ASSISTANCE
project

The societal modelling
of situation awareness
in search and rescue
research:
SEX & GENDER ANALYSIS

The societal modelling of situation awareness in search and rescue research:

SEX & GENDER ANALYSIS in the ASSISTANCE project

Index

Foreword

Across the European Union, different First Responder (FR) organizations – such as LEAs, firefighters, and medical emergency staff – cooperate when facing large and complex disasters. New threats, such as climate change for natural disasters and increased radicalization for man-made disasters, can amplify the effects of similar events.

The impact of these kinds of large disasters could have disastrous consequences for the European Member States' regions and social wellbeing in general.

Moreover, members of the FR organizations that respond to these kinds of events are exposed to unexpected dangers that can severely affect their personal integrity.

ASSISTANCE offers a holistic solution that adapts a well-tested Situational Awareness platform. This platform uses advanced technologies, such as UAVs, wearable intelligent sensors, and swarms of robots and drones equipped with specific sensors, to respond to the needs and contingencies of those in command of rescue operations

This platform offers real-time video footage, position recognition of people and objects, the updates on the status of evacuation routes and network coverage to its users. It can be tailored to the needs of each organization involved. However, it also is a tool for any and all organizations involved (firefighters, police, medical personnel, etc.) to coordinate their work in mitigating the effects of the disaster.

ASSISTANCE also aims to create an advanced European training network based on the use of virtual reality, mixed reality, and augmented reality to enhance the skills of first responders while taking in to account the expectations and needs of professional growth of the operator.

With this combination of solutions, ASSISTANCE will improve the FRs' Situation Awareness during their mitigation activities through the integration of new paradigms, tools, and technologies with the main objective of enhancing both the safety and the efficiency of operators.

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https://assistance-project.eu

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1 Keywords

Keywords

SAR technology

Situation Awareness

Ethics of Technology

Societal Impact Assessment

Gender Dimension asessment
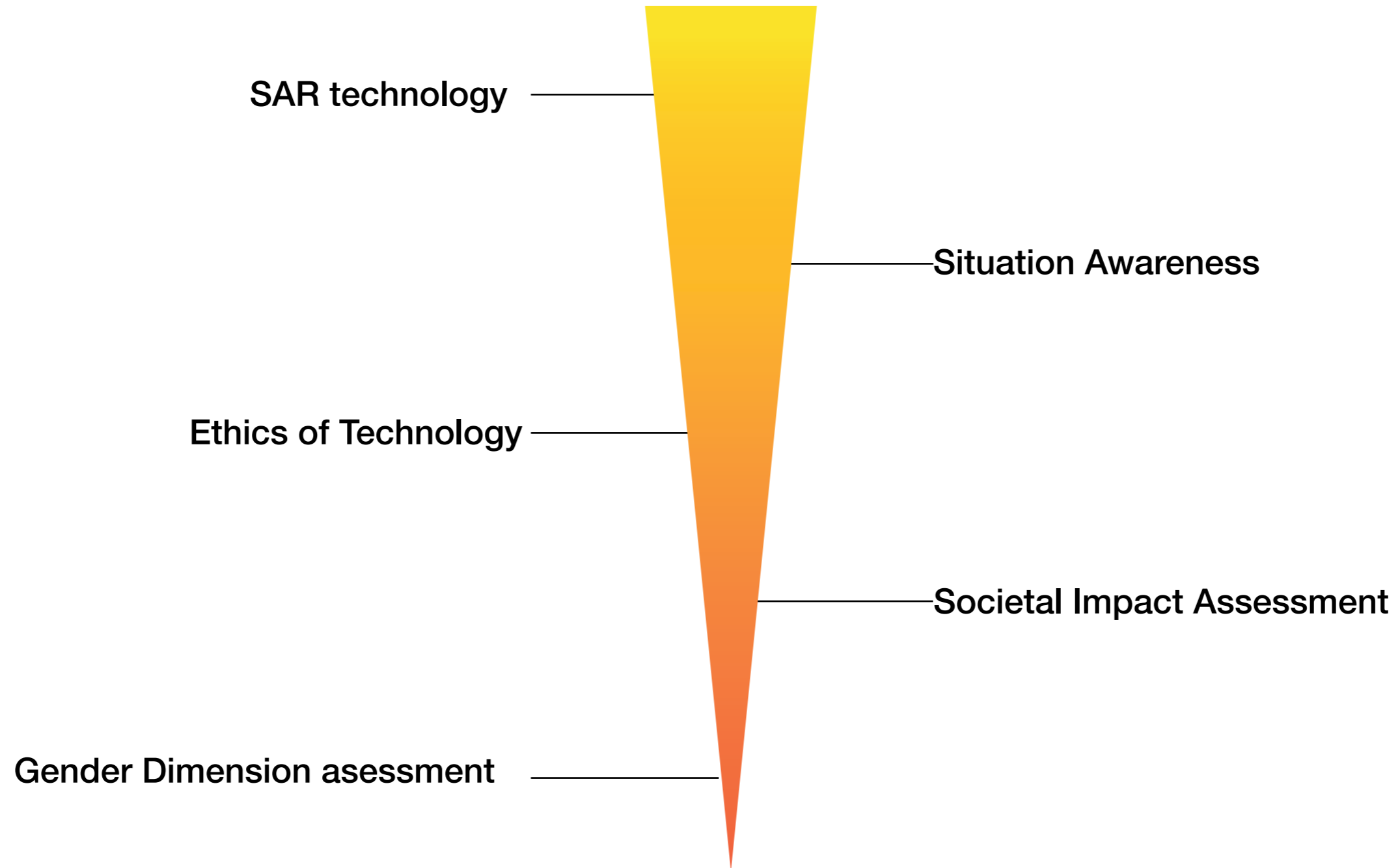
2 First Responders' Need for Research in Search and Rescue Operations

2.

