The Effect of National Culture on Evacuation Response Behaviour: A Cross-Cultural Survey

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Abstract Are there cultural differences and similarities in the way occupants respond to evacuation notifications? Evacuation response behaviour is characterised by the way occupants react to evacuation notifications to validate what is happening around them and prepare for evacuation movement. This study presents a cross-cultural survey based on a case study of a library evacuation to specifically explore how national culture – combined with cues and affiliation – influence evacuation response behaviour. A total of 585 adults from Czech Republic, Poland, Turkey and the United Kingdom participated in the survey. The main results show that for the three scenarios explored (1) UK participants perform significantly fewer response tasks than participants from the other countries, (2) participants from all countries first look around to see what is happening, and seek additional information as one of the first three tasks they perform, (3) Czech, Turkish and UK participants are more likely to wait for a friend/colleague in a scenario without cues than with cues. These results provide insights for safety practitioners and other stakeholders on the importance of cross-cultural research for evacuation behaviour and its inclusion in policy making and emergency preparation.

1. Introduction

The way occupants react to evacuation notifications can have a significant effect on evacuation outcome [1]. Evacuation response behaviour is characterised by the way occupants react to evacuation notifications to validate what is happening around them and prepare for evacuation movement, for example by information seeking or collecting belongings.

Culture, *cues* and *affiliation* [2] have been shown to influence response phase behaviour. *Culture* defined as "the collective programming of the mind distinguishing the members of one group or category of people from others" [3], refers in this study to national cultures, namely the culture of people with the same nationality, living in the same country. National culture can be described by Hofstede's six cultural dimensions: Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long Term Orientation and Indulgence [3]. Moreover, we believe cultures that are focused on safety are those that show concern for the welfare, including subjective well-being and health, of their members [4]. As most evacuation research has been conducted in countries with similar cultural backgrounds: USA, UK, Canada, Australia, New Zealand [5,6] little attention has been paid to cross-cultural differences and similarities. Recent survey based research concerning wildfire scenarios has highlighted that cultural differences influence evacuation behavioural response to wildfire cues, and so it is important not to generalise how populations are likely to behave based on data from a single region [7, 8]. This study has a focus on the influence of national culture on evacuation response behaviour in building fires.

Cues are changes in an environment that indicate that something is not normal, such as sounds of an alarm or glass breaking, signs of smoke or fire [9] or warnings by staff members [1, 10]. Research on *cues* has shown that warnings by staff members can lead to faster response than the sounding of an alarm by itself [1, 10].

Affiliation can be described as the tendency for people to seek the familiar in uncertain situations [11]. This includes searching for relatives and leaving the building via the exit that is most familiar. Research on affiliation has shown that people in groups tend to evacuate more slowly than people alone [1, 2, 11, 12].

This study presents a cross-cultural survey based on a case study of library evacuation with participants from Czech Republic, Poland, Turkey and the United Kingdom to explore the extent to which national culture – combined with cues and affiliation – influences evacuation response behaviour. The specific research question addressed is: "How does national culture – combined with cues and affiliation – influence evacuation response behaviour?".

1.1. Case study: a library evacuation

The choice for a library evacuation as a case study in the four above-named countries was based on the expectation to attract comparable populations with similar demographics and it was inspired by a previous study [13] that examined unannounced university library evacuations in Czech Republic, Poland, Turkey and the UK to explore if there were significant differences between cultures in response to emergency situations. To determine the types of responses that can be distinguished during evacuation a literature search of

scientific studies and incident reports was performed. Starting with ten benchmark articles, three more articles were found through snowballing with new response behaviours, resulting in 13 articles [5, 14–25]. These response behaviours were analysed and linked to nine information tasks (six information seeking and three information sharing tasks), such as 'look around to see what is happening' or 'seek info through a member of staff', and eight action tasks, such as 'collect and put on coat', see Tab. 5 in App. A.2 for all tasks. These tasks were used as options for participants to select from a list in our survey.

2. Methods

A cross-cultural survey was administered in the native language of the participants described below. Ethical approval for this study was granted by the Human Research Ethics Committee (HREC) of Delft University of Technology.

