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Taking a leap of faith: insights from UK first responders on instantaneous trust

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Autonomous systems' potential to instruct the public during real-life emergencies to foster instantaneous trust and compliance and their impact on rescue operations remain largely unexplored. To determine the requirements for designing technologies capable of delivering instructions in high-risk situations, we needed to understand the key communication elements for establishing immediate trust dynamics, ultimately fostering compliance and contributing to effective life-saving efforts. This paper adopts a participatory approach to curate perspectives from emergency rescue professionals in the UK, gathered through a survey, whose responses were analysed to identify the themes in the dataset and ultimately to elicit verbal and nonverbal elements and message delivery techniques to address the challenges to compliance in interpersonal communication during emergencies. Participants indicated that the adoption of autonomous systems for communication could positively impact rescue operations. They highlighted that verbal communications need to be concise and informative, while nonverbal cues must effectively reinforce verbal messages under distressful conditions. However, challenges such as accountability, adaptability, reliability, and affordability are still prevalent. We formalise a novel communication model designed to engender instantaneous trust between the rescuer and the rescued. We find that verbal elements in the model must increase the situational awareness of the rescued and sufficiently inform them of the context. In contrast, the nonverbal elements should foster credibility, consistency, reliability and positivity between the communicating parties. Based on the professionals' responses, we further advance recommendations for the use of autonomous systems in emergency rescue scenarios in terms of increasing accountability and accessibility.

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Introduction

Imagine yourself injured and stuck in a cave while hiking in the highlands. You call for emergency services, and after a while, a rescue drone appears and gives you instructions on how to stay warm. Would you trust the drone enough to comply with the instructions? How would you like this message to be delivered? We argue that the communication capability of the autonomous systems (AS) is critical to ensure the safety and well-being of the rescued in such situations. This paper proposes a communication model inspired by emergency rescue professionals as a preliminary step in addressing the problem of human–AS communication in high-risk situations.

Instantaneous trust is commonly known as "swift trust" in organisational behaviour (Kroeger et al. 2021) military research (Capiola et al. 2020), and disaster recovery management (McLaren and Loosemore, 2019). However, in this study, we adopt the definition of *instantaneous trust* advanced in Weerawardhana et al. (2024), as trust that develops quickly without its traditional sources, such as time and experience (Caterinicchio, 1979; de Visser et al. 2020; Glikson and Woolley, 2020). In these situations, individuals involved are often forced to make snap decisions—taking a leap of faith—to exhibit trusting behaviours, such as compliance (Braithwaite and Makkai, 1994; McClaughlin et al. 2023; Natarajan and Gombolay, 2020; Robinette et al. 2016; Wray et al. 2006). Our contribution adds to the present body of work on instantaneous trust by exploring how it can be engendered through the communications between the first responders and the rescued in various emergency response scenarios. To foster the ongoing debate around trust and emergency services (Brooks et al. 2022; Collin-Jacques and Smith, 2005; Fotaki and Hyde, 2015; McMurray, 2011), and understand the key messaging elements for establishing instantaneous trust dynamics in the field, we curate perspectives from emergency rescue professionals and present a novel communication model for emergencies, focusing on verbal and nonverbal elements. Ultimately, we aim to surface communication requirements and message delivery techniques to address the challenges to compliance arising in interpersonal communication during emergencies. We believe that our findings will lay the foundation for understanding the technical and human factor requirements for messaging in emergencies and contribute to the development of autonomous systems (AS, hereafter), such as robots for emergency response capable of delivering ethically grounded instructions in high-risk situations (Battistuzzi et al. 2021), such as those that emergency services typically face.

The emergency response domain has seen a significant push toward adopting AS for rescue efforts (Comes, 2024; Scanlan et al. 2017). In addition, AS-assisted emergency rescue scenarios have been simulated under experimental conditions to investigate overtrust (Robinette et al. 2016) and to understand informational characteristics to enhance compliance (Weerawardhana et al. 2024). In both cases, autonomous robots provide instructions and lead to safety during fire evacuation. Despite these recent advances, AS's capability for messaging during real-life emergencies, as well as its impact on rescue operations and the rescue, remain underexplored.

Therefore, we focus on the following research questions:

- **[RQ1]** What are the key characteristics of a message delivered by emergency professionals to engender trust and compliance with instructions during emergencies?
- **[RQ2]** What verbal elements (i.e., information) should be communicated to foster trust between the rescuer and the rescued?
- **[RQ3]** What nonverbal elements are essential to enhance the compliance of the rescued with their instructions?

To address these questions, we first review the literature on engendering trust (and compliance) through communication focusing on messaging elements. Next, we clarify and detail the method we adopted for analysing the survey data we collected. Then, we focus on specific themes emerging from our data, including establishing immediate public trust and compliance, the elements in messages that can engender those, and broader challenges that can compromise compliance in emergencies. We further explore the current use of AS in the emergency response landscape and the challenges to its adoption. We consider the broader implications of engendering immediate trust (Cuthbert and Scott, 1980) between humans and also with AS, as suggested, for example, in Haas et al. (2015) and in Lalot et al. (2022), that may likely impact the frontline. Finally, we outline the key characteristics we recommend emergency messages to have, as well as the strategies that may help trust relations to be quickly built, enhancing compliance in stressful and dangerous conditions. With this case study, we show an example of how rescuers' experiences can inform emergency message design and tailoring to support emergency services in saving lives.

Literature review

The communication model we advance through this study comprises of verbal and nonverbal elements. Therefore, in this literature review, we first discuss domain- and emergency scenario-specific informational elements, specifying what should be communicated, that have been shown to foster trust and compliance and are impactful in effective emergency response and preparedness. Next, we focus on the non-informational elements, such as nonverbal cues, that specify how a message should be communicated. Finally, we briefly review the present work related to the use of AS in emergency response, in the lab, and in the wild to scope the range of tasks that are being supported by AS in emergency scenarios.

Messaging for trust and compliance in emergencies. The trust placed in and from the rescuers is essential for faster and smoother emergency operations. McLaren and Loosemore (2019), in an exploratory study, investigate how swift trust manifests within a multinational disaster project management team formed in response to a cyclone disaster. They show that reputation, role and interdependence of team members are important in building swift trust. Similarly, interpersonal elements such as acting with respect, openness, humility and respect for local cultural traditions are also highlighted. The communication model we present in this paper encapsulates these concepts into a system-agnostic communication message to foster trust and compliance from the rescued during emergency scenarios. Long et al. (2015), studying the Grenfell Tower fire emergency response, identified trust as a critical factor influencing individual decision-making concerning protective actions. In a similar study regarding residents affected by a flood, Yeo et al. (2018) discovered that the public's threat assessment was modulated by the degree of trust they had in emergency services. Likewise, Min (2020) and Seale et al. (2022) discovered that in countries with high levels of social trust, cooperation and compliance with social norms were higher, contrasting the spread of COVID-19 more efficiently. In a case study of emergency preparedness for tornadoes, Choi and Wehde (2020) show that the public's perceived trust in local governments and FEMA (i.e., the communicator) significantly affects public preparedness for natural disasters. Turcanu et al. (2021) provide further evidence to highlight the criticality of the trustworthiness of the

communicator from a study of nuclear emergency preparedness. They also discuss messaging requirements specific to the domain (i.e., nuclear), such as communicating risks and uncertainties in the preparedness and protective actions for radiological accidents that influence the effectiveness of the emergency response.