The ASSISTANCE project aims to help the different First Responders organizations to face disasters

As disasters become more massive, search and rescue (SAR) operations can no longer be considered solely as recovery activities, but also as awareness and performativity creation. The more securely and efficiently FRs can operate, the more resilient European society will become. The problem is that, in most of the cases, European FR organizations do not leverage necessary innovations and advanced training approaches already available on the market. The consequences of this fact are disastrous, with hundreds of FRs across Europe becoming severely injured or, worse yet, losing their lives in action. Furthermore, vast swathes of the afflicted population become potentially avoidable victims, which leads to a growing sense of insecurity and vulnerability in the EU when disasters strike.

The ASSISTANCE project[1], completely user-driven since its inception, aims to protect and help the different organizations of FRs that work together during the mitigation of large-scale disasters, and to improve the FRs'

capabilities and skills in facing such disasters. ASSISTANCE will also produce a Situational Awareness (SA) platform that allows for providing tailored information needed by each individual FR organization when collaborating on disaster mitigation. This platform integrates Unmanned Aerial Vehicles (UAV), robots, and wearable sensors that will enhance the FRs' SA by providing, among other things, real time video, resources location, and evacuation route status.

Finally, ASSISTANCE proposes an advanced European training network based on the use of Virtual Reality (VR), Mixed Reality (MR), and Augmented Reality (AR) for increasing FRs' capabilities. This advanced training network development will include tailored curricula design, immersive interfaces, adapted training methodology definition, virtual scenarios, etc.

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1 https://assistance-project.eu/
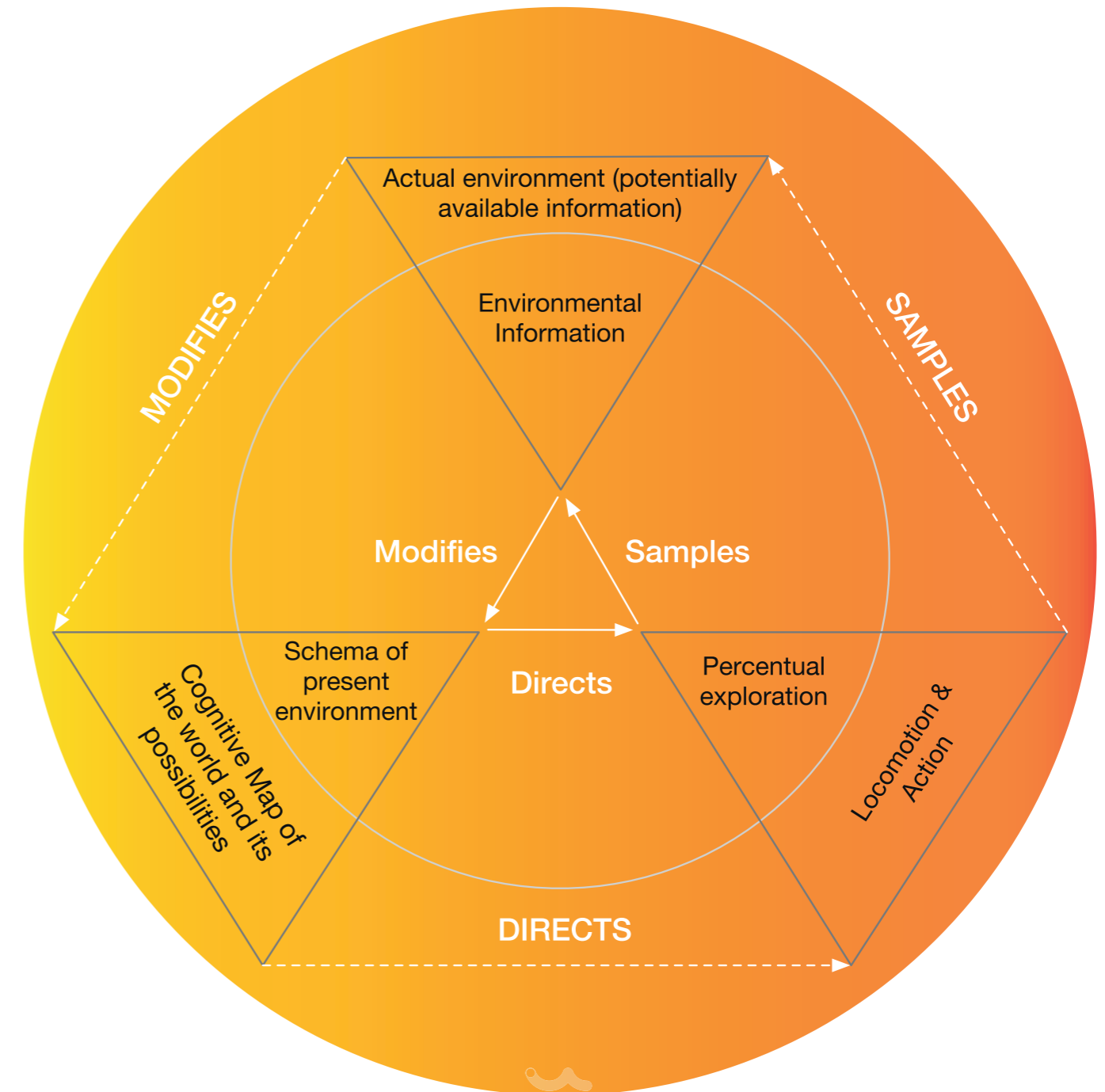
3 SA in SAR: the current issues

3.

As Mica R. Endsley argues in her pioneering study – published in a special issue of the Human Factors journal on SA in 1995 – SA refers ostensibly to the level of awareness and understanding that an individual has of a situation.

It is, in other words, an operator's dynamic understanding of 'what is going on' (Endsley 1995). . Within SAR contexts, SA is applied primarily to avoid injury to search crews by ensuring they are aware of the environment, the lay of the land, and the many other factors of influence within one's surroundings while assisting in the localisation of injured or missing individuals. Depending upon the approach of the specific type of literature, there are various views on the construct of SA and there have many attempts at defining it and, obviously, as many critiques as well.