2.1. Participants

Participants were collected by the survey firm Dynata[1] with the following inclusion criteria: age range 18–40 years old, similar residency and nationality, equal distribution of males/females per country (minimum 40%) and participants had to have visited a public library at least once. A total of 750 people participated in the survey, of which 165 did not meet the inclusion criteria or did not finish the survey, leaving 585 participants (296 males, 281 females, 8 with another or unknown gender) for data analysis. The participants were: $n = 115$ from Czech Republic (age: $M = 25.95$, $SD = 4.53$), $n = 123$ from Poland (age: $M = 26.13$, $SD = 4.89$), $n = 118$ from Turkey (age: $M = 27.64$, $SD = 4.76$) and $n = 229$ from the United Kingdom (age: $M = 29.14$, $SD = 5.37$). See Tab. 6 in App. A.3 for more demographic information of the participants. Participants were rewarded with points convertible to rewards, with an estimated value of € 1 per completed survey.

2.2. Survey

After granting informed consent, participants were asked to imagine themselves in a library, as an occupant in one of three different evacuation scenarios (see below). These scenarios were presented in text with a photo of a public library and the sound of a fire alarm including a verbal message (see App. A.1) to evacuate the building. For each scenario, participants were asked to describe their response behaviour by selecting the tasks and task sequences they would perform.

Basic scenario: Participants imagine themselves as building occupants sitting down at a desk in a library, by themselves, while working on a personal computer or reading a book. Building occupants can see some other people working or walking around the library. Then an alarm including the verbal message starts to sound. Building occupants do not have any information on why the alarm went off and other building occupants are

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[1]https://www.dynata.com/

behaving calmly. In this scenario participants were asked which action and/or information tasks they would perform first after hearing the alarm.

Staff member scenario: Same as basic scenario but in addition a staff member informs building occupants to leave the building. In this scenario participants were asked which action and/or information tasks they would do after hearing the alarm *and* being informed by a staff member to leave the building.

Fire and/or smoke scenario: Same as basic scenario but in addition building occupants can now see signs of fire and/or smoke. In this scenario participants were asked which action and/or information tasks they would perform after hearing the alarm *and* seeing signs of fire and/or smoke.

Extended version of the basic and fire and/or smoke scenario: Same as above but in addition a friend/colleague is assumed to be in close vicinity in the library. In the extended scenario participants were asked whether they would wait for their friend/colleague to leave the building together.

3. Results

The first main finding is that UK participants perform significantly less response tasks than participants from the other countries. For the basic scenario, one-way independent ANOVAs revealed significant effects of country at the $p < .001$ level on the number of selected action tasks, $F(3, 581) = 14.18$, partial $\eta^2 = 0.07$, a medium effect, and also on the number of selected information tasks, $F(3, 581) = 8.02$, partial $\eta^2 = 0.04$, a small to medium effect (see Fig. 1 in which also significant post hoc analyses are reported). For the staff member and fire and/or smoke scenarios similar results were found. Presented in Tab. 1, Tab. 2 and Tab. 3 are the results for respectively the basic, staff member and fire and/or smoke scenarios showing (a) the three most frequently selected tasks per country, (b) the results of the Pearson Chi-square tests and (c) the countries for which the results differ significantly. All pairwise comparisons were made with a Bonferroni correction.
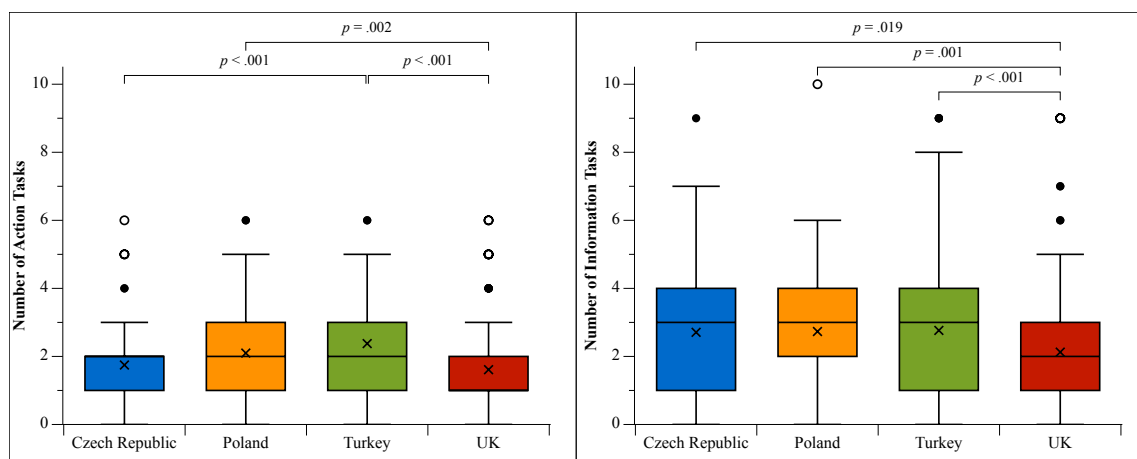