Trust is key in the medical domain, too, as supported, for example, in the work by Lateef (2011), who found that the relationship between physicians and patients is grounded on trust. Deterioration or lack of trust may have serious consequences for patients' treatment, including missing follow-up appointments or disregarding instructions, regardless of complaints. In this sense, communication was vital to ensure patients' care, satisfaction and service quality are based on a trustworthy relationship between the doctor and the patient. Achieving this would allow healthcare staff to better inform patients, manage their pain and protect them from negative repercussions, whenever possible, individually targeting their expectations and needs. In addition to the healthcare professionals themselves, the hospital or the medical institution facilitating treatment also determines a trusted interaction between the patient and the physician. Similarly, Macrae (2020) illustrates how key communication can be in preventing the further spread of diseases and the medical emergencies deriving from those. From this perspective, our study addresses the communication priority, which establishes much-needed trust in the public that will foster compliance with the instructions given by the trained professionals.

These studies show that the trust between the communicator and the message recipient fostered through various informational elements engenders compliance in emergencies. Building on this, our work aims to formalise the verbal and nonverbal components contributing to communication effectiveness in emergency response scenarios.

Addressing communication challenges in emergencies. In stressful and risky situations, such as emergencies, compliance affects safety and is time-critical. In this context, communication is key in establishing and fostering immediate trust, persuading individuals to quickly follow instructions and comply with directions, as suggested by Brooks et al. (2022). Granatt (2004) argued that efficiency and authority are essential to providing effective public information and warnings. The authors posited the importance of establishing partnerships with media organisations as a means for far-reaching, swift communication networks during emergencies. Mizrahi et al. (2023) show similar evidence for providing information about an authority (e.g., the government) and the authority's competency to manage emergency response tasks to support compliance with emergency communication.

Research on public compliance focused both on key elements for fostering and preventing it (Fotaki and Hyde, 2015). Among the former Kim and Oh (2015), presented a nationwide analysis looking into factors affecting public compliance in emergencies in the US and found that public confidence in federal authorities significantly increased compliant behaviours. With such confidence in the authorities, individual awareness about local response plans positively correlated with evacuation compliance, such as during Hurricane Katrina (Kim and Oh, 2015). Centred on inhibitors of compliance, Schenhals et al. (2019) conducted semi-structured interviews with patients, who had just been discharged from the emergency department in the US. This study revealed that participants failed to follow instructions they were given because they did not understand the instructions or the process, struggled to book follow-up appointments or did not believe instructions were worth following. The study highlights the importance of the clarity of communication to reduce uncertainty and ensure compliance. Communication may also be challenged by misinformation or misunderstandings (Chowdhury et al. 2023; Macrae, 2020). In their systematic review of abrupt large-scale infectious disease outbreaks since 2000, they concluded that widespread misinformation impacted prevention, treatment, and vaccines. Further, instructions must be informative to avoid unintended behaviours due to unawareness of the most suitable procedure to follow in that situation. At the same time, justice will be ensured if emergency services are not to comply with the standards, as suggested also in Cheung et al. (2016) and in Korte (1971), respectively.

Oxman et al. (2022) concluded that both providing trustworthy information and transparently persuading the public to follow instructions based on them were equally as important during public health emergencies. Nonetheless, informativeness and persuasion could contrast when the reliability of the known information about the situation was uncertain. To overcome this possible conflict, the authors presented nine guiding principles for health authorities in deciding the appropriate strategy to communicate health-related information to the public. Instances where conflicts between communicating health information to persuade or inform the public were discussed from the communication strategies (e.g., use of spin) and an ethics perspective (Tomkins and Bristow, 2023). The study found that for persuasion to be effective, the decision to adopt persuasion should be transparent, and the evidence should not be distorted. Hence, a much-needed balance in terms of information quantity emerges from the literature. Similar observations were discussed in Cheung et al. (2016), Heersmink et al. (2024), Danaher and Saetra (2022), and Cai et al. (2022).

These works highlight the authority construct and assurances on the authority's competency as essential informational elements in emergency communication. We provide empirical evidence to further support this in the context of an AS-assisted emergency rescue scenario in the section "Leap of faith". This paper expands on these findings by encapsulating additional verbal (i.e., informational) and nonverbal elements into a more holistic formal communication model, which we present in the following sections.

Use of autonomous systems in emergency response. Presently, AS is mostly used for surveillance and monitoring tasks in emergencies, such as patient monitoring (Areia et al. 2021; Kelly et al. 2021; Posthuma et al. 2020; Sampson et al. 2019; Tóth et al. 2020) drones deployed by the London Fire Brigade (https://www.london-fire.gov.uk/about-us/services-and-facilities/vehicles-and-equipment/drones/) or telecommunication devices used to provide medical assistance remotely (van den Broek, 2017; Collin-Jacques and Smith, 2005; Nicolini, 2007; Smith et al. 2008). López et al. (2017) propose a proof-of-concept for a drone system capable of capturing live imagery of the location of an emergency alert and transmitting the images to first responders. Elayan et al. (2021) present a cooperative health emergency response system for autonomous vehicles, which allows a person inside the autonomous vehicle to find the nearest emergency treatment provider. Although these case studies exemplify the potential of AS to be used to protect lives during dangerous operations, concerns about the reliability of AS remain, posing even greater risks for humans on the scene when a fault occurs or recovery is needed (Hägele and Söffker, 2017, 2020; Macrae, 2022; Polat, 2023; Shneiderman, 2020).

As Templeton et al. (2023) argued, all computational models that are currently used to forecast the most likely outcome of emergencies include awareness time, compliance time and

behaviour exhibited. Nevertheless, we noted that trust was missing, and its absence impacted the compliance rate, possibly causing threats to the public involved in an emergency. Furthermore, the current research landscape on AS in emergency response has paid little attention to enabling AS to communicate life-saving instructions to humans during emergencies to engender trust and compliance. This requires an understanding of not only what to communicate but also how to communicate it. To address this gap, we studied how professionals communicate during emergencies and defined a system-agnostic messaging model whose elements may be explored further in implementing AS, such as robots and drones deployed in emergency scenarios.

Leap of faith. The work presented in this paper stems from research investigating the relationship between compliance and instantaneous trust in human–robot interactions in emergency rescue scenarios (Weerawardhana et al. 2024). The authors argue that when humans have little to no experience with a robot, as during an emergency, manipulating the robot's physical and informational characteristics can nudge them to *take a leap of faith* and comply with an instruction it delivers.

They consider three robot design characteristics known to impact trust in non-instantaneous settings—(1) Relatability, (2) Guarantee and (3) Guarantor—and examine how the different instantiations of Relatability, Guarantee and Guarantor influence when a human must make a snap decision to comply with an instruction a robot delivers. *Relatability* refers to the physical characteristics of the robot, specifically the gestures, manner of speaking expressed as tone of voice, and embodiment. The Guarantee and the Guarantor are informational characteristics. *Guarantor* is defined as the human responsible for the robot, and *Guarantee* is the assurance supplied to confirm that what the human is being asked to do is indeed correct. Through participatory methods, they find that in emergency scenarios, although most participants comply with a robot's instructions, compliance can be attributed to specific instantiations of Relatability, Guarantee, and Guarantor. Communicating the domain relevance and reputation of the guarantor was the most impactful in persuading them to comply. Surprisingly, participants did not require a guarantee (i.e., an assurance) to comply with the robot's instruction during emergency scenarios. Their study discovered the *information elements* that need to be communicated to engender compliance. Our study expands on these findings and formalises a more holistic construct of an emergency communication message, encapsulating verbal and nonverbal elements by marshalling perspectives from emergency rescue professionals.

Methods

We used the Jisc Online Surveys platform to conduct our study, which was approved by [hidden for double-blind review] Ethics Review Board. Our survey included eight questions. The first two focused on individual professional profiles and collected information about their roles within the emergency/rescue services, and the scenarios they typically faced in the line of duty. Another three focused specifically on how they usually established trust with the members of the public to get them to ultimately follow instructions in an emergency. By doing so, we aimed to gather the emergency rescue professionals' perspectives on the essential communication elements to achieve trust and the key challenges that might hinder achieving compliance grounded on trust. We further asked about the current adoption of AS (e.g., drones, robots, other software systems) in the frontline services, their perceptions (positive and negative) on the feasibility of using AS to issue instructions during emergencies, and support emergency operations in general, and risks they could foresee if AS were to be adopted in emergencies.

