

Empowering Safety Technology for Women’s Solo Journeys: Insights from a Story Completion Study

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The growing trend of female solo travel has brought attention to the unique risks women face while travelling alone, such as sexual harassment and physical threats posed predominantly by men. Therefore this study explores how technology can be leveraged to improve solo women travellers’ physical safety. Through a series of workshops using the Story Completion method, 14 women with experience travelling alone shared experiences and ideas regarding concerns and chances of using safety technology. The results obtained through thematic analysis showed the need for devices that converge technological and non-technical assistance to address the threats women face when travelling alone, utilising authentication, location detection, and sensing technologies.

Additional Key Words and Phrases: Female solo travel, Ubiquitous technology, Story Completion, Thematic analysis, Physical safety, Sexual harassment

1 INTRODUCTION

The phenomenon of women travelling alone is no longer a rarity but a growing global trend [11, 12, 22, 25]. Despite this increase, many women still hesitate to embark on solo journeys due to the higher risks they face compared to men [9, 13, 24]. Of particular concern are the issues of sexual harassment and assault, including stalking, catcalling, rape, and invasive male gazes [7, 11, 14, 15, 18–20, 23]. Paying attention to this issue, our study aims to examine how technology, specifically within smart devices like smartphones, can be utilised to improve the safety of women who travel alone, with a specific focus on addressing the risks of sexual harassment. The question guiding our research is “*How can ubiquitous technologies be integrated into smart devices to increase the safety of female solo travellers?*”

2 BACKGROUND

As highlighted by several studies [10, 18, 24], addressing gender inequality and safety concerns women face in travel necessitates close examination and proactive efforts from the academic community to enhance women’s safety rather than shifting the burden onto women themselves. With the continuous increase in female travellers, comprehending the vulnerabilities and awareness of risks they encounter during travel becomes a paramount concern. While there is a paucity of research focusing on this specific problem, some studies have investigated how current technologies are being used in the travel sector. These technologies can be categorised into three groups based on the works of Not et al. and Moisa et al.: identity authentication technologies (such as NFC, RFID,

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and facial recognition), location detection tools (including GPS, QR codes, augmented reality (AR), infrared (IR), and Bluetooth), and sensing technology that can detect human activities and environmental factors [16, 17]. Additionally, the ubiquitous presence of mobile phones has made them indispensable companions for travellers, not only enhancing their overall travel experiences but also increasing their sense of safety [1, 4]. By leveraging these technological advancements and conducting further research in this area, the travel industry can better address safety concerns and support the well-being of female travellers.

3 STORY COMPLETION METHOD

Story completion is a method where participants are asked to complete provided story stems with their ideas, interpretations, and responses [5, 8, 21]. This method is chosen due to its significant potential for exploring sensitive or distressing topics such as sexual harassment, as it allows addressing personal experiences indirectly through nonpersonal narratives [5]. For the study, five offline workshops in a group format were conducted, and 2 to 3 people attended each workshop. The total number of participants is 14 females between the ages of 18 and 31, and all of them have the experience of travelling alone at least once. The group setting can improve the participation rate and data quality and has the advantage of being able to actively respond to participant questions during story completion, so the experiment was conducted in the form of a group workshop. The workshops lasted 45-90 minutes, depending on participant numbers and writing speed. It began by welcoming the participants and introducing the workshop, a demographic survey, a warm-up session with a collaborative mind map exercise and a brief explanation of the technology used in the travel industry today. Afterwards, in the core part of the workshop, story completion, participants were presented with three storylines featuring Laura, a young woman travelling alone in a foreign country (Fig.1.a). Participants were asked to imagine and write down individually the dangers and solutions that Laura faces during her travels according to the flow of each of the three given stems (Fig.1.b). They were encouraged to be creative and not limit themselves to technological feasibility. Finally, a feedback session was conducted to gather participants' thoughts on the procedure and any changes in their views on solo female travel. Consequently, a total of 14 stories (made up of 42 stems) obtained through the above process are analysed through thematic analysis [2]. This method, primarily used in qualitative research, is characterised by its high flexibility and is helpful for systematically identifying and organising meaningful patterns and themes in the entire dataset [3, 6]. Using this approach, we constructed patterns regarding the threatening situation, types of devices, device features and technologies used, reasons for their failure, and additional factors related to female solo travel. These patterns are categorised according to relevance, and hidden themes can be revealed by linking essential aspects of related categories. Based on this, key findings will be introduced in the subsequent chapter.

