing the flames and smoke videos, and not warned that they would have their memories tested, it would seem likely that any narrowing was occurring earlier on, during the visual perception stage.

One further point ought to be noted regarding recall accuracy: those participants who were not accurate had most often selected a descriptor that was just one away from the correct descriptor, and were suggesting something that was not radically qualitatively different to the actual conditions. Thus, even if not absolutely correct, it is possible that members of the public might still often be able to provide a reasonably good description of the hazard's size.

Regarding willingness to approach or engage with the flames and smoke, participants who stated outright that they would not have engaged with the fire hazards were in the minority; more participants demonstrated a willingness to engage. The (perceived and actual) size of the hazards did moderate willingness. Nevertheless, a fairly substantial proportion of the sample reckoned they could have extinguished the flames that were up to and running along the ceiling and would have entered the room with the smoke layer that would have enveloped their heads. The moderating effect of fire hazard size suggests that participants did recognise, at least to some extent, the potential risks to themselves in engaging but for some it would seem those risks were deemed acceptable. It was hypothesised that an inflated belief in one's ability to control events might elevate willingness but the data did not support this notion; there was no significant relationship between locus of control scores and willingness. Similarly, participants with a greater propensity for taking risks in a health/safety domain were not found to be significantly more willing to engage with the flames and smoke. Moreover, neither locus of control nor risk-taking appeared to bias how small or large participants perceived the fire hazards to be. It could be that the individual differences measures used in this study were not specific enough; neither the DOSPERT scale nor Rotter's locus of control scale contained items about fire. Alternatively, it could be that risk-taking and locus of control do have some influence in a fire context, just not a direct or isolated one. It is also worth noting that socio-demographic characteristics such as being male vs. female, older vs. younger, having a fire-related job or prior personal experience of a fire were not found to significantly influence results in this study, although some of these characteristics have been highlighted as having an influence on behavioural responses in real-life cases of fire^{9,11}.

It has been noted previously that members of the public will be willing to enter spaces filled with smoke, although this has typically been observed and discussed in relation to movement towards a place of safety, i.e. evacuation¹⁷. In the current study, entering the room with the smoke would have taken the participants closer to the danger. Although there was a door in the room seen in the videos it

was to the edge of the screen and rarely mentioned in the free recall answers, so it is unlikely that many participants were aware of there being a (potential) escape route via that room. Wood detected a greater propensity for occupants to move through smoke when the fire occurred in a domestic setting compared to when in a non-residential setting⁹. His survey questions did not offer the opportunity to establish the context for participants moving through smoke, although his analysis did not find evidence that it was associated with evacuating. Therefore, Wood concluded that the movement through smoke was occurring during the performance of some other type of activity, such as trying to tackle the fire. The results of the current study support this notion that occupants might enter a space with smoke for reasons other than to ultimately reach a place of safety. Certainly the findings of both studies highlight the potential danger occupants might place themselves in during domestic fires when one again considers the fact that smoke is the main cause of fire-related injuries and fatalities².

Although the experimental stimuli used in the experiment were designed to increase ecological validity (e.g. using moving rather than still images, kitting out the kitchen with some everyday items to give it a more lived-in look, shooting the scene from first-person perspective), they nevertheless lacked certain sensory aspects of a real fire, e.g. heat, the smell and toxicity of the smoke. Thus, the percentage of people willing to try to extinguish the flames or enter into the smoke might have been somewhat elevated here. The recent Kent study of real-life fires demonstrated that occupants may be prompted to leave the room of fire origin when they feel the effects of the fire hazards¹². However, as the data here hints that attentional narrowing may go on when fires grow beyond minor ones, it does raise the question of whether occupants would notice such effects immediately.

CONCLUDING REMARKS

The findings of this study indicate that while recollections of hazards encountered during a domestic fire can be obtained from members of the public, at least via the use of recall aids such as picture descriptors, occupant-fire interactions are unlikely to be straightforward. Larger flames and volumes of smoke would seem to impact not only how people perceive and later recall the hazards but also behavioural responses to those hazards such as willingness to engage with them. However, the size of the hazards may not be an overriding factor in behavioural responses as a number of participants were still willing to engage with the flames and smoke even when large. Taking person variables, such as participants' gender, risk-taking propensities or beliefs concerning control over events, into consideration did not provide any elucidation of participants' willingness or recall performance in this preliminary study. Despite that, findings from earlier real-life cases of domestic fires would suggest it would be unwise to rule out person variables. Moreover, the pattern of accurate recollection for fire hazards of various sizes observed here was not the same for smoke as it was for flames. Thus, investigations into human behaviour in domestic fires will need to recognise and delve further into the apparent complexities of occupant-fire interactions. Future research should venture beyond simply asking what occupants do when they encounter a fire in the home and look more closely at why they do what they do: how do they perceive the scene they are faced with, and what motivates or is the end-goal of their responses? Furthermore, this research should aim to better link these behaviours to outcomes such as the severity of harm to the property and to the occupants.

The current experiment has been extended to include a larger number of participants in order to allow investigation of more complex relationships between variables. The results from this broader sample will be reported elsewhere in due course. In addition to this strand of the LIFEVID project, a survey of occupants' real-life experiences of domestic fires is being conducted with the help of UK fire and rescue services. The methodology of using picture descriptors to collect reports of fire hazard size has been incorporated into this LIFEVID survey. While the current study looked only at participants' impressions of the flames and smoke upon first encountering them, the survey contains questions that should capture some of the dynamics of a developing domestic fire, e.g. the size of the hazards when first encountered vs. when tackling the fire or when leaving the room of fire origin. There are also questions on occupants' reasons for entering and leaving the room and/or building altogether, which include reference to the effects of fire hazards as well as evacuation and the undertaking of other

activities. It is hoped that this work will help return much-needed attention to a rather neglected area of important research.

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