The survey was distributed through the platform from 27 February 2023 to 31 August 2023 to several organisations, government- and privately owned, involved in emergency response in the UK. Twenty-six completed surveys were returned. The respondents included 17 from fire and rescue services, four medical professionals, three emergency managers and researchers, one cave rescuer and one underwater systems operator. Every participant was recruited using a convenience sampling technique (Glikson and Woolley, 2020), spreading adverts through professional groups, networks on social media, and the project's industry partners.

To analyse the linguistic data captured in this survey, we adapted the process defined by Braun and Clarke (2012) for performing the thematic analysis. We worked simultaneously so that we could resolve any disagreements and uncertainties arising during the coding, hence ensuring intercoder reliability. For each question, corresponding responses were collaboratively marked to extract keywords and phrases. After listing them all in a spreadsheet to easily review, we summed up the repeated concepts and grouped the interrelated ones, labelling ideas to summarise them. Next, we took the code frequency counts of each category that emerged through the analysis and applied the categorisation process described above multiple times until both coders could effectively make sense of and summarise the insights emerging from the data. Finally, we included categories that only appeared once in the data set in larger groups to provide a more condensed overview of the data.

Results and analysis

The thematic analysis of the responses revealed two channels of communication occurring in an emergency: (1) between the rescuer and the rescued and (2) between the rescuers themselves. Messages exchanged between these two channels differed in terms of content and delivery expectations. In Channel 1, preserving the privacy of the rescued and the confidentiality of the sensitive data whilst giving the right amount of information is an ongoing struggle. In Channel 2, the goal is instead to battle the negative attitude the public has toward other professionals, such as the police, whilst collaborating with them during an emergency. According to these challenges, Channel 1 messages must properly inform the rescued and create trust. Meanwhile, Channel 2 messages must inform the rescuers and increase situational awareness so that they can trust themselves on the job.

Getting immediate public trust and compliance through communication. Our analysis of channel 1 found that immediate trust in the general public during an emergency could persuade them to comply via (1) verbal communication and (2) nonverbal communication, including performance as a first responder and following the description by Hall et al. (2019). In our analysis, we used verbal and nonverbal to refer to message contents that are expressed through words or other elements (e.g., tone of voice, pace, facial expressions), respectively. Meanwhile, we intended performative characteristics as behaviours that contribute to the communication but are not part of the actual message, such as professional conduct and gestures.

According to our coding, survey participants pointed out verbal instructions can help achieve trust and foster compliance. In particular, 16 referred to the importance of message clarity and simplicity, as well as delivered with authority, calmness (2 mentions), and at an adequate pace. Two participants gave

practical recommendations: 'This needs to be clear, conscience, well paced and calm but stated with authority. It is important not to use complex language or acronyms', 'provide evidence of authority ... via identification badge or uniform'. In other words, as a participant explained: 'A message should not cause panic, or worry it should help keep the public calm and safe and worry-free.'

To build trust quickly, disseminating facts about the situation on the ground was also cited as important in four responses, 'Some people will be calm but worried, and others will be loud and scared. Assessing the people in the vicinity and area allows the situation to be dealt with in a few different manners'. To reassure the public, oftentimes first responders need to claim their authority (three mentions), hence credibility confirming their reliability (four mentions) by giving information about their name, role, experience, and years in service, for instance (one mention). One firefighter claimed, 'The Fire and Rescue Service is lucky that they are held in high esteem by the public and that trust already exists, all members of the public know we are there to ensure their safety and wellbeing'. Overall, verbal communication is meant to be supported by other communication elements, such as nonverbal and performative, to foster credibility in the hope of quickly establishing trustworthy relationships.

According to our analysis, the information about the situation, its context (one mention), and the expected outcome of the rescue (four mentions), including justifications that explain why (five mentions) the public has been asked to behave in a certain way by emergency services, the urgency or timing of such requests (four mentions) and the consequences of non-compliance could have (one mention) should inform but not scare or stress out the public. Additionally, messages should be consistent (one mention) and repeated as many times as needed to be clear to the listeners (one mention). If the circumstances prevent the messages from being clearly understood (e.g., delivering instructions over the phone), supporting audio/visual techniques (e.g., spelling, using different terms, repeating) must be adopted (one mention). As one of the responders clearly stated: 'one should ask for confirmation that they understand the message'. It is also helpful for first responders to relate to the person being rescued to immediately build a trusted rapport (four mentions). One of our survey participants points out as key: 'Honesty, treating people with respect and integrity. facts and simple actions for people to follow'.

Messages likely to foster compliance should be concise (as indicated by five mentions) and comprehensive (one mention); hence, they need to contain sufficient information (three mentions) as facts, while adhering to government regulations, such as the GDPR. Accordingly, the importance of handling and delivering sensitive information appropriately was highlighted in the response one firefighter gave: '99% of the general public are very noisy and have a morbid curiosity at incidents, giving them just enough information (without breaching GDPR) to satisfy this curiosity usually works and gives them a sense of being included and helpful'. Therefore, preserving privacy and confidentiality was pointed out as key and challenging for emergency services, especially when dealing with large crowds.

Our analysis of the communication occurring in channel 2 found that to provide the best response they possibly can, first responders are expected to quickly get an understanding of the present situation (one mention). Oftentimes, this requires asking questions from the rescued and/or other professionals (e.g., the police), as indicated in the 'educational' category (with two mentions) in Fig. 1. As one of the participants neatly summarises, 'By being calm in demanding situations to allow personnel in both my work environment and others in the vicinity to remain calm to assess the situation and generate an acceptable solution. Assessing people is a key skill that will allow the situation to be managed, listening to people in this situation allows for a calmer method of approach'. Thus, our survey discovered differences between the messages exchanged in the two channels and the purposes they serve in an emergency operation. Furthermore, the data we collected shed light on the challenges associated with the many channels of communication, between different parties. As one firefighter alluded to, 'Another reason is if we are assisting the Police we something, we get 'tarred' (for want of a better word) with the same suspicion and mistrust that the public has for the police'. As such, when this trust is compromised, consequences are apparent and may make collaborations among the emergency bodies harder.

The professionals we surveyed valued nonverbal means of communication very much, with 22 responses mentioning gestures and visual representations. Eye contact and physical touch are important nonverbal strategies to quickly get pubic attention and establish trust. Particularly, being impassive ('deadpan/emotionless'), while explaining the reasons why compliance is requested can increase the likelihood of compliance. Speed was, indeed, mentioned as key by one participant: 'should be simple and short should be delivered only when one has the person's attention'. Similarly, another respondent commented: 'I believe honesty, information and advice, coupled with good clear communication, in a regular and timely manner'. Therefore, conciseness appears as key, too. These findings should not surprise, considering that between 70% and 93% of communication happens without the aid of words (Dunning, 1971; Hull, 2016; Peters, 2007).

Considering the performative aspect, the emergency response professional's conduct in their role supports compliance of the rescued. Specifically, the ability to assess the situation and evaluate the severity of the incident, being aware of external contexts (e.g., time of day, location, incident type), and gathering required resources in response to an incident are important indicators of their competency. Further, being approachable during an emergency can foster public compliance (three mentions). The lack of professional conduct negatively impacts rescue operations, as a cave rescuer among the respondents mused: 'lack of professionalism in the volunteer rescue services'. As such, the expertise and professionalism of rescuers should shine through their actions and communication, partially supporting (Lindberg and Rantatalo, 2015; McMurray, 2011), as well as smooth cooperation (Davidson and Sanderson, 2022; Kneale et al. 2023). Indeed, trust is much-needed both between the rescuer and the rescued and also among the rescuers themselves.