Figure 1 Results of the ANOVAs and Games-Howell post hoc analyses of differences in selected action and/or information tasks in the basic scenario.

3.1. Basic scenario

In the basic scenario participants were asked which action and/or information tasks they would perform first after hearing the alarm, with the results shown in Tab. 1. Participants from Czech Republic, Poland and Turkey most frequently selected the same three tasks although the order slightly differs. Czech and Polish participants selected 'Look around to see what is happening' significantly more than UK participants. Czech, Polish and Turkish participants selected 'Seek info through a member of staff' and 'Pack personal and work items in close vicinity' significantly more than UK participants. Polish and Turkish participants selected 'Physically assist others' significantly more than UK participants.

Top 3	Action (a) and/or information (i) tasks	Percentage	$\chi^2(3)$	Significantly differed with
	Czech Republic ($n = 115$)			
1	Look around to see what is happening (i)	63.5%	20.65***	UK*
2	Pack personal and work items in close vicinity (a)	13.0%	32.67***	UK***
3	Seek info through a member of staff (i)	4.3%	31.35***	UK*
	Actively provide info/instr. to others nearby (i)	4.3%	9.48*^{a}	
	Poland ($n = 123$)			
1	Look around to see what is happening (i)	60.2%	20.65***	UK***
2	Seek info through a member of staff (i)	8.9%	31.35***	UK**
3	Pack personal and work items in close vicinity (a)	8.1%	32.67***	UK***
	Turkey ($n = 118$)			
1	Look around to see what is happening (i)	46.6%	20.65***	
2	Seek info through a member of staff (i)	13.6%	31.35***	UK***
3	Pack personal and work items in close vicinity (a)	6.8%	32.67***	UK***
	United Kingdom ($n = 229$)			
1	Look around to see what is happening (i)	37.6%	20.65***	CR*/PL***
2	Pack personal and work items in close vicinity (a)	9.6%	32.67***	CR/PL/TR***
3	Collect and put on coat (a)	7.4%	8.20*^{b}	
	Physically assist others (a)	7.4%	24.47***	PL/TR***
	Move to another location to seek info (i)	7.4%	11.99**^{c}	

Table 1   Selected action and/or information tasks per country in basic scenario.
CR = Czech Republic. PL = Poland. TR = Turkey. UK = United Kingdom.
^{a} Only a significant difference at the $p < .05$ level is found between Poland and the UK.
^{b} Pearson Chi-square test is significant, but no significant differences between countries are found.
^{c} Only a significant difference at the $p < .05$ level is found between Czech Republic and Poland.
*$p < .05$. **$p < .01$. ***$p < .001$.

3.2. Staff member scenario

In the staff member scenario participants were asked which action and/or information tasks they would do after hearing the alarm *and* being informed by a staff member to leave the building, with the results shown in Tab. 2.

Top 3	Action (a) and/or information (i) tasks	Percentage	$\chi^2(3)$	Significantly differed with
	Czech Republic (n = 115)			
1	Look around to see what is happening (i)	38.3%	19.53***	
2	Pack personal and work items in close vicinity (a)	16.5%	26.37***	UK**
3	Seek info through a member of staff (i)	10.4%	13.22**	TR**
	Poland (n = 123)			
1	Look around to see what is happening (i)	48.0%	19.53***	UK***
2	Pack personal and work items in close vicinity (a)	17.9%	26.37***	UK***
3	Work-related duties (a)	5.7%	36.99***^{a}	
	Turkey (n = 118)			
1	Look around to see what is happening (i)	29.7%	19.53***	
2	Seek info through a member of staff (i)	14.4%	13.22**	CR**/UK*
3	Pack personal and work items in close vicinity (a)	11.9%	26.37***	UK**
	United Kingdom (n = 229)			
1	Look around to see what is happening (i)	22.3%	19.53***	PL***
2	Pack personal and work items in close vicinity (a)	13.5%	26.37***	CR/TR**/PL***
3	Seek info through a member of staff (i)	11.4%	13.22**	TR*