Following Salmon et al. (2007) and other scholars (Fracker 1991; Smith and Hancock, 1995), we proceed to outline the key problems that currently invest the SA debate in the field of SAR.
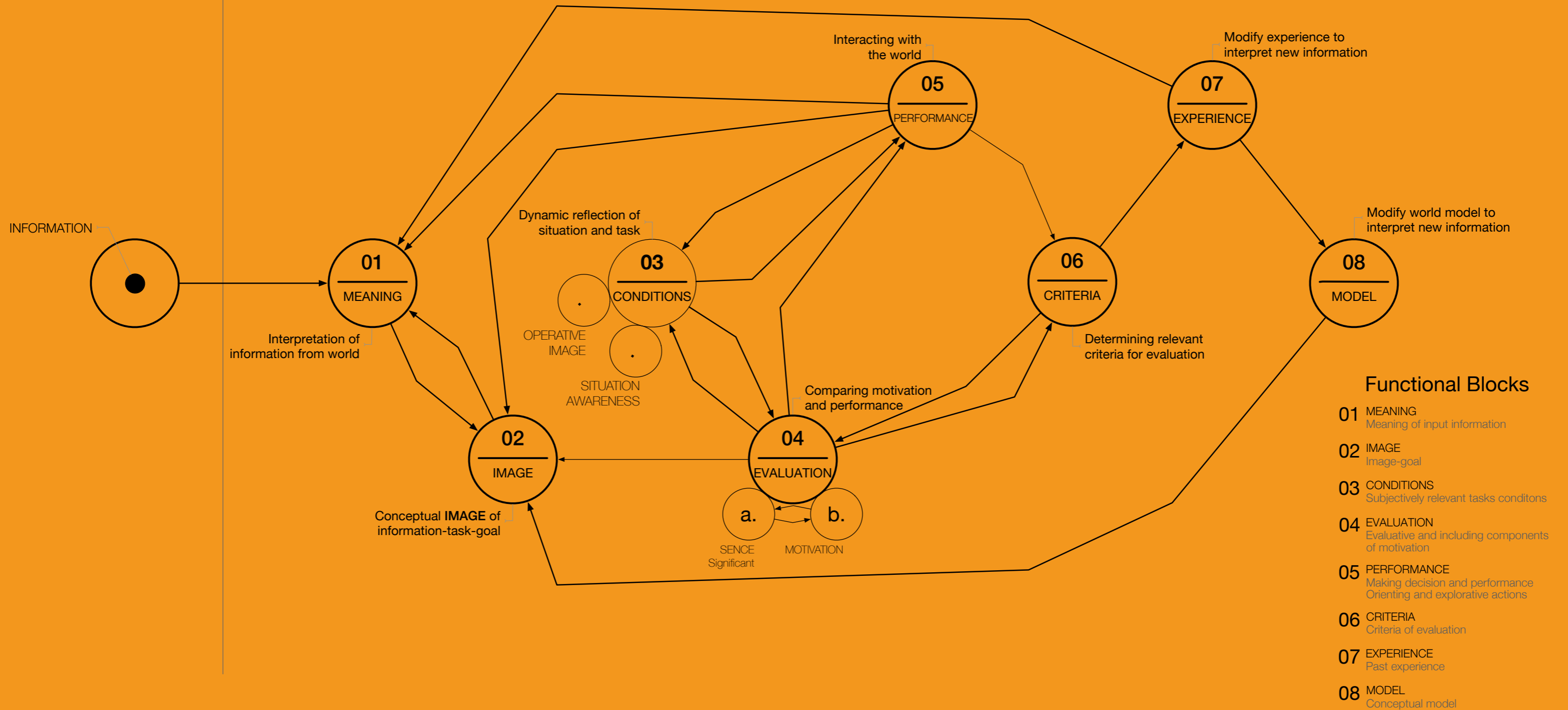
3.1 SA: a process or a result?

One controversial aspect is whether SA in the field of disaster recovery should be considered a "result" rather than a "process". SA could be construed as the result s of operations of perception management in constantly and rapidly evolving SAR activities (Endsley 1995).. But SA can also be viewed as a decision-making process in which the appropriate courses of action are taken based on the most likely future scenario (Fracker 1991; Smith and Hancock, 1995; Bedny and Meister 1999). This difference in the definition of SA, considered continuously a momentary or a dynamic form of knowledge, risks generating an arbitrariness in SAR operational performance.

F1 – SA as a perceptual cycle (Smith & Hancock, 1995)

SITUATIONAL AWARENESS

INFORMATION

01 MEANING

Interpretation of information from world

Dynamic reflection of situation and task

03 CONDITIONS

OPERATIVE IMAGE

SITUATION AWARENESS

02 IMAGE

Conceptual **IMAGE** of information-task-goal

Interacting with the world

05 PERFORMANCE

Comparing motivation and performance

04 EVALUATION

a.   b.

SENCE Significant   MOTIVATION

Modify experience to interpret new information

07 EXPERIENCE

Modify world model to interpret new information

06 CRITERIA

Determining relevant criteria for evaluation

08 MODEL

Functional Blocks

01 MEANING
Meaning of input information

02 IMAGE
Image-goal

03 CONDITIONS
Subjectively relevant tasks conditons

04 EVALUATION
Evaluative and including components of motivation

05 PERFORMANCE
Making decision and performance
Orienting and explorative actions

06 CRITERIA
Criteria of evaluation

07 EXPERIENCE
Past experience

08 MODEL
Conceptual model

**F2 – SA as a process of activity theory (Bedney & Meister, 1999)**

3.2 SA: Psychological or shared mechanism?

SA should affect SAR organizations that operate within a world of high risk by allowing them to acquire and demonstrate performance levels with fewer-than-expected accidents. But do SA skills pertain to the cognitive capacity of individuals or are they knowledge that exists only if socially enabled?