Regarding channel 2, both duties on the job and skills possessed by the first responders reflect on the ultimate public compliance during an emergency. Our survey highlighted how cooperating swiftly with other emergency services (e.g., police) and members of the same organisation positively impacts compliance. A supervisor of the emergency services stated that 'Team relationships, training, operational experience, and learning from experience which is then fed back into the team' were the elements that allowed them to effectively preserve public safety by fostering compliance with the needed procedures, in line with Smith et al. (2008). Similarly, another participant reported as key 'Trust in those you lead and trust in you from those you report to'. In this sense, the trust embedded in the institutions shines through (eight mentions). As one participant from the medical domain alluded to, 'Trust is embodied in the office of the nurse. All that is required is not to betray that trust'. Similarly, a firefighter stated: 'Fire Service instructions at emergency incidents are always followed and I have never, never experienced a cordon breach'. From this perspective, rescuers can and should capitalise on the trust embedded in the institution they represent (four mentions).

After discussing how the rescuers promote immediate trust and compliance from the rescued through verbal and nonverbal communication, we will now focus on how these communication aspects materialise in emergency messages.

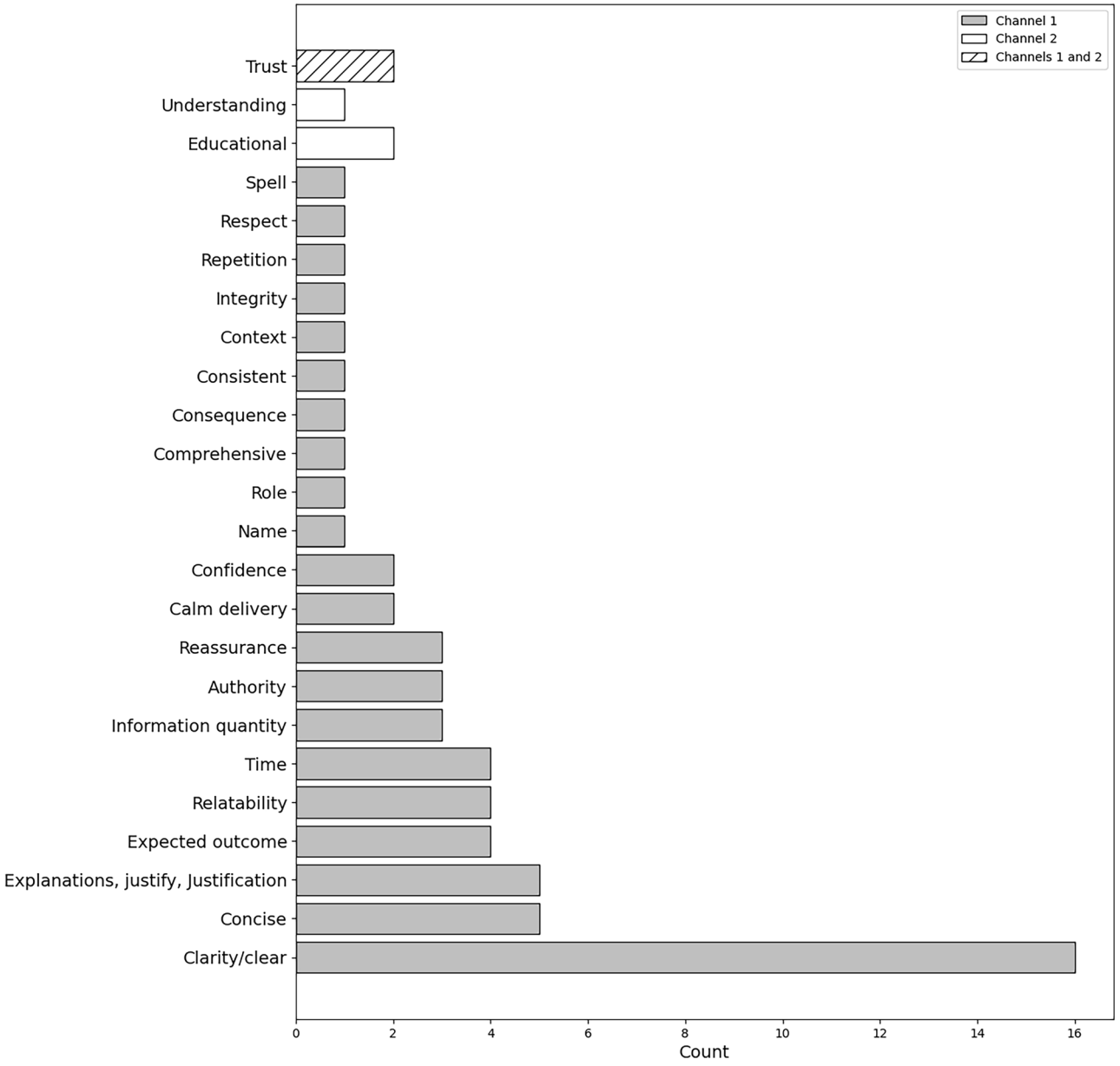

Fig. 1 Essential elements in a message to achieve trust and compliance in an emergency. This figure illustrates the key elements necessary for effective messaging during emergencies, as identified from responses to the interview question: "From your experience, what is essential for a message to contain or have to achieve trust and compliance in an emergency?" Based on feedback from first responders, we categorised these elements into three groups: `Channel 1: communication between the rescuers and the rescued', `Channel 2: communication among the rescuers)', and `Both'.

Challenges hindering compliance in emergencies. As previously identified, the two interacting parties, the rescued and the rescuers, originated two different communication channels:

- Channel 1—between the rescuers and the rescued
- Channel 2—among the rescuers

Challenges applied to both these channels, concerning communication and beyond.

Key challenges affecting both channels, reported by our respondents, revolved around:

- information dissemination
- motivation
- time pressure
- public image
- lack of training
- environment
- procedures
- personality traits
- service coordination

According to our data, the most significant barrier to communicating as effectively as possible was the dissemination of accurate information (10 mentions). For example, first responders reported having to 'fight against' incorrect and/or false information propagating through social media and from disingenuous sources. The impact of social media dynamics, especially the presence of misinformation challenged the building and maintenance of trust, which was found to have possible life-threatening implications, such as the 'Culture of conspiracy theories now abounding', about which one of our participants lamented. Whenever these untruths would spread, prior to an

emergency or during, they would sediment as their '(wrong) knowledge' and affect public compliance, which could be further compromised by a confused state of mind or equipment that did not work properly (e.g., phones with bad reception). Therefore, trust should be enhanced in any possible way, through communication, broadly.

The next challenge was associated with motivating the rescued through the communication of evidence (six mentions). This would justify the request to comply. As stated in one of our survey responses, 'Excellent rationale and explanation for why an individual needs to comply in an emergency situation'. Hence, motivations for compliance could and should be provided by the rescuers.

The rescued person's inability to understand the instructions being delivered may prevent or delay their compliance, as mentioned in five responses, including: 'if patients are mentally ill, confused or intoxicated'. For example, their deteriorated mental capacities, confusion or intoxication could prevent them from understanding requests. Additionally, fear and panic, induced by the risks associated with emergencies could also act as a barrier to compliance (four mentions). One response reported: 'The physiological state of an individual (e.g., stress, panicked) making them unwilling/incapable of taking instruction'. Therefore, the need for brevity, clarity and trustworthiness was highlighted by all responders who discussed information delivery in their survey answers.

With a total of four mentions, the style of communication (e.g., tone, tailoring to the situation) was cited as another important factor in fostering compliance: 'The instructions and or alarm must be bespoke to the situation'. Any disruptions to communication during emergencies may hinder the response/reaction and, by extension, compliance. Instances provided included poor communication skills of the rescuers and the use of personal protective equipment, which may obstruct facial expressions and verbal communication (four mentions): 'Some PPE can inhibit interpersonal communication'. Other responders referred to the poor attitude and lack of professionalism (two mentions). Similar observations were found in Lindberg and Rantatalo (2015). Because of the urgency of emergency interactions, communication should be supported as much as possible.