4 RESULTS

In this research, we aimed to explore how ubiquitous technologies can be integrated into smart devices to increase the safety of female solo travellers. The collected stories exhibit similar settings across all three stems, with the majority of participants (9 out of 14) describing a male offender, often inebriated, who verbally harasses or follows the protagonist Laura. These incidents usually occur late at night on empty streets or public transportation stops. In the following, the main findings will be presented, focusing on the application of current safety technology, related concerns, and participants' preferred technological solutions.

4.1 Use of Technology for the Safety and Related Concerns

Figure 2 summarises our first key finding, demonstrating the most frequently mentioned devices, technologies and their limitations in mitigating risks. It also reveals how the narratives develop and shows overarching themes across the three stems. Notably, 11 out of 14 participants chose to deal with risky situations in Stem 1 by applying

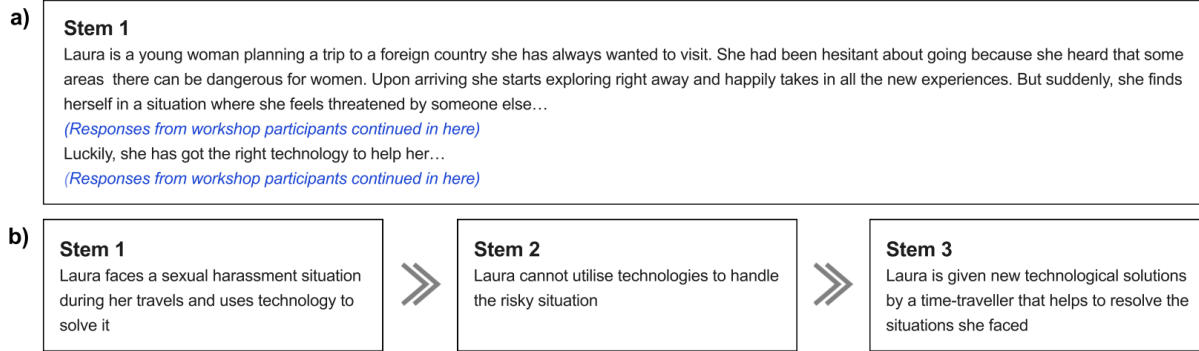


Fig. 1. Story Completion Task Example and Structure

Stem 1 - Current Technology	Stem 2 - Limitation	Stem 3 - Futuristic Solution
Smartphone (11)	Out of battery (2), Cannot use phone (4), Poor reception / WiFi connection (4)	Small/ camouflaged device (7), Smartphone (4), Wearable device (3)
GPS (10), SOS button (4), Avoidance strategies (2)		GPS (4), Self-defence weapon (4), Bio sensing (2), NFC/RFID (2), Physical barrier (2), SOS button (1)
Contact law enforcement (12), Share live location (10), Get other people's help (7)		
<div>(Number in brackets = The total number of participants who included these in their stories)</div> <div> <div>Device</div> <div>Technology</div> <div>Function</div> </div>		

Fig. 2. Analysis table of the story completion

GPS technology or the smartphone's SOS function to inform people close to Laura or the police about the problem and her location. Out of the 14 participants, 10 describe Laura feeling scared or unsafe, often due to being outnumbered or because the people around her act drunk and suspicious. This could explain why numerous narratives heavily rely on seeking help from others. However, it is important to recognize that outside assistance is not always available. A recurring theme in 10 of 28 the Stem 1 and 2 stories is the absence of people in Laura's vicinity who could offer assistance in these situations. Another frequently mentioned reason for not being able to escape the threatening situation is Laura's inability to use her device due to concerns about pickpockets or physical attacks by men. P6 (Stem 2): "As he still proceeds as he wishes, she tries to use her phone to film him to get him to stop, but the guy just hits her phone out of her hand." The second most common issue is a lack of internet connectivity and battery, limiting essential functions in smart devices such as smartphones. Furthermore, the participants were explicitly instructed to incorporate technological solutions into their stories for solving the risk cases. Nonetheless, several non-technological safety measures were included in Stem 1 and 2 narratives, such as seeking assistance from individuals in their surroundings or avoidance strategies such as avoiding eye contact or changing the sidewalk.