Facing this dilemma is particularly important for complex disaster environments where multiple sources of information compete for the attention and feedback of SAR teams and their individual members. The information SAR team members choose to assimilate has a substantial influence on their situation awareness. Influencing attention distribution subjectively (by certain learning approaches) or socially (by others), therefore, can have a significant impact on situation awareness. In the literature, the main models of SA (see the figures below that illustrate models of situation awareness) have left this issue unsolved.

F3 – SA as a product of informationprocessing (Endsley, 1995)
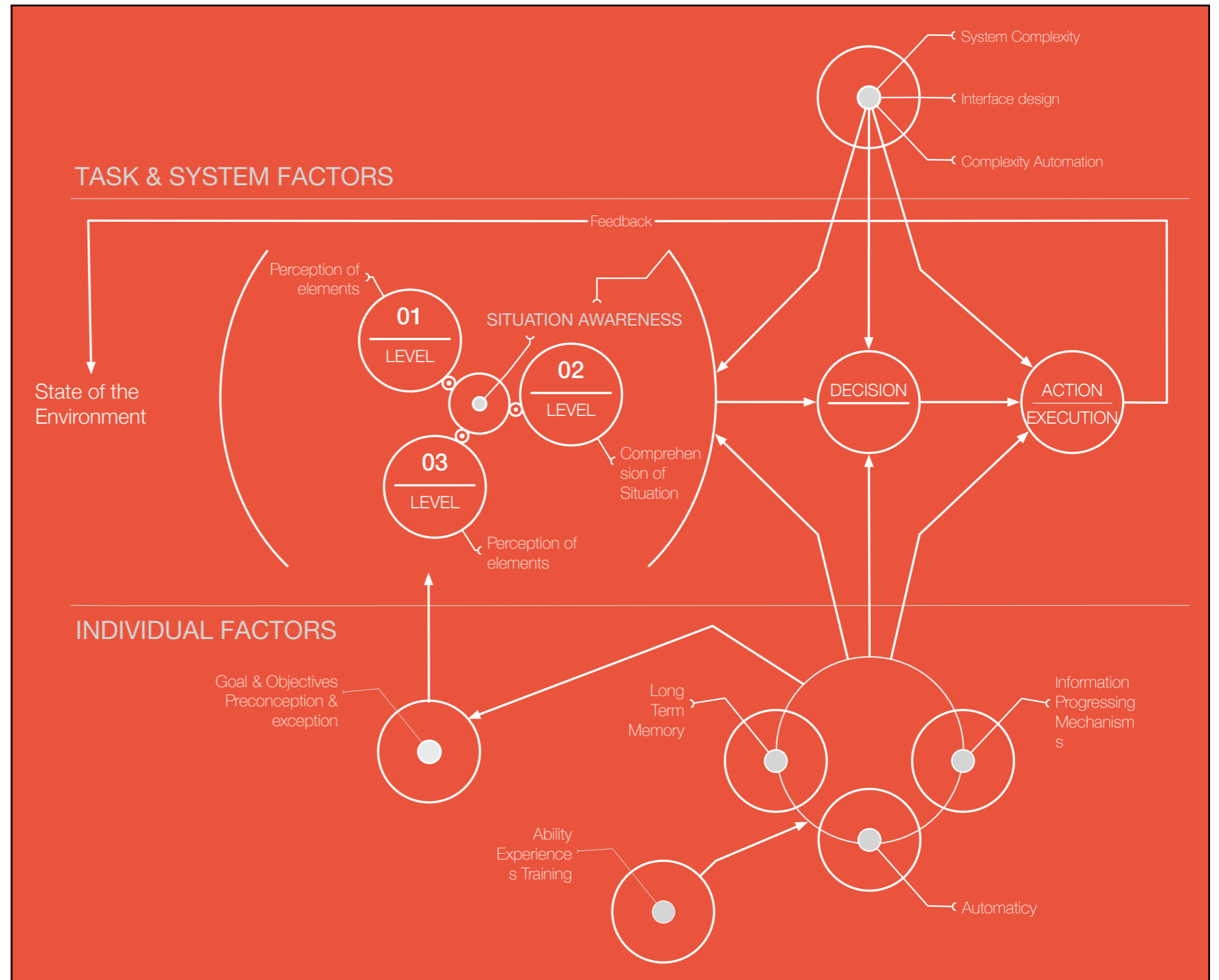
3.3 AI-assisted SA: Automation requires diligence

AI assistance in forming SA can include the use of decision control systems and ICT technologies to enhance the efficiency of operators and the efficacy of their decision making. While beneficial to process improvement, AI assisted SA can place the provider in the role of monitor instead of operator. Relying on automation can lead to complacency, reduced vigilance, and changes in the quality of feedback provided to the human operator, creating (and not reducing) ethical dilemmas (Mittelstadt et al. 2016).

SA via gamification: Trivialization of the decision -making process

One of the risks of creating SA by using gamification is the hyper-simplification and trivialization of the decision-making process.

This happens in SAR technologies where gamification has been introduced, for example, for end-users' training or to create human-computer interfaces (HCIs) that are excessively user-friendly. Radically gamifying the learning process ends up with the SA becoming too tied to the performance of technology, losing sight of SA's main capability: the dynamic understanding of 'what is going on'.

This capability is a mix of learning and sensemaking (Klein, Moon, and Hoffman, 2006), that is the intuitive process by which people give meaning to their collective experiences.

3.4 Innovation in ASSISTANCE: gender as a societal aspect for modelling SA

Although women make up a low percentage of FR forces (World Fire Statistics 2017), thus putting off gender equality in the SAR world, their numbers are steadily increasing and many associations have been created to reduce gender gaps. Examples in law enforcement include the International Association of Women Police[1], the National Association of Women Law Enforcement Executives in United States, and the European Network of Policewomen[2]; in the field of firefighting and rescue, they include the International Association of Women in Fire & Emergency Services, WAFA[3] in Australia, Women[4] USA, and CTIF – Commission for Women in Fire & Rescue Services[5] Europe. But gender is important not only in temrs of equality and non-discrimination in the field professionally, but also as a very remarkable aspect to reshape the SA and try to answer the current issues of the debate.