The public image of emergency response organisations (e.g., fire brigades or police) and the coordination behind and between them (e.g., government or personnel higher up in the chain of command) were pointed out as impacting the attitude, trust and consequent compliance that members of the public had when encountering their representatives. Whilst firefighters generally benefited from a positive and well-received presence, for instance, law enforcement personnel were reported as often viewed with a fearful and suspicious sentiment: 'The Fire Service already has a good relationship with the public and are trusted. This comes from years of resolving incidents and showing positivity and wanting to resolve incidents'.

Lack of training could also jeopardise rescues, hence compliance. For example, members of the public may get directly involved in the rescue operations and refuse help being offered (two mentions). As highlighted in one of the responses we collected: 'A lot of the time, members of the public are willing to help and provide assistance'. As reported by Fleştea et al. (2017), bystander involvement has a positive and a negative impact on coordination during emergencies.

Environmental factors, such as noise, smoke or light, especially if unnoticed, may lead to the public underestimating the risks and the urgency to address them as instructed by emergency services. Similarly, large crowds may interfere with information dissemination in a timely fashion, hence complicating the rescue efforts, as pointed out also in Korte (1971).

System-related issues (two mentions) could also impact compliance. Whenever the procedures followed for routine tasks fail to achieve their purpose, they may negatively affect public trust, causing doubts about the systems' operational capabilities. Therefore, ensuring that the system operators are well-trained could result in trustworthy perceptions, positively affecting compliance.

Additional communication hindrances to those just discussed could originate from the rescued' personality traits. For example, a person's accent, language, culture, and ethnic background could act as a barrier for them to ask and receive help during an emergency (six mentions). As a respondent stated, 'Different cultures view emergency services in different lights, language barriers can cause issue'.

Resistance to complying may also occur if the rescuers did not coordinate their messaging carefully and end up being perceived as unreliable or inaccurate. This perception would decrease the public trust in emergency services, reducing the levels of compliance and making them undermine the warning signs (three mentions). Instances referred to in the responses included: 'conflicting information coming from social media'. For instance, conspiracy theories and counter-intuitive instructions (two mentions) may negatively affect the reasoning skills of the rescued. As such, the rescuers themselves could complicate rescuing operations due to human factors and situational characteristics, as suggested, for instance, in Cuthbert and Scott (1980).

In summary, challenges that could compromise public compliance in emergencies may regard both Channel 1 and Channel 2, specifically information dissemination, motivation, time pressures, public image, lack of training, environmental and procedural factors, and human factors such as personality traits and coordination. After examining the challenges that could affect compliance, we will proceed to examine how the deployment, actual or forecasted, of AS is viewed by the first responders.

The use of AS in emergency response, current status and challenges. Through the survey, we asked participants whether or not AS was currently being used in their line of work. Specifically, 15 of 26 participants, i.e., ~56% of the total sample, stated that AS was currently being used for collecting data to inform decision-making and for communication (e.g., text messaging and social media) within their organisation. Types of AS used include drones (eight mentions), computer software systems (one mention), messaging systems (five mentions) as well as defibrillators (one mention).

Whilst asking whether AS was used to issue instructions to support the first responders, 19 of 26 participants, i.e., 73% of the total sample, agreed that they gave instructions in a variety of contexts. Most attention was given to "hard-to-reach" (seven mentions), providing information (seven mentions) and possibly saving first respondents' lives (seven mentions), communicating (four mentions) or alerting (two mentions) victims, as well as large areas and/or hazardous environments (three mentions). In this sense, they could support the effective allocation of human resources, allowing emergency services to multitask. Specifically, they could be used to speed up operations (four mentions), communicate (four mentions), locate (one mention), monitor dangers (two mentions) (e.g., building reliability) and support crowd management (two mentions). Additionally, AS could compensate for challenges concerning the training of human workers (e.g., time and resources needed).

Nevertheless, trust in the AS' role (two mentions) could represent an issue for message reception, to the point that some

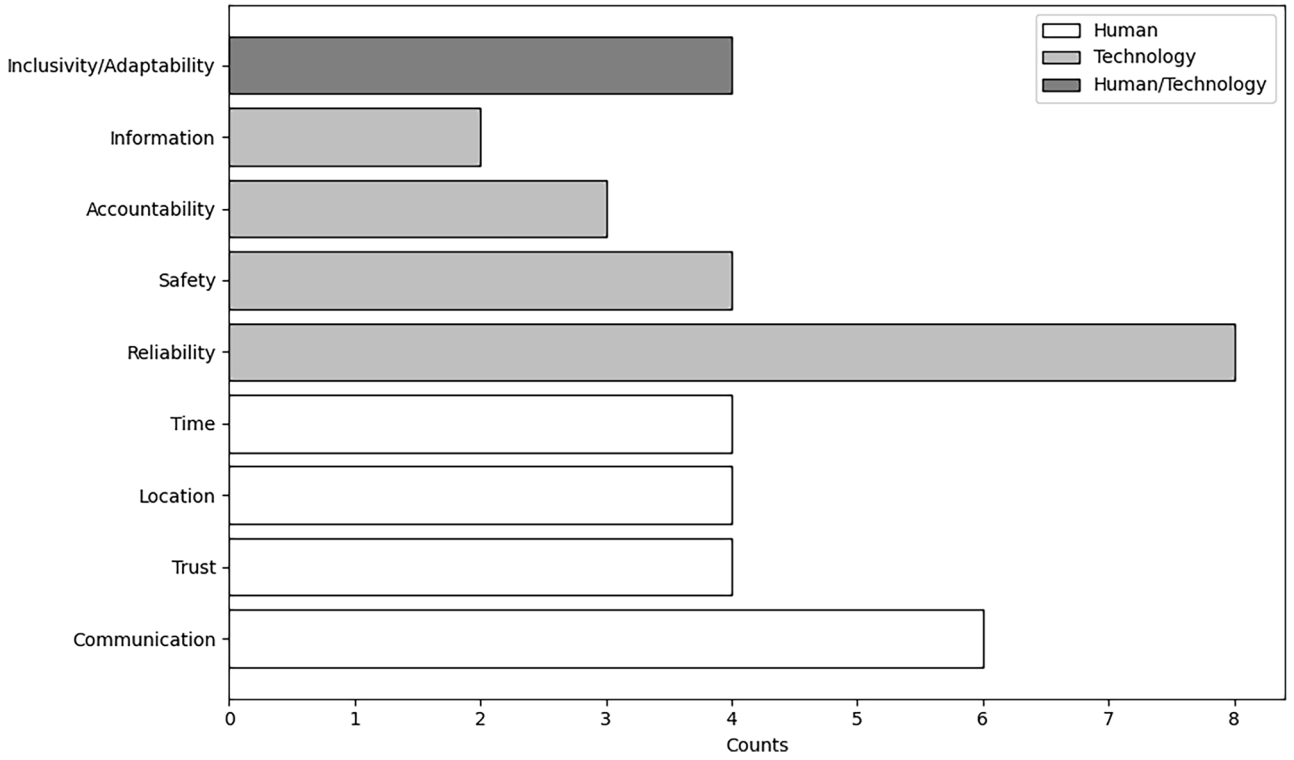

Fig. 2 Perceived risks in using autonomous systems (robots, drones, other software systems) during emergencies. This figure categorises the perceived risks associated with the use of autonomous systems (robots, drones, and other software systems) in emergency situations. The categorisation is based on responses to the question: "What are the risks in using autonomous systems during emergencies? Can you please provide examples and explanations of any pros and cons for the use of autonomous systems in emergencies, given your experience?" Responses from participants are organised into three perspectives: `Human', `Technology', and `Both'.

participants recommended using AS for key messages only (one mention) (de Visser and Shaw, 2018). <1% (0.04%) of the total sample disagreed that AS could be used to issue instructions, citing that it may slow down response time (four mentions). 23% of the total sample, neither agreed or disagreed with the use of AS in emergency response. Therefore, the actual and foreseen adoption of AS in rescuing operations was generally well-perceived by professionals working in the field.