Table 2   Selected action and/or information tasks per country in staff member scenario.
CR = Czech Republic. PL = Poland. TR = Turkey. UK = United Kingdom.
^{a} Only two significant differences at the $p < .001$ level are found between Czech Republic and Turkey and between Turkey and the UK.
*$p < .05$. **$p < .01$. ***$p < .001$.

Compared to the basic scenario, participants in Czech Republic and Turkey were consistent in their selection of two of the three most frequently named tasks ('Look around to see what is happening' and 'Pack personal and work items in close vicinity'). Participants in the UK now chose the same two tasks in addition to 'Seek info through a member of staff' also selected by Czech and Turkish participants. Polish participants selected 'Look around to see what is happening' significantly more than UK participants. Czech, Polish and Turkish participants selected 'Pack personal and work items in close vicinity' significantly more than UK participants. Turkish participants selected 'Seek info through a member of staff' significantly more than Czech and UK participants.

3.3. Fire and/or smoke scenario

In the fire and/or smoke scenario participants were asked which action and/or information tasks they would perform after hearing the alarm *and* seeing signs of fire and/or smoke, with the results shown in Tab. 3. Two new action tasks were added: 'Call alarm number' and 'Fight the fire'.

Top 3	Action (a) and/or information (i) tasks	Percentage	$\chi^2(3)$	Significantly differed with
	Czech Republic (n = 115)			
1	Look around to see what is happening (i)	35.5%	13.01**	
2	Call alarm number (a)	19.7%	27.27***	UK**
3	Pack personal and work items in close vicinity (a)	9.2%	21.74***^{a}	UK**
	Poland (n = 123)			
1	Look around to see what is happening (i)	42.2%	13.01**	UK**
2	Call alarm number (a)	18.9%	27.27***	UK***
3	Pack personal and work items in close vicinity (a)	5.6%	21.74***^{a}	UK*
	Move to another location to seek info (i)	5.6%	3.34	
	Turkey (n = 118)			
1	Look around to see what is happening (i)	18.5%	13.01**	
	Call alarm number (a)	18.5%	27.27***	
2	Seek info through conv. with people nearby (i)	9.9%	11.16*	UK**
3	Seek info through a member of staff (i)	8.6%	17.18***	UK***
	United Kingdom (n = 229)			
1	Look around to see what is happening (i)	21.3%	13.01**	PL**
2	Call alarm number (a)	13.5%	27.27***	CR**/PL***
3	Seek info through conv. with people nearby (i)	7.8%	11.16*	TR**

Table 3 Selected action and/or information tasks per country in fire and/or smoke scenario.
CR = Czech Republic. PL = Poland. TR = Turkey. UK = United Kingdom.
^{a} Also a significant difference at the $p < .01$ level is found between Turkey and the UK.
*$p < .05$. **$p < .01$. ***$p < .001$.

Compared to the basic and staff member scenario, the most frequently selected option in the fire and/or smoke scenario for participants in all countries is still 'Look around to see what is happening'. Also, 'Call alarm number' has entered the top three as number two in all countries, except in Turkey where it was the most frequently selected task together with 'Look around to see what is happening'. Polish participants selected 'Look around to see what is happening' significantly more than UK participants. Czech and Polish participants selected 'Call alarm number' significantly more than UK participants. Czech, Polish and Turkish participants selected 'Pack personal and work items in close vicinity' significantly more than UK participants. Turkish participants selected 'Seek info through conversations with other people nearby' and 'Seek info through a member of staff' significantly more than UK participants.

See Fig. 2 in App. A.4 for differences in the selected action and information tasks between the basic, staff member and fire and/or smoke scenarios.