More awareness of gender difference means more situational awareness.

There is an inherent conceptual peculiarity in the definition of gender which immediately highlights its semantic and pragmatic richness, the difference between "gender" and "sex". As the World Health Organization states: "gender refers to the roles, behaviours, activities, attributes and opportunities that any society considers appropriate for girls and boys, and women and men. Gender interacts with, but is different from, the binary categories of biological sex". More specifically, gender can be seen as both an empirical category and a theoretical conceptualization (Woodward et al. 2015; Tannenbaum et al. 2019) that facilitates new ideas and methodologies, thus improving the quality of research. Therefore, if SA must be built on dynamic and differentiated analyses, gender? Indeed, it offers broad declinations ranging from biological to cultural aspects of building one's self.gender? Indeed, it offers broad declinations ranging from biological to cultural aspects of building one's self.

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1 https://assistance-project.eu/

2 http://www.enp.eu/

3 https://wafa.asn.au/

4 https://www.womeninfire.org/

5 https://www.ctif.org/index.php/commissions-and-groups/women-fire-and-rescue-services

The gender dimension as an innovative paradigm of risk assessment

The international initiative "Gendered innovation" has highlighted how gender adds a valuable dimension to innovation and design methods[6]. A peculiar feature that makes gender a key aspect of innovation is risk perception . Whereas a substantial body of research (i.e. economics) indicates that women and men differ in their perceptions of risk, others are not conclusive.

Further research is needed on this topic in disaster response involving both FRs and citizens. Disasters are inherently dangerous for citizens/victims and job duties for FRs involve many risks. As touched upon in different contexts of disaster study, safety behaviours in FRs showed that women perceived risk differently than their male colleagues (Khan et al. 2017). Rather than the hypermasculine culture, women's views may improve safety behaviours (i.e. weighing risk and benefits of dangerous situations, focusing on biomechanics and technique, asking for help, reporting injuries, being heard by colleagues, and illuminating a hostile work environment).

However, as stated by the authors, women's experiences depend on other factors (e.g. years of experience, leadership roles, and crewmates). It should be noted that risk-taking also depends on personal risk/gain analysis regardless of gender. Understanding differences and similarities between female and male attitudes and perceptions towards safety and security can help to reconfigure the SA in disaster recovery and SAR fields.

ASSISTANCE will address this issue for both FRs involved in the project and citizens. A preliminary approach was conducted to explore the gender dimension in awareness and risk perception of citizens. It involved a pilot questionnaire administrated to 54 participants (female: 29; male: 25) between 18 and 65 years old. Responses were divided by gender and contingency tables were analysed using Fisher's Exact tests. Figure 4 summarizes the main findings with ($p > 0.05$ no significant gender differences; $p < 0.05$ significant gender differences). Overall results show that there are differences but also similarities between women and men.

The awareness of women about extreme weather disasters and industrial accidents in Europe is higher than men. However, women and men do not differ in self-perception of preparedness to face disasters. Women may experience higher risk perception in relation to extreme weather, fire disasters, and terrorist attacks. Then it will be necessary to determine sources of gender differences and the underlying mechanisms (e.g. gender norms, gender identity, gender relations, interaction with other factors, etc.) and consider alternatives and/or options to implement solutions.
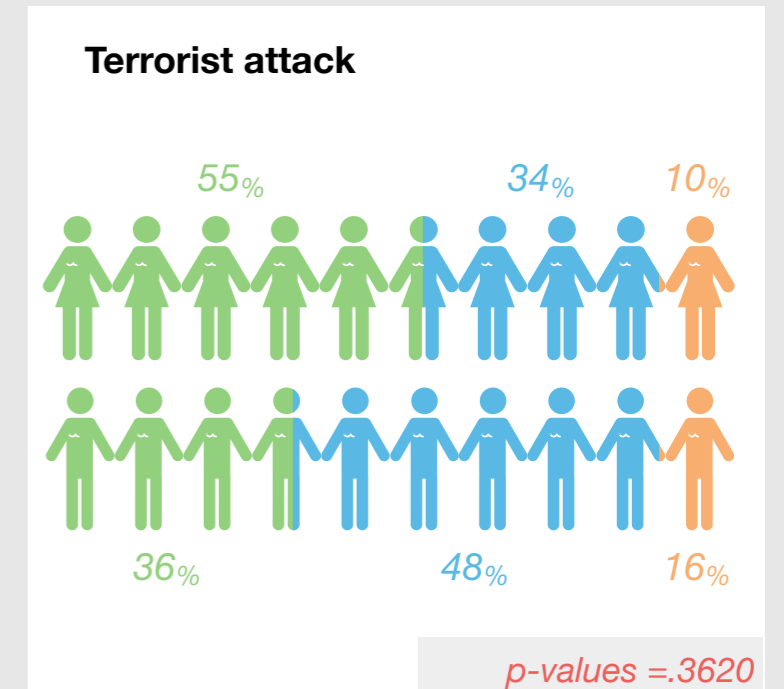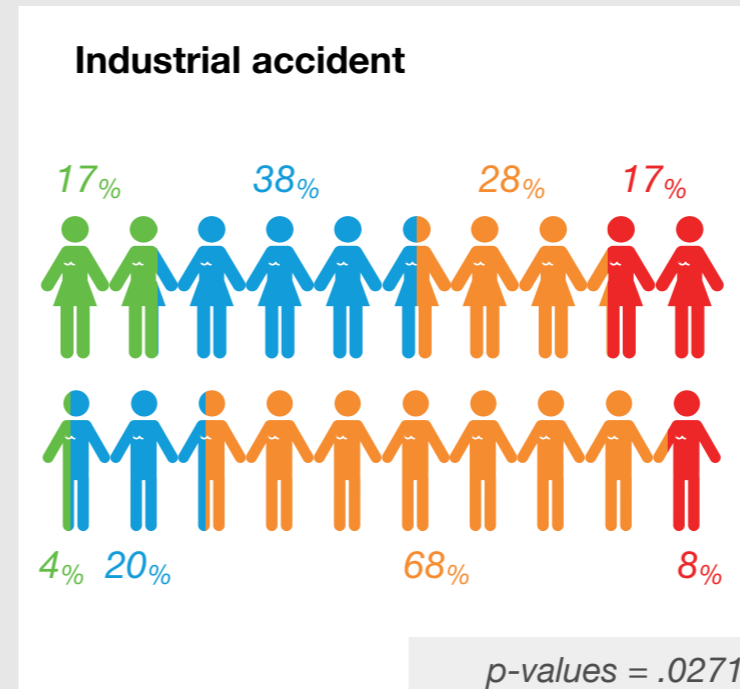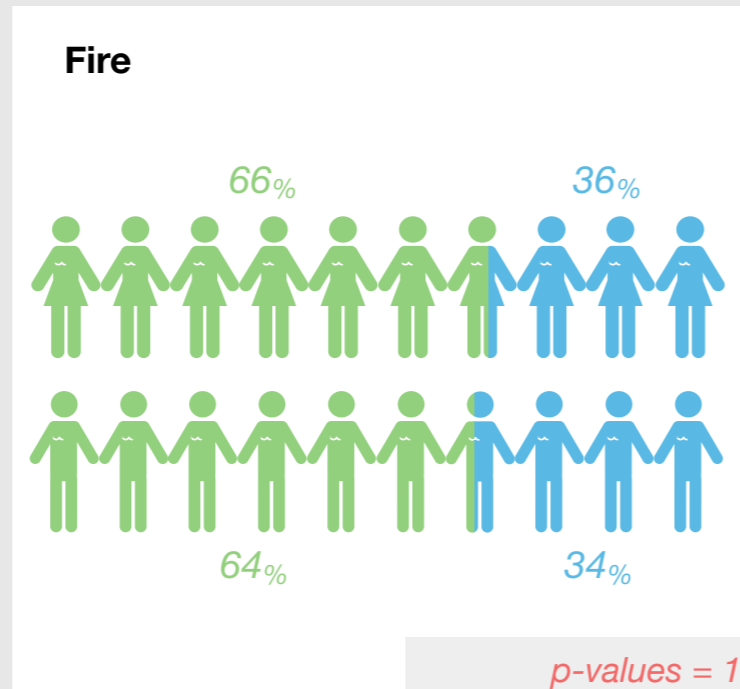