Figure 2 shows the rescuers' concerns about risks caused by the use of AS in their workplaces. From a *technology* perspective, participants feared the (possible lack of) accountability (three mentions) and adaptability (four mentions) on the part of AS. Such concerns were seen as possibly compromising the capacity of AS to provide reliable (eight mentions) live and/or time-sensitive information. More specifically, the first responders feared a lack of feedback, review, monitoring, losing the meaning of words during communication and misunderstandings when using AS to support emergency operations. Additionally, they worried about the AS, which could be difficult and expensive to replace if damaged or lost, require long setting-up times and become suddenly unreliable (e.g., system failures during critical times). Such delicate equipment could lead to security issues, possibly compromising rescue operations by providing incorrect data (two mentions) or requiring unplanned human interventions to resolve problems, which would put the safety of the rescuers at risk (four mentions). Therefore, improving the accountability, adaptability, reliability and affordability of the AS was seen as critical to promote their adoption in real-life emergencies.

From a *human factors* perspective, the rescuers anticipated difficulties in getting the public to comply with or listen to an instruction issued by a machine because of the impersonal nature of the interaction. Indeed, technology defiance, resistance to change and novelty (including new pieces of equipment) were mentioned by participants as current concerns. Similarly, 'lack of trust' (four mentions) and knowledge on how to use AS were also feared as resulting in non-compliance, misuse or unneeded distraction. Accordingly, participants claimed that the public needed to be informed and educated about the use of AS in life-threatening situations to ensure that they complied with the instructions delivered by machines (six mentions). In this sense, unfamiliarity with technologies was seen as possibly originating mistrust in the message being delivered or the emergency service deploying the AS, negatively affecting rescue operations. Finally, they also had concerns regarding the location (four mentions), as the physical area where the AS were deployed would constrain the AS operator, most likely a rescuer, to a specific place making them unavailable if needed elsewhere.

Similarly, the use of AS was feared to slow or hinder emergency operations (four mentions). The opposite scenario, where individuals would over-rely on AS, was also seen unfavourably. Finally, lack of compassion, human touch and accessibility (i.e., communicating with people with mental and physical disabilities) were pointed out as concerns by the professionals we surveyed (four mentions). Therefore, additional efforts were foreseen as required to effectively deploy AS in real-life emergencies. In other words, education about the use of AS in the line of duty was viewed as essential for both the rescuers and the rescued, as supported, for instance, in Trevisan et al. (2024).

In summary, our results showed a general well-reception of AS in emergencies. However, the success of the deployment of AS in these scenarios was perceived as dependent on resolving technology and human factor-related concerns.

Discussion

Despite the existence of models and frameworks that confirm the need to establish trustworthy communication to deliver emergency messages, the literature primarily focuses on situation-specific (e.g. pandemic, nuclear power plants) (Seeger et al. 2018, 2020; Crouse 2008; Vandrevala et al. 2024; Oshita, 2019) and technology-specific (e.g. autonomous vehicles) (Fabi and Thampi, 2022; Asuquo et al. 2018; Qi et al. 2024) contributions. Meanwhile, our study provides a more broadly applicable model, which is meant to be used in any type of emergency. Therefore, its novelty lies mainly in its generalisability, as we considered and collected responses from a wide range of emergency rescue services.

The results just presented are likely to have implications on engendering immediate trust, inter-personally as well as between humans and AS, that may impact the emergency services' front lines. To address the three research questions presented in this paper, we pinpoint the key characteristics of the messages that facilitate rescue operations that are grounded in trust, as well as the strategies that may help build and foster trust quickly.

Recommendations for emergency communication. Based on our findings, we propose a communication model that strives to engender instantaneous trust in emergencies (illustrated in Fig. 3). The survey discovered external factors, such as time of day, location, incident type and severity, determined the appropriate levels of communication-specific factors, verbal and nonverbal. Verbal instructions increased the situational awareness of the rescued and informed about the context. Importantly, messages should also be concise and contain the right amount of information so as not to overwhelm individuals in distress. Instead, verbal communication elements should foster credibility, consistency reliability and positivity. Each of these aspects can be fostered by adopting language and visual aids (communicating outcomes, name, role and seniority of the rescuer, display of badges/emblems). nonverbal elements reinforced verbal communication and managed the relationship between the communicating parties, as supported in other studies (Argyle, 1976; Cai et al. 2022; Hinde, 1972). In an interaction taking place between a rescuer and the rescued, the rescuer should signal empathy, care, relatability and adaptability by adopting a confident, calm, compassionate, attention-grabbing demeanour. These behavioural aspects could be further augmented by the rescuer's conduct as a professional and maintained a positive public perception. Taken together, nonverbal and verbal communication fostered trustworthiness (see also in Cuthbert and Scott (1980)) and built faith in the rescuers, ultimately leading to compliance with the instructions given.

In resolving RQ1, our data highlighted the importance of communicating the correct information, very strongly, reinforced by nonverbal communication. Specifically, making sure that the public is getting the correct and/or legitimate information was reported as challenging by the first responders. With the public having access to a variety of information sources, our participants were deeply concerned about the negative impact of incorrect or unreliable information (see Table 1). In this respect, our findings partially supported those in existing literature, such as Chowdhury et al. (2023) and Cai et al. (2022), about the impact of conspiracy theories and misinformation on compliance, as well as Schenhals et al. (2019), regarding the lack of understanding of medical instructions, resulting in non-compliance and additional medical emergencies. Our findings appear to partially support (Nickel, 2022), yet partly contrast those in Oxman et al. (2022), which suggested that in cases of extreme urgency, compliance should be prioritised over a clear justification of the measures.

In resolving RQ2, our survey found that including information about the rescuer's name, role, seniority and experience in the emergency message improved clarity and transparency and instilled trustworthy perceptions. Similarly, communicating intended outcomes and the consequences of non-compliance, as well as providing explanations and justifications for the requested behaviours, could make the public feel included in the operations, thus motivating them to respond positively to the rescue efforts. The message could be repeated if needed. Furthermore, spelling words and omitting acronyms could facilitate understanding. Additionally, increased clarity might decrease the rescued person's fear of the situation. Finally, displayed emblems of authority could support emergency communication further, fostering compliance. Therefore, in the communication channel among rescuers, sharing similar information could foster trust. This appears to support Heersmink et al. (2024).

In addressing RQ3, nonverbal communication between the rescuers and the rescued was identified as a key aspect that enhanced compliance and was grounded upon trust. Among nonverbal factors, the ability of the first responders to communicate messages empathically would convey their genuine concern and willingness to contribute to the safety of the rescued. Simultaneously, it would show respect and integrity towards the rescued. Therefore, messages should be delivered confidently, calmly, compassionately and promptly. To engender trust-based compliance, messages should be communicated after securing the attention of the interlocutor.

The first responders' performance on duty also enhanced the compliance of the rescued. For instance, our findings identified performance-related factors, such as the ability to cooperate with other emergency services and members of the public, which would ideally make everyone involved in the emergency feel useful, enhancing reliability and credibility, ultimately establishing and fostering the much-needed trust to survive and effectively manage emergencies. Our finding is supported by research (Davidson and Sanderson, 2022; Fleștea et al. 2017). Examples of performance-related factors, provided by our survey, participants included references to reassurance through gestures (e.g., physical touch) and displaying emblems of authority (e.g., badges and uniforms).