3.4. Basic scenario versus fire and/or smoke scenario: wait for friend/colleague

In the extended scenario participants were asked whether they would wait for their friend/ colleague so as to leave the building together (see Tab. 4). In the basic scenario most

participants, on average 81.4%, indicated that they would wait for their friend/colleague and leave the building together. Significantly more Czech participants would wait for their friend/colleague than UK participants: 90.4% versus 74.7%.

In the fire and/or smoke scenario also most participants, on average 71.1%, would wait for their friend/colleague and leave the building together. Significantly more Czech and Polish participants would wait for their friend/colleague than UK participants: 81.7%/77.2% versus 61.1%.

McNemar's Chi-square tests revealed significant differences between the basic scenario and the fire and/or smoke scenario in Czech Republic ($p = .031$), Turkey ($p = .004$) and the UK ($p < .001$). For Poland the result was not significant, $p = .281$. In all cases, however, in the fire and/or smoke scenario fewer participants would wait for their friend/colleague than in the basic scenario.

Would you wait for your friend/colleague so that you can leave the building together?	Percentage	$\chi^2(3)$	Significantly differed with
Czech Republic (n = 115)			
Basic scenario	90.4%	13.70**	UK**
Fire and/or smoke scenario	81.7%	20.06***	UK**
Poland (n = 123)			
Basic scenario	82.9%	13.70**	
Fire and/or smoke scenario	77.2%	20.06***	UK*
Turkey (n = 118)			
Basic scenario	83.9%	13.70**	
Fire and/or smoke scenario	73.7%	20.06***	
United Kingdom (n = 229)			
Basic scenario	74.7%	13.70**	CR**
Fire and/or smoke scenario	61.1%	20.06***	CR**/PL*

Table 4 Waiting for friend/colleague to leave building together per country in basic and fire and/or smoke scenario.
CR = Czech Republic. PL = Poland. TR = Turkey. UK = United Kingdom.
$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

4. Discussion

This study's research question was: "How does national culture – combined with cues and affiliation – influence evacuation response behaviour?". The first main finding is that participants from the UK selected significantly fewer tasks than those from Czech Republic, Poland and Turkey. The three most frequently selected tasks were in most scenarios similar for participants from all four countries although the order sometimes differed. In [26] it was analysed how these differences would translate to response phase duration and evacuation times with computer modelling and simulation. It was found that an increased number of response tasks led to higher response times and total evacuation time, as in

accordance with [17]. The second main finding is that in all scenarios participants prefer to seek information first by looking around to see what is happening. This is consistent with findings from evacuations and drills [13, 27]. The third main finding is that Czech, Turkish and UK participants were more likely to wait for a friend/colleague in a scenario without cues than in a scenario with cues. It seems when the perceived personal risk increases, participants are less likely to wait for a friend/colleague.

These findings may be linked to Hofstede's cultural dimension scores, yet they remain speculative, awaiting empirical validation. One hypothesis is that UK's lower number of response tasks could be associated with its lower uncertainty avoidance and higher individualism scores compared to the other three countries. According to [3], high uncertainty avoidance cultures tend to experience greater anxiety in ambiguous situations. We interpret this as that a weak uncertainty avoidance leads to performing less response tasks. In individualist societies, prioritizing self-reliance over collective well-being is common [3]. Hence, we speculate that such cultures might be less inclined to use communication or information gains during an evacuation, leading to less response tasks for the UK, versus the other countries. In essence, Brits may be more inclined to take decisive action without extensive consultation. Additionally, we speculate that collectivist cultures, exemplified by Turkey in our study, may exhibit more affiliative behaviours.

The strengths of this study are: the focus on cultural behaviour during evacuation, the number of people who were reached online and the ability to ask participants detailed questions on their behaviour. The limitations of this study are those of the chosen method: self-reported behaviour may not fully reflect actual behaviour during an emergency evacuation [8, 28, 29] and participants might answer questions in a socially desirable way [30, 31]. To our best ability, both limitations have been minimised, by actively avoiding steering questions and by accurately describing each of the possible behaviours. While developing the survey, method, item and construct biases [32] have been avoided. Future research can address these limitations by extending this research with other factors that influence behaviour, using answer scales allowing for factor analysis and multivariate statistics, conducting empirical evacuation experiments, and studying participants' behaviour in real life.