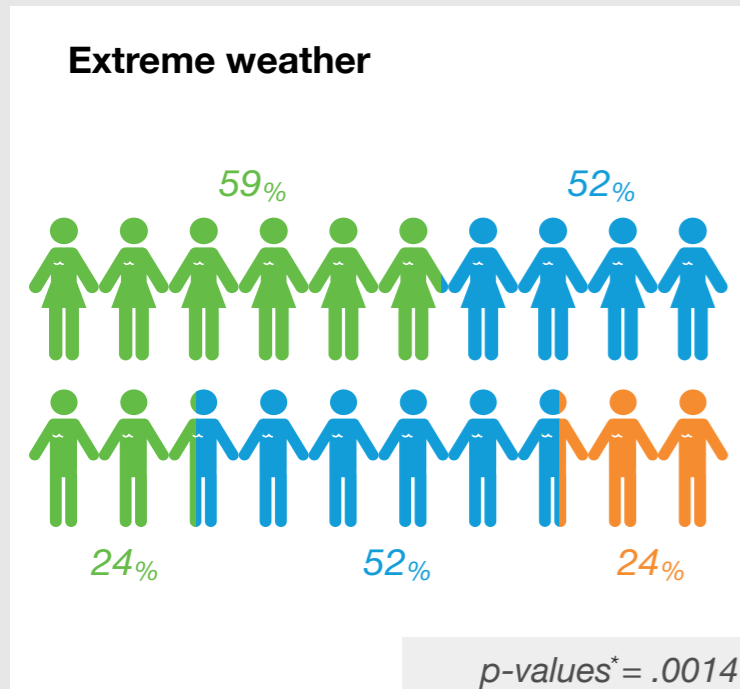6 http://genderedinnovations.stanford.edu/

Likelihood of disasters in Europe (%)