Summarising, our findings showed that communication, both verbal and nonverbal, engendered compliance, partially supporting the conclusions put forward in McClaughlin et al. (2023). Furthermore, trust is instrumental for effective and efficient rescuing operations (see also Long et al. 2015; Min, 2020; Trevisan et al. 2024; Yeo et al. 2018). In this sense, our work added to the just-cited studies, which considered fire, medical and flooding emergencies, respectively. In comparison, ours provided insights across additional emergency organisations, including cave rescue, emergency dispatchers, emergency system designers and coordinators. Moreover, it confirmed the positive impact that trust could have on compliance in emergencies, as supported in Templeton et al. (2023) and Wray et al. (2006). Our findings also highlighted the damaging effects of conspiracy theories and misinformation on compliance during rescues, as concluded in Chowdhury et al. (2023).

Recommendations for the use of AS in emergencies. 58% of the sampled responders claimed that AS was currently used in real-life emergencies by themselves or their colleagues. Types of AS included drones, messaging systems, defibrillators, and software to control autonomous vehicles. AS were used for monitoring fires, looking for missing entities (e.g., humans, objects) and providing data for first responders to make decisions in their line of duty.

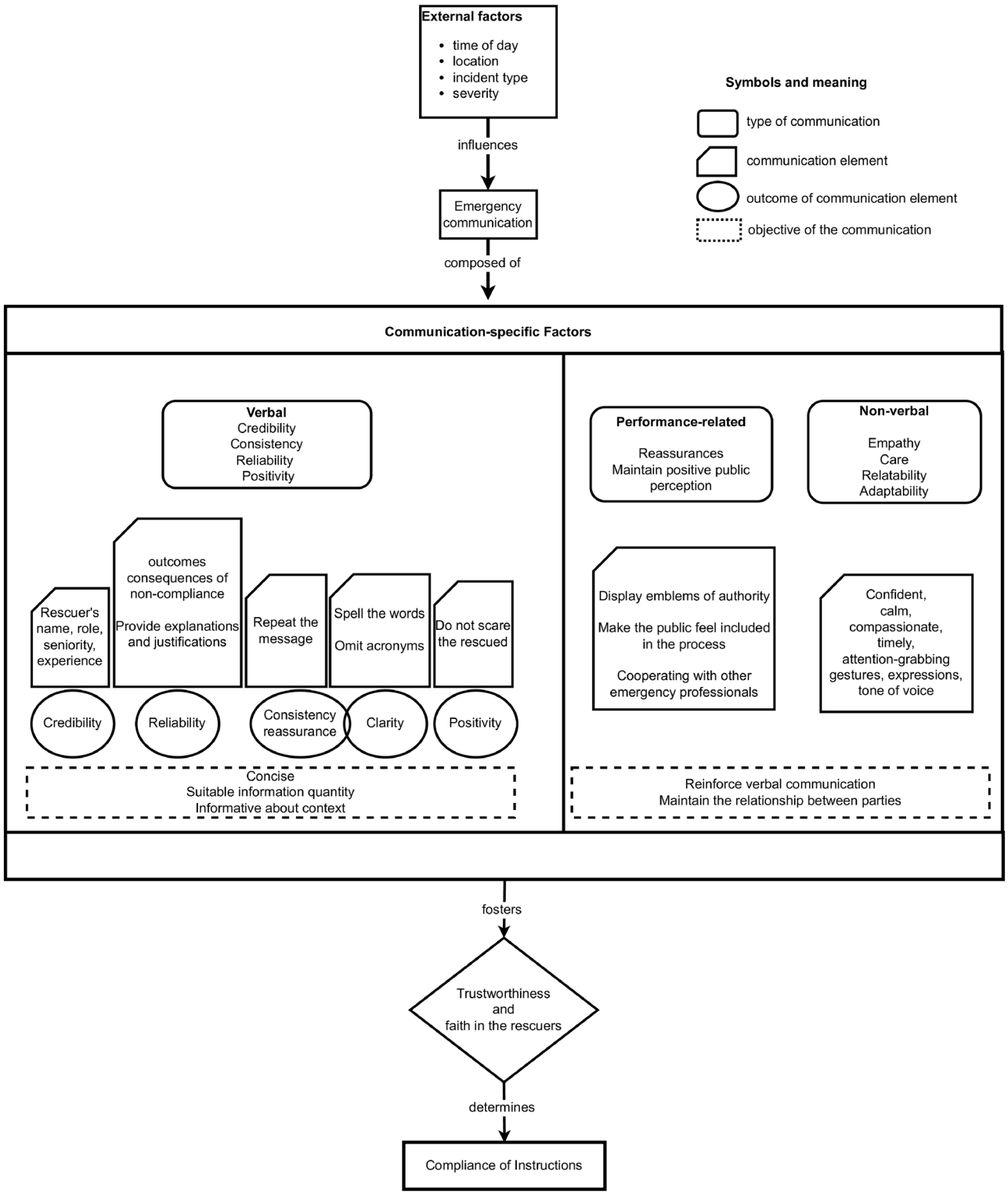

Fig. 3 Communication model to engender instantaneous trust in emergencies. This figure presents a communication model designed to foster instantaneous trust during emergencies. The model incorporates findings from our survey, which revealed that external factors—such as time of day, location, incident type, and severity—influence the necessary levels of communication. These include both verbal and nonverbal elements. Verbal instructions are critical for increasing situational awareness and providing context-specific information without overwhelming the individuals in distress. Key verbal elements promote credibility, consistency, reliability, and positivity, enhanced by specific language and visual aids like communicating outcomes, displaying rescuer names, roles, and seniority, and the use of badges or emblems. Nonverbal elements complement verbal communication, managing the relationship dynamics between the communicating parties, as evidenced by related studies.

Table 1 Count of mentions of key challenges that may hinder compliance or trust in emergency services, according to the response we collected.

Keyword categories	Frequency of occurrence
accent, authority, bespoke, complacency, directly, help, frustrated, government image, inconvenience, inference, physiological, system training	1
poor communication skills	2
PPE	2
crowds/large groups/larger	3
trust/lack of trust/truth	3
resources, time, volunteer	3
cultures, diversity	4
language	4
conflict, conspiracy, counter-intuitive, evidence, resistance	5
fear, panic, scaring, suspicion	6
communication, attitude, professionalism, tone, info quantity and quality, social media	7
conflicting information, confusion, mentally ill, confused or intoxicated, misunderstandings, unclear	7
information, lack of info, perceive, reason, too much detail, why	8

Table 2 Risks identified in using AS in emergencies by the survey respondents, where categories were labelled by and grouped based on the analysis.

Keyword categories	Category label	Frequency of occurrence
data, input	Information	2
accountability, wisely, uniform	Accountability	3
accessibility, differing needs, cater for all scenarios, older people who don't use smart phones	Inclusivity/flexibility	4
cultural changes are required, overreliance, trust, hesitance	Trust	4
elsewhere, larger, reach, closer	Location	4
removes humans from a risk, harms, control operatives, compliance	Safety	4
time, speed, slow	Time	4
communicate, communications, building evacuation announcements, mass messaging, losing the understanding, misinterpretation	Communication	6
reliability, new system fail, failure, incorrect, technical issues, limited	Reliability	8

According to our data, providing evidence through the message that AS was effective in emergencies could build trust, both in the technologies and the rescue institution that deployed them, as implied by Collin-Jacques and Smith (2005) and Nicolini (2007). Similarly, if too much trust was placed in the AS by the rescued, their over-reliance on technology also concerned our survey respondents, as faulty behaviours or malfunctions could be overlooked. In this respect, our findings supported (Robinette et al. 2016). As our participants alluded to (see Table 2), if the machines were to suddenly become unreliable or faulty, they might leave the emergency services unsupported or working with incorrect or incomplete data without realising it.