This research supports the growing view that social culture exerts an influence on how people respond to fires. Acknowledging the potential importance of culture on how populations may respond to emergency situations is important for policy makers and planners as it highlights the need for cross-cultural research.

Ethics Statement Ethical approval for this study was granted by the Human Research Ethics Committee (HREC) of Delft University of Technology.

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A. Appendix

A.1. Verbal message in sound clip

"Attention. Attention. An emergency has been reported in this building. Please cease operations and leave the building utilizing the nearest exit or fire exit stairway. Do not use elevators. Repeat: Do not use elevators. [sound of slow whoop] Attention. Attention."

A.2. Response behaviour tasks

No.	Task description	References
	Action tasks	
1	Change footwear/glasses/clothing	[15, 17, 22, 24]
2	Collect and put on coat	[5, 15, 18–21]
3	Collect emergency equipment (flash lights, water, etc.)	[21, 23, 24]
4	Pack personal and work items in close vicinity, such as laptop, documents, phone, keys, etc.	[5, 15, 17–25]
5	Physically assist others (help others put on coat or collect items)	[5, 14, 17–20]
6	Work-related duties, such as shutting down work station, locking files, tidying desk, etc.	[5, 17–21, 24]
7	Fight the fire	[5, 16, 18–20, 22, 25]
8	Call alarm number	[16, 22, 25]
	Information seeking tasks	
9	Look around to see what is happening	[5, 15, 17–22, 25]
10	Move to another location to seek information	[5, 18–20, 22]
11	Phone someone to seek information	[5, 15, 17–20, 22–24]
12	Seek information through a member of staff (building security/reception)	[17, 23, 24]
13	Seek information through conversations with other people nearby	[5, 17–21, 23–25]
14	Seek information through electronic media	[5, 17–20, 24]
	Information sharing tasks	
15	Actively provide information and/or instructions to others nearby	[5, 14–23, 25]
16	Actively search for others in the building, to provide information and/or instructions	[15, 21–24]
17	Phone someone to provide information	[5, 15, 18–20, 22, 23]

Table 5   Response behaviour tasks identified from literature.

A.3. Personal and demographic information of the survey participants

	Czech Rep. (n = 115)	Poland (n = 123)	Turkey (n = 118)	UK (n = 229)	Totals (n = 585)
Gender					
Male	47.8%	50.4%	52.5%	51.1%	50.6%
Female	49.6%	48.8%	46.6%	47.6%	48.0%
Non-binary/third gender	0.9%	0.8%	0.8%	0.0%	0.9%
Prefer not to say	1.7%	0.0%	0.0%	1.3%	0.9%
Education level					
Up to high school	80.0%	51.2%	22.9%	18.3%	38.3%
College	13.9%	22.0%	66.1%	46.7%	39.0%
Master's degree	6.1%	26.0%	6.8%	26.6%	18.5%
Doctorate/Professional degree	0.0%	0.8%	4.2%	8.3%	4.3%
Formal fire training					
No	26.1%	36.6%	37.3%	56.8%	42.6%
Yes	73.9%	63.4%	62.7%	43.2%	57.4%

Table 6   Personal and demographic information of the survey participants per country.

For gender, the Pearson Chi-square test is not significant, $\chi^2(9) = 6.01$, $p = .739$, meaning that the ratio of the distribution of the participants based on gender over the four countries did not differ significantly. For education level, the Pearson Chi-square test is significant, $\chi^2(9) = 189.62$, $p < .001$, meaning that the ratio of the distribution of the participants based on education level over the four countries differed significantly. For receiving any formal fire emergency training before, the Pearson Chi-square test is also significant, $\chi^2(3) = 34.81$, $p < .001$, meaning that the ratio of the distribution of the participants based on receiving any formal fire emergency training over the four countries differed significantly. Czech, Polish and Turkish participants received a formal fire emergency training before significantly more than UK participants, $p < .001$, $p = .002$ and $p = .004$.