4.2 Envisaged Technological Solutions

The technological concerns described in the first two stems are reflected in the "futuristic" technologies envisaged in Stem 3 narratives. Respondents reduced their smartphone dependence and explored using other smart devices,

such as wearables or newly invented devices. Instead of relying on GPS and the SOS button, which may not work well depending on the region one is travelling to, participants considered using diverse technologies, such as biosensors, NFC, RFID or creating a physical barrier between the victim and the offender. *P10 (Stem 3): "The device meanwhile detected Laura's heart rate, her voice as she screamed for help and concluded that she did not feel safe."* Interestingly, respondents also considered integrating non-technical methods like self-defence tools into smart devices. *P14 (Stem 3): "Also, the wristband unfolds some self-defence features, like a super bright lamp that dazzles the offender's eyes, some sharp spines to facilitate the self-defence."* This may be because technical support is not always available in dangerous situations, as described in 4.1. Another notable observation is that the safety-supporting devices created by respondents in Stem 3 are generally small and camouflaged as ordinary objects to hide their actual function. *P9 (Stem 3): "A small device you can attach to your purse. On the outside, it looks like a small mirror. [...] Users can pretend to retouch their makeup or fix their hair while at the same time sharing their info and location with future help."* This finding indicates that there is a desire among women travelling alone for safety devices which are small in size and effectively hide their safety features. Also, given the limitations of using the technology identified in Stem 2, the device should be able to operate on its own without relying on an internet connection or reception. The specific issues mentioned in Stem 2 for smartphones as a safety tool were lack of assistance and device usability. In response, participants envisioned alternative solutions using wearables, biosensors, and disguised devices. They also integrated self-defence tools and emphasised the need for comprehensive safety strategies. The findings highlight a shift towards diversified and integrated approaches to personal safety in the future.

5 DISCUSSION

Our study investigated the technological needs of female solo travellers using story completion [5, 8, 21]. This method, primarily used to address topics related to women's sexual vulnerability [5], allowed participants to safely share their personal experiences and thoughts on the questions of technology against sexual harassment and other potential threats of solo female travellers. The findings allow us to look into a novel, sensitive field of applications of technology that was not paid much attention to in the research before. Through this approach, we found a tendency to develop alternative solutions when dealing with threatening situations, including integrating non-technical methods such as self-defence tools into smart devices rather than relying entirely on technology. These forward-looking ideas open up further research and development possibilities to develop innovative safeguards that cater to the needs of female solo travellers. However, it is vital to acknowledge the limitations of our study. The limited number of participants may make it difficult to generalise the results, and the variability in the length and level of detail of the data collected could cause problems in the analysis process. Additionally, not all stems explicitly addressed the issue of sexual harassment, and some participants expressed little concern about it during travel, which may limit the search for safe solutions. Despite these limitations, our study addressed a gap in research on the perspectives and technological needs of female travellers travelling alone. Participants expressed appreciation for the opportunity to reflect on the risks associated with travelling alone, indicating that our study had a very successful and significant impact.

6 CONCLUSION

This study yields insights into women's solo travel experiences and safety concerns and how technology can be used to mitigate these risks. By exploring women's perspectives and apprehensions related to technological safety measures while travelling alone, we identified the need for small and camouflaged devices incorporating technological and non-technological strategies to protect one's own safety without requiring an Internet connection. We believe our research will serve as a foundation for developing better services and devices that improve the well-being of women's solo travel in the future.

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