Other concerns expressed by the participants revolved around accessibility and flexibility, similar to Trevisan et al. (2024). The deployment of AS in emergencies was viewed as possibly problematic when it came to catering to all types of scenarios and humans with different needs (e.g., in terms of communication or needing reassurance in stressful situations).

Regarding communication specifically, the unfamiliarity of both rescuers and the rescued with AS was also perceived as risky. In case of any communication breakdowns, human trust in AS might also be impacted. To avoid this situation, we recommend cultural changes to cooperate and operate such technology in an emergency could be needed, supporting the findings by Santibañez et al. (2024). In this sense, interdisciplinarity would be key, as sustained also by Guo et al. (2024).

Another concern raised by the first responders was the lack of accountability for the deployment of AS, as the machines could not make conscious decisions while in operation. Similarly, participants voiced their uneasiness when it came to the machines representing the emergency service body that they were a member of.

Finally, the programming or set-up time that machines could require to become operational was viewed by the participants as possibly causing delays in the rescues. Additional efficiency concerns were expressed in terms of the much-needed cooperation between different rescuing bodies, as suggested by Davidson and Sanderson (2022). Specifically, AS were seen both as helpful tools and sources of risk. While allowing more professionals to collaborate, managing the AS, at the same time as the human resources on the ground, could be problematic in time-critical situations.

In summary, the emergency responders we surveyed generally had a positive attitude towards the adoption of AS in emergency operations, especially because AS had the potential to:

- facilitate rescuing operations (e.g., managing equipment such as drones)
- alert about dangers
- reach humans or retrieve objects in challenging conditions
- spread important messages or information (i.e., giving clear instructions)
- reduce risks and increase the safety of all humans involved
- provide evidence of their usefulness, increasing the trust humans placed in them

In this sense, our findings supported Rymansaib et al. (2023) and Nickel (2022), showing how AS could effectively assist emergency services and investigators in conditions of poor

visibility and concealed hazards. In the medical field, automation coupled with communication could assist rescuers. For example, Khalid et al. (2021) proposed a framework integrating communication with autonomous decision-making capabilities, which improved the trustworthiness and reliability of the AS in emergencies. Khan and Neustaedter (2019) explored the benefits and challenges of using drones in firefighting operations. Similarly, Roldán-Gómez et al. (2021) discussed difficulties and potential solutions when fighting forest fires. Specifically, they made design recommendations for a robot-assisted firefighter that could support human 'colleagues' in prevention, surveillance, and extinguishing efforts with the aid of virtual and augmented reality to gather information and deploy drone swarms. Similarly, Comes (2024) highlighted how AI can support humans during crisis situations. Hauer (2022) provides a critical perspective on the "incomplete moral choices" that may be made when fully autonomous AI is involved in decision-making processes. This does not appear to apply to the deployment of AI systems in emergencies, though, as these devices are operated by humans.

Final remarks

Revisiting the RQ1 in our study, we discovered characteristics of the messages used by emergency service professionals to deliver vital, clear information to individuals at risk. An effective emergency communication message, resulting in compliance, was predicated upon verbal and nonverbal communication. Our study found that information about the credibility and reliability of the rescuers and the rescue operation had to be communicated verbally, and supported by nonverbal and performative elements, such as professional conduct, to instil a sense of reassurance.

Proceeding to finalise our answer to RQ2, information about the rescuers and their experience is likely to foster trustworthy perceptions about them. At the same time, explaining the intended outcomes, consequences of non-compliance and justifications for the requested behaviour increased the situational awareness of the rescued, further supporting compliance. Nevertheless, the information revealed had to respect confidentiality and sensitivity, as advanced by Cheung et al. (2016). If not provided with sufficient information, the rescued might not be persuaded to comply, ultimately compromising the rescue operations. Conversely, when given too much information about incidents, the rescued might be frightened by the risks they were exposed to and unable to comply, as nervous or panicky.

To address RQ3, we could claim that confidence, reliability, reassurance, credibility and positivity enhanced the compliance of the rescued, rooted in trust. Therefore, motivations for compliance could and should be provided by the rescuers, especially since establishing trust and compliance was time-critical. In other words, verbal and nonverbal communication (including professional conduct) could contribute to the outcome of the operations, given the interdependencies between the answers found to RQ1 and RQ3. Rapid and effective communication should be facilitated by tone of voice, tailored content, professionalism, and attitude while minimising communication barriers.

In addition to motivations and determinants of compliance, we were able to identify challenges that hindered it:

- information dissemination
- motivation
- time pressure
- public image
- lack of training
- environment
- procedures
- personality traits
- service coordination

Considering the limitations of this work, the study sample was relatively small. Even though this is a common practice in qualitative research, a larger sample is recommended for future work on the topic of emergency response to corroborate the validity and reliability of the findings. We have presented the communication model as system-agnostic. Empirically evaluating how the model changes when implementing the communication elements in different AS used in emergency services (e.g., robots, drones), emergencies, and human factors of the rescuers and the rescued is recommended for future work. We believe Artificial Neural Networks (ANNs) are a valid candidate for implementing the communication model we present in this paper, as exemplified in Sarkar et al. (2022) between humans and AS that can appropriately manage the uncertainty involved in the interaction context. In addition, considering that automation techniques are perceived as potentially exposing humans to risk even in non-life-threatening scenarios, such as in retailing and transportation services (Sarkar et al. 2024; Sharma et al. 2022; Sohn, 2024; Zemanek Jr and Kros, 2024) addressing the trust issue would further enhance the leap of faith.

Additionally, this survey was limited to first responders working in the UK. Cross-country studies would provide deeper insights into both general and local or culture-specific emergency communication requirements, patterns, and procedures. Therefore, the communication model proposed in this work should be evaluated against diverse backgrounds and tested with different populations.

With this work, we uncovered communication-related aspects practised by professionals to build trust quickly. For future research, hence, experimental designs are especially recommended to examine the practical considerations—human factor and technological—for embedding such communication capabilities to AS. In the long term, these communication aspects, if embedded in future AS may improve their utility in emergencies by enabling them to communicate instructions to the rescued and the rescuers. In support of this hypothesis, we saw a positive sentiment from emergency professionals toward adopting AS for emergency operations. However, challenges posed by accountability, adaptability, reliability and affordability were seen as critical to promote their adoption in real-life emergencies. To mitigate these concerns, we recommend educating both the rescuers and the rescued to improve their understanding of the viability and applicability of such technologies. Further research is needed to overcome the current reliability and human–machine interaction challenges to ultimately support the adoption of AS in real-life emergencies.

Data availability

The raw survey responses collected for this study from first responders in the UK in 2023 are available at this link to this public GitHub repository https://github.com/sachinisw/FirstResponderData.

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Competing interests

The authors declare no competing interests.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the King's College London research ethics office. The study was approved by the Research Ethics Committee of King's College London (Reference Number: LRM-22/23-32307) on 09/02/2023 before the research commenced. The research was performed as a fully anonymous study following the guidelines/regulations stipulated by the King's College London Research Ethics Committee. The approval covered all experimental procedures and data collection involving human participants. No personal data was collected. Since our study does not involve any medical research involving human participants, it is not subject to the Declaration of Helsinki.

Informed consent

Informed consent was obtained online by participants reading the information sheet and completing the online consent form by clicking yes on all the consent statements. Informed consent was obtained at the beginning of the survey. Therefore, each participant completed the survey on a different date and time, between March 6 and July 20, 2023. Informed consent was obtained by Sachini Weerawardhana from all participants (i.e. the first responders). Consent covered participation in the online survey, withdrawal, processing of data under the terms of the UK data protection law, including the UK General Data Protection Regulation (GDPR) and the Data Protection Act (2018), and publishing of processed data in scientific conferences and journals. The study does not involve vulnerable individuals. The survey was fully anonymous. Participants were made aware of this upon signing their consent to take part in the study. Since the data collected was anonymous, no anonymisation process was needed.

Additional information

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