GENDERED ATTITUDES TOWARDS DISASTERS

This exploratory study introduces gender dimension in awareness and perception of potential disasters. It is a preliminary example to promote the importance and study of gender in SA and SAR.
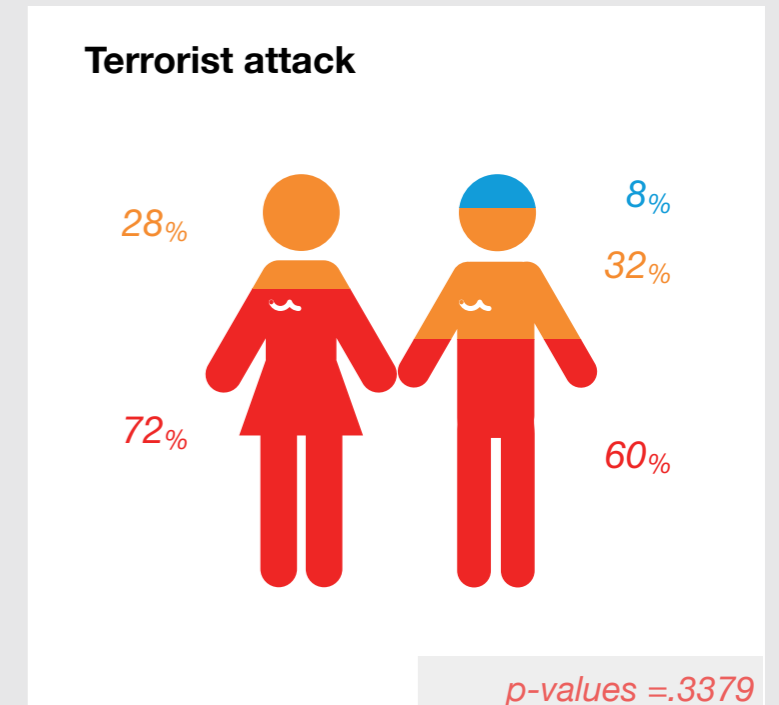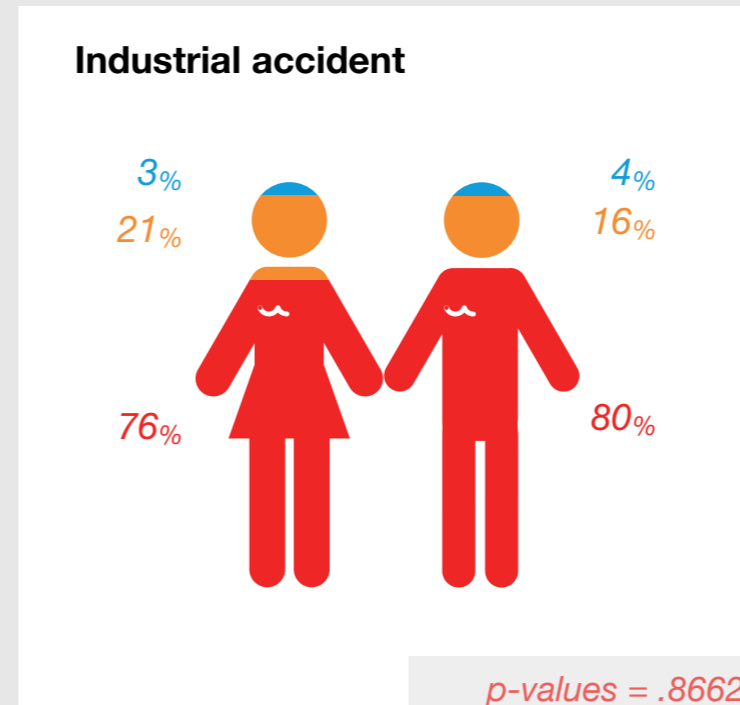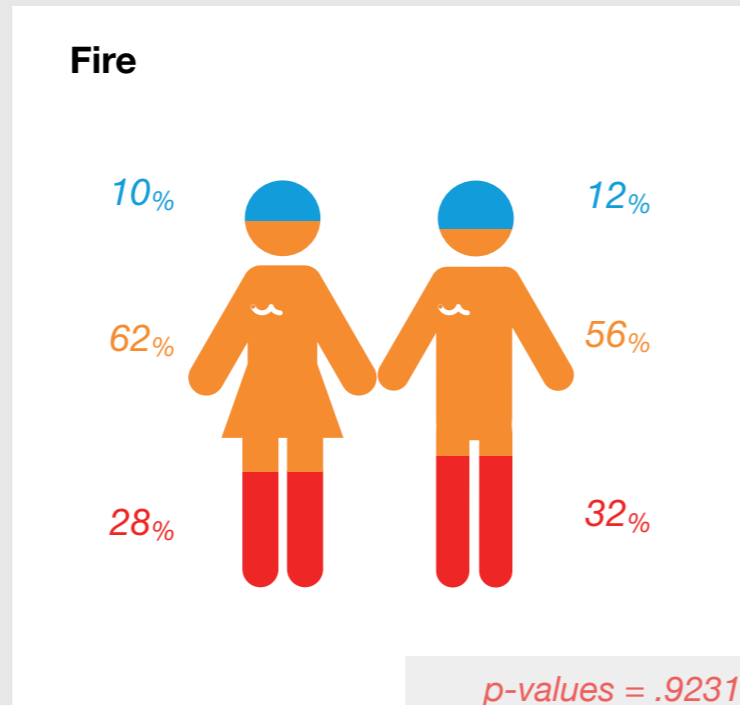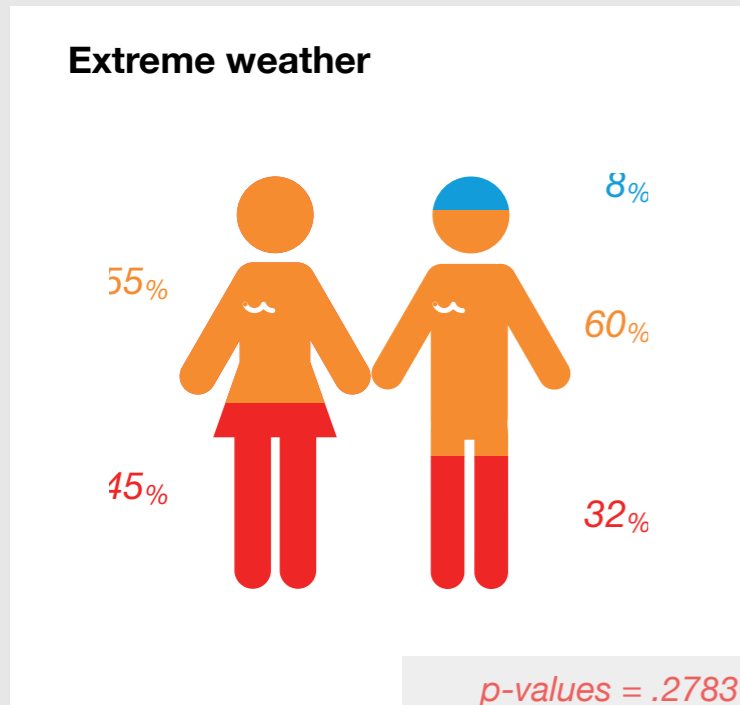
Extreme weather

59% · 52%

24% · 52% · 24%

p-values = .0014

Fire

66% · 36%

64% · 34%

p-values = 1

Industrial accident

17% · 38% · 28% · 17%

4% · 20% · 68% · 8%

p-values = .0271

Terrorist attack

55% · 34% · 10%

36% · 48% · 16%

p-values =.3620

*Differences between means were tested using Fisher's Exact Test (α=0.05). The **p-value** for each is reported below and non-significant values are highlighted by shading over each chart.*

