

Guerilla Warfare and the Use of New (and Some Old) Technology: Lessons from FARC-EP's Armed Struggle in Colombia

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ABSTRACT

Studying armed political struggles from a CSCW perspective can throw the complex interactions between culture, technology, materiality and political conflict into sharp relief. Such studies highlight interrelations that otherwise remain under-remarked upon, despite their severe consequences. The present paper provides an account of the armed struggle of one of the Colombian guerrillas, FARC-EP, with the Colombian army. We document how radio-based communication became a crucial, but ambiguous infrastructure of war. The sudden introduction of localization technologies by the Colombian army presented a lethal threat to the guerrilla group. Our interviewees report a severe learning process to diminish this new risk, relying on a combination of informed beliefs and significant technical understanding. We end with a discussion of the role of HCI in considerations of ICT use in armed conflicts and introduce the concept of counter-appropriation as process of adapting one's practices to other's appropriation of technology in conflict.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**;

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Infrastructure, Appropriation, Political Conflict, War

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1 INTRODUCTION

Computers and information communication technology (ICT) have become a crucial component of the infrastructure of conflicts around the world: the Islamic State had an extensive social media strategy [39], for example, using it for recruitment purposes [8]. The Nigerian terrorist group Boko Haram employs Twitter to convey their ideological position [10], and thus building a network of followers [11]. The Pakistani extremist group, Lashkar-e-Taiba, used Google Earth and mobile phones extensively to plan and coordinate their attack on a hotel in Mumbai in 2008 [13, 31]. Such technologies are not only used to carry out attacks, but also to coordinate civilian emergency responses, for example following the attack on a park in Lahore, Pakistan in 2016 [20]. Over the past decade or so these specific usages of digital and information communication technologies have received increasing scholarly attention, especially from within the CHI and CSCW community [6, 42]. Such studies show that the use of these technologies is embedded in complex interactions between culture, political conflict, materiality, other technologies and existing social practices. They are appropriated and made to work by actors in distinct ways to respond to situated needs and requirements. In this paper we report on investigations

done in Colombia with former combatants and members of the well-known guerrilla group, FARC-EP. The group was one of the main protagonists in a conflict that went on for over 50 years and involved various left-wing rebel groups, right-wing paramilitaries, criminal outfits, the national army and even the United States through the policy agreement called Plan Colombia. The war cost over 200,000 lives [2], generated one of the highest numbers of internally displaced persons in the world [1], and finally ended in 2016. Previous studies have investigated the role of social media in conflict, and traced the slow evolution of infrastructures, including social media use, in conflictual and post-conflictual situations, as we show below. Few have, however, detailed the way in which attritional infrastructures, as we term them, engender counter-appropriations, perhaps because of the sheer difficulty of obtaining data in such situations. In what follows, we describe how geo-locating and sensing technologies were used by the national army against FARC-EP and the painful learning process the guerrillas had to undergo to adapt to these new attritional circumstances, and their consequences for the practices of FARC-EP. Where previous studies of a similar kind often made use of or were complemented by online investigations, then, the present case relies solely on empirical data obtained *in situ*.

2 RELATED WORKS: TECHNOLOGIES OF CRISIS AND WAR

For several years now, research has examined the role of technology and especially digital media in politically contested and conflict-laden situations or in cases of political activism. Studies have for example examined the role of IT applications in the European Social Forum [29]. The political uprisings that have been summarized under the rubric, “Arab Spring,” have drawn scholarly attention to the use of social media in conflictual situations [6, 19, 22, 28]. These studies have looked, for instance, at how platforms such as Facebook and Twitter have been used during protests in Tunisia and Egypt [6, 19]. Many of these studies relied on the analysis of online data such as Tweets or blogs to understand how activists have utilized these media in their protests. This approach enabled the study of potentially dangerous contexts in relative safety. Using online surveys, Kavanaugh et al. [18] studied how young Tunisians used media during the Tunisian Revolution in 2011. Ban Al-Ani et al. (2012) [6] investigated the use of blogs during uprisings in Egypt in the same year. Using both quantitative and qualitative analysis of posts made by Egyptian activists, they were able to identify counter-narratives Egyptian bloggers created in protest against the government of Mubarak. Similarly, Mark et al. [23, 24] focused on the study of “war diaries” that Iraqi

bloggers published during the war in Iraq. Their study examines the relationship between war-related posts and other topics, such as posts about daily routines. Exemplifying a quantitative approach to the study of social media in protest, Zhou et al. (2010) [45] analyzed 3 million tweets made in Iran during post-election protests in 2009. Their account provides insights about how information spreads, specifically on Twitter. While such online studies shed light on digital technology and media in potentially dangerous contexts, they tell us less about how these technologies are used on the ground. Several studies have tried to engage activists and participants directly and investigate the actual practices. Using telephone interviews, Semaan and Mark (2011) have studied how ICTs help Iraqi citizens deal with breakdown of infrastructure during the second Gulf War and maintain a sense of normalcy in new social arrangements [34] as well as build trust and collaborative practices [33]. Only few studies have investigated the role of digital technologies in conflict on the ground, for understandable reasons. Focusing on the protests in Turkey in 2013, Tufekci [40] explored how political activists were using social media, exhibiting a high level of creativity in their practices to escape known surveillance efforts by the government. Wulf et al. [43] investigated how activists in Tunisia used social media platforms to organize protests, share news and mobilize support. In this study they also examined how social media use interacted with more traditional media such as TV, and how both offline and online networks were influential in organising the protests. A similar co-evolution of online and offline practices was observed in a study on the role social media played in Palestinian protests against the wall built by Israel [42]. These studies show how mobile phones and social media are used advantageously by activists in the organization of political protests and the dissemination of information about them. They also shed light on how these infrastructures enabled increased surveillance of activists by government actors, and the creative practices actors employed to escape this surveillance. Relatively few qualitative studies investigate the role of digital technology in the context of open warfare. Rohde et al. (2016) [28] have studied the role of digital media and mobile phones in the Syrian civil war by interviewing protesters and members of the Free Syrian Army. Their data provide further examples of how actors creatively escape surveillance, but also show the need actors face to devise strategies to deal with disrupted digital infrastructure. Shklovski and Wulf [35] have investigated the use of digital media by civil actors as well as combatants in the Ukrainian-Russian war. Their study shows how mobile phones have become a crucial component of the infrastructure of the war, but also how combatants are forced to mitigate the risks phones pose for their lives by enabling localization through enemy soldiers.

Our study presents a continuation of this line of investigation into digital technologies and related social practices in conflict by examining a context of actual war where available infrastructure was radically asymmetrical. By focusing on the attritional use of communication and other technology in the Colombian conflict, and the development of counter appropriations, this paper adds to this narrow canon of literature investigating communication and other technology in warfare. It specifically helps us to understand how guerrilla and rebel groups used technology for their own strategic goals but even more how they evolved methods for dealing with their enemy's use of technology. It does so in a unique context, one where no online traces of behavior are available and hence, only on the ground studies provide for an understanding of events.

The role of technology in the Colombian War

Colombia has been engaged in a conflict that can be described as civil war since the mid-1960s. While there are numerous parties involved, most notably amongst them are perhaps the Fuerzas Armadas Revolucionarias de Colombia – Ejército del Pueblo (FARC-EP), the government and right-wing paramilitaries. Digital and electronic technologies have played a crucial role for one side in this conflict, especially after the involvement of the United States of America through the Plan Colombia [41]. Though originally drafted in 1999, it came into effect in the year 2000, signed by then-President of Colombia, Pastrana, and president of the USA, Bill Clinton. The plan aimed to end the conflict and the related drug trade in Colombia through increased funding for development but especially training and technology for the military and for right-wing paramilitaries. 75% of the funding budget went to military and police assistance [16, 30], the majority of which was given in the form of technology, such as airplanes, helicopters and surveillance technology [30]. This plan was largely considered a failure [16, 30, 41]; one of the plan's main goal was to reduce the amount of cocaine, a major income source for FARC-EP and other guerrilla groups, being delivered to the USA. However, the price, purity and availability of the drug in the USA has remained stable. Violence and insecurity decreased slightly but remained the same in the areas of the country most heavily targeted by the plan [16]. While its goal was also to facilitate the peace process, Isacson found that Plan Colombia had a negative impact [16]. The study we report on investigates in situ the role technology played within FARC-EP, but also how the group managed to adapt to the technologies used against them, introduced under the Plan Colombia.

3 COLOMBIA: A HISTORICAL ACCOUNT

Since Colombia's birth in 1886, the whole country has been politically divided into unstable Liberal and Conservative constituencies. In 1948, Jorge Eliécer Gaitan, a promising candidate in the presidential election of 1950, was killed. He had emerged as a popular liberal figure, who defended rural and workers' rights [25] and was a promising candidate in the presidential election of 1950. This murder in 1948 set off a ten-hour riot in Bogota where an estimated 5,000 people were killed, [21], leading to ten years of civil war and political unrest across the country, known as La Violencia. Around 200,000 people lost their lives during La Violencia [17], even with the National Front agreement between the Liberal and Conservative party, where for 16 years the two parties would govern Colombia together without elections.

Liberal small farmers subsequently rose up and organized in armed groups to defend themselves from members of the rival Conservative Party and defend the ownership of their land from private settlers. This eventually resulted in the formation of Marquetalia Republic, an enclave in rural Colombia, held by communist peasant guerrillas [7]. After the enclave was attacked by Colombian forces in 1964, a surviving combatant, Manuel Marulanda Vélez, together with the intellectual Jacobo Arenas, founded the guerrilla group in 1982. They had revolutionary Marxist-Leninist political and ideological views and believed in the fight for a New Colombia [7]. FARC-EP was the military wing of the Colombian Communist Party (PCC) and employed a variety of military tactics. In consequence of their actions, they became the target of the Colombian army as well as right-wing paramilitary groups who were supported by the Colombian military, following recommendations made by USA military counterinsurgency advisers sent to Colombia during the Cold War [9]. Popular disappointment with the failure of previous attempts to achieve peace led to the election of Álvaro Uribe in 2002, who was opposed to any dialogue without a prior end to violent activities by FARC-EP. Under his presidency, Colombia and the USA intensified their collaboration under Plan Colombia [16], which was originally signed in 2000 by the Pastrana administration. The negotiations for a peace agreement were renewed in 2012 by the president Juan Manuel Santos and in November 2016 it was signed by the Colombian government and FARC-EP, after more than 50 years of conflict.

The structure of FARC-EP

FARC-EP was organized into seven main operational areas located in the Caribbean, Northwestern, Middle Magdalena, Central, Eastern, Western and Southern regions of Colombia, known also as blocks. This was the equivalent to 11 regions and 242 municipalities [27], meaning they were present

in approximately 20 percent of the country. The guerrilla army's organization followed a strict hierarchical centralized structure. Run by the central Estado Mayor, the hierarchy extended down through several levels to the smallest unit, a squad, consisting of twelve members. The size of the organization varied considerably during its 52-year existence. In the last decade of its existence numbers varied between 10,000 and 18,000 soldiers [5].

4 FIELD OF RESEARCH

The context in which the present study focuses and in which it was conducted is a community of former FARC-EP guerrillas. This space is called a Territorial Space for Training and Reincorporation (ETCR) where around 400 former combatants were located following the Havana Peace Agreement. After the agreement, around 7000 members of FARC-EP headed to the 26 transition zones around the country and handed in their weapons. The zones were thought to be purely transitional, allowing FARC-EP members to slowly move towards civilian lives over a period of two years, while receiving 90% of the Colombian minimum wage per month (around 250 USD). However, conditions remain fragile. Several ex-combatants have been executed by unknown perpetrators [4], creating a strong feeling of insecurity amongst the group. There is little or no development funding for projects in the ETCRs and no strategy for the reincorporation of the ex FARC-EP guerrillas. Most importantly there is no sign of access to or redistribution of land in the country, which was a central point in the agrarian component of the peace agreement. Dissatisfied with the process of reintegration and future prospects, some ex-combatants have recently withdrawn themselves and returned to the forests [3]. The specific camp our study is set in is located 3-4 hours by car away from the closest city, only reachable by 4x4 jeep. The area of the ETCR was controlled by FARC-EP for a long time and mostly served the growing of coca. The site has been regularly fumigated with the carcinogenic herbicide glyphosate to inhibit the growth of coca plants. The land is rented by the government from a neighboring farmer. Within a year of moving there, the former combatants were able to build a library, class rooms, restaurants and bars, a small hotel, several small shops, areas of plantation, three greenhouses, some fishing pools, and a meeting hall. The next electricity line is 5km away from the camp and the supply of electricity relies on a diesel generator. The diesel is supplied free of charge by the government but because of access difficulties, the community is frequently without electricity.

5 RESEARCH METHODS

The research methods employed by the authors consisted of an exploratory analysis of observations and unstructured

and narrative interviews. These narrative interviews allowed interviewees to tell detailed stories in cooperation with the interviewer. They often did not take the traditional form of question/answer but are rather like a conversation [14, 15]. The data collection took place primarily in the ETCR, with additional interviews and observations made in Bogota. The first author of the paper travelled to Colombia for the first time in January 2018 as part of a several weeks — long social design workshop. The author spent two days in Bogota and three weeks in the ETCR, and was in frequent contact with the communities. At the end of the event she spent an additional five days in Bogotá, where she reached out to persons affected by the conflict. During this time a first set of comprehensive data was collected. In August 2018 author one returned to Bogota and the specific ETCR, followed by authors three and five to collect further data. During this journey she spent several days in Bogota, again interviewing people whose lives were entangled with FARC-EP and the conflict. After this, she travelled to the ETCR, followed by authors three and five, where they spent 7-8 days. During this time the authors interacted with the camp inhabitants, consisting of former FARC-EP combatants as well as their family members and friends. They also engaged in work and social activities. On both trips, comprehensive data was collected by the authors in the form of field notes. In total, 114 pages were collected, and the authors interacted with more than 50 people. Due to the unstable situation, both researchers and inhabitants of the ETCR were forced to treat their interactions flexibly. Some information was obtained in single conversations lasting several hours, some in repeated interactions, some lasted only a few minutes. Author one and five speak intermediate Spanish, and all interactions were conducted in Spanish. On a number of occasions, they were supported by a translator, who mediated between English and Spanish. Given the still uncertain and unsafe situation that many of our informants are in, with several fearing for their lives, it required intensive trust building between the authors and our interviewees. Repeated trips and many informal interactions led, over time, to a mutually trustful and sympathetic relationship that allowed us to present this account. As the information we have gained leaves some of our interviewees in vulnerable and dangerous situations, we took several precautions to preserve our contacts' anonymity: all names in this paper have been changed. Any other information that could reveal a person's identity such as gender or the locations where specific events took place has been omitted or deliberately changed. We also reveal only the most necessary information about the setting of our research, so as not to reveal which ETCR our informants are part of. Throughout the journey, and upon return, the data was open coded in collaboration with (a strictly limited

number of) other colleagues, ultimately resulting in the narrative presented here in this paper. All authors discussed and compared the codes and themes extensively. The authors remained in contact with their acquaintances and informants through email and social media and at times clarified any questions or uncertainties throughout the analytic process. Finally, it needs to be said that the authors are fully aware that we are presenting a one-sided account: there is much to be said about the appropriation practices of the Colombian army and the experiences and sentiments of Colombian soldiers in this war. Unfortunately, we did not have the chance to learn about their positions and therefore only focus on the members of FARC-EP. We make no judgements about the political positions of protagonists.

6 EMPIRICAL FINDINGS

The FARC-EP operated mainly in the vast and often remote Colombian countryside. Their distributed units were mobile and would move around regularly to control their territory and engage in combat with the Colombian army as well as paramilitaries. All of their equipment, including hospitals, were therefore mobile. Technological progress played a key role throughout the history of FARC-EP, their strategies, tactics and practices: To coordinate the activities of such a clandestine, distributed and highly mobile army, communication inside the organization was key. As a result of the rapidly evolving technologies employed by the Colombian national army, the FARC-EP was forced to develop strategies to deal with this use, even if the technologies at their own hands were much less advanced. We refer to this as counter-appropriation. In the following, we will outline the groups' strategical and personal means of communication. We follow with a description of the introduction of high technology into the war by the Colombian army, and the response by FARC-EP. We will end with a description of how learning was organized as a prerequisite for their adaptation and adoption of new technology.

Telecommunication infrastructure

Laura, a female commander who had been part of FARC-EP for about 25 years, was one of our key informants. While her primary role in the army was that of a nurse, she spent most of her life within FARC-EP as a communication specialist with one of the secretariats.

The Use of Paper. Laura explained that until 1998 communication between secretariats happened via written messages on paper which were en- and decrypted by trusted specialists like herself. By means of different coding schema per secretariat, textual messages were encrypted. Each secretariat's specialist would encrypt messages by translating alphabetic letters into numbers. The sequence of numbers was written

on a piece of paper which was then transported by trusted combatants to the respective recipients. Since FARC-EP operated across the entire country, the transportation of messages could sometimes take several weeks.

The Use of Radio. In 1998, after FARC-EP grew considerably in size, the old communication patterns became less effective. To improve their communication and coordination across the large army, FARC-EP introduced high frequency (short wave) radio communication to communicate between the secretariats. Being mobile units, they now needed to carry around a battery and a radio transmitter in addition to existing gear. Moreover, they needed an antenna which they hung over the branches of trees to cover a