A.4. Differences between the basic, staff member and fire and/or smoke scenarios

As mentioned in Sec. 3.3 McNemar's Chi-square tests are performed to investigate differences in the selected action and information tasks between the basic, staff member and fire and/or smoke scenarios. The results of the most selected four tasks are reported in Fig. 2.
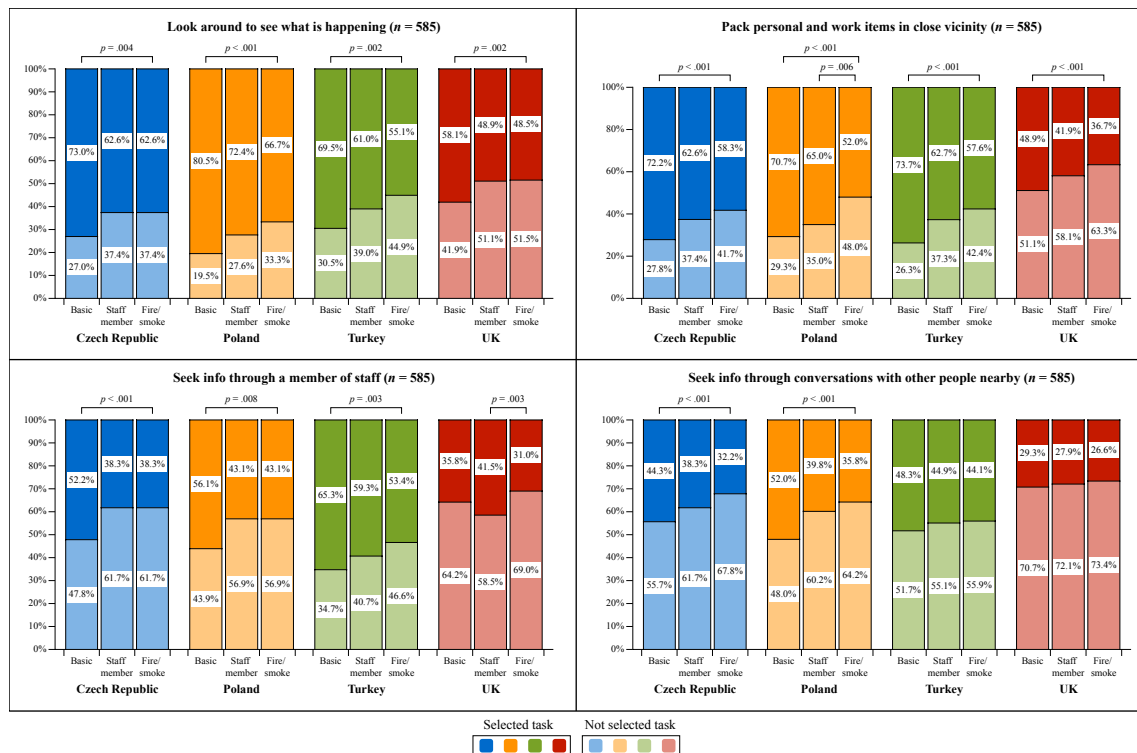
Figure 2 Results of the McNemar's Chi-square tests of differences in selected action and/or information tasks in the basic, staff member and fire and/or smoke scenarios.

A.5. Sample size analysis

The group of UK participants was relatively larger than the other groups (see Tab. 6). Therefore, we randomly selected 150 participants from the UK group (total group is now $n = 506$) to make it similar in size to the other groups and conducted all analyses again with these four sample sizes. The results were comparable. Any differences are mentioned below.

Differences in Tab. 1 Basic scenario: $n = 585$ versus $n = 506$
'Look around to see what is happening': Czech Republic versus the UK is not significant.
'Seek info through a member of staff': Czech Republic versus the UK is not significant.
'Collect and put on coat': Poland versus the UK is significant, $p = .022$.

Differences in Tab. 2 Staff member scenario: $n = 585$ versus $n = 506$
'Seek info through a member of staff': Turkey versus the UK is not significant.

Differences in Tab. 3 Fire and/or smoke scenario: $n = 585$ versus $n = 506$
'Look around to see what is happening': The Pearson Chi-square test is not significant and therefore Poland versus the UK is not significant either.
'Pack personal and work items in close vicinity': Poland versus the UK is not significant.
'Seek info through conversations with other people nearby': The Pearson Chi-square test

is not significant and therefore Turkey versus the UK is not significant either.

Differences in Fig. 2: *n* = 585 versus *n* = 506
'Seek info through a member of staff': Basic scenario versus fire and/or smoke scenario is significant, $p = .014$.