Very Likely · Likely · Unlikely · Very Unlikely

Self-perception of preparedness (%)

Extreme weather

8%
55%
60%
45%
32%

p-values = .2783

Fire

10%
12%
62%
56%
28%
32%

p-values = .9231

Industrial accident

3%
4%
21%
16%
76%
80%

p-values = .8662

Terrorist attack

28%
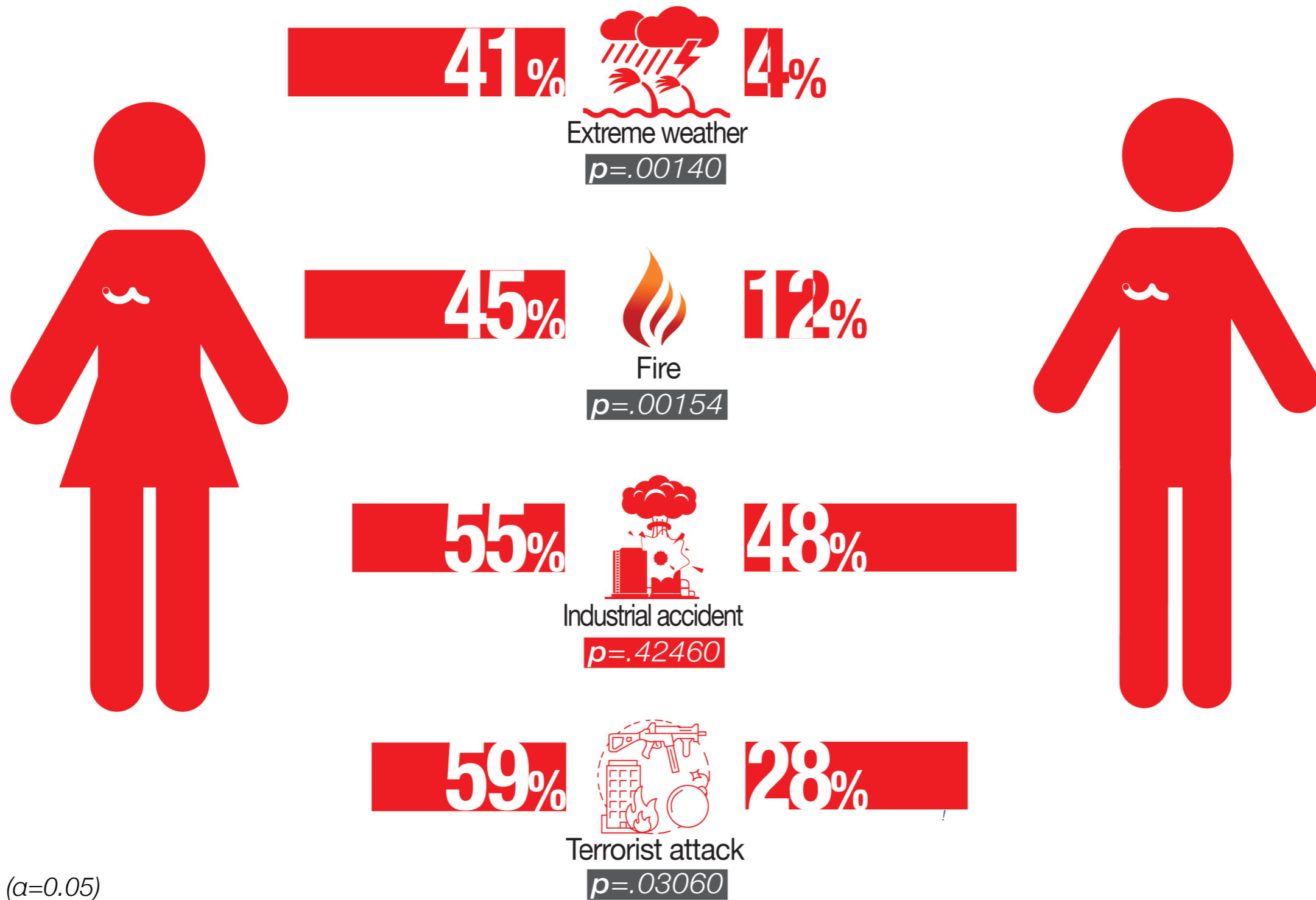8%
32%
72%
60%

p-values =.3379

● **Good** = *"I know what to do"*   ● **Fairly** = *"I fairly know what to do"*   ● **Bad** = *"I do not know what to do"*

Percentage of respondents that perceived each risk as "High" or "Very High"

41% Extreme weather **4%**
p=.00140

45% Fire **12%**
p=.00154

55% Industrial accident **48%**
p=.42460

59% Terrorist attack **28%**
p=.03060

* Fisher Exact test (α=0.05)

4 Conclusion

Gender remains still too a young concept in SAR studies and applications. The differences in gendered behaviours may have a direct impact on the way in which decision-makers, ground level staff, and citizens/victims perceive, understand, internalise, accept, and respond to critical situations.

However, when empirical investigations are conducted in research contexts like ASSISTANCE based on real-scenario's simulations, gender demonstrates its capacity of being a concept able to capitalize inclusion and equality in policy making processes.

In order to move beyond the empty rhetoric of gender equality plans in the SAR field, which per se offer no guarantee for any meaningful action, we recommend – based on the research that we are conducting as ASSISTANCE – the following two actions:

a. focusing on fulfilling those plans with content

b. ensuring training and awareness-raising on the issue in relation to the daily work[7].

In so doing, gender awareness raising in SAR contexts can encourage a general understanding of gender-related challenges in the construction of SA, promote ethical decision-making processes, and improve SAR team performance. It is a simple and effective way to identify specific provisions related to societal dilemmas in complex SAR operations and evaluate the interpretive statements provided within SAR technologies to develop an appropriate and ethics-by-design response.

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7 http://www.bsr-secure.eu/showcase/women-civil-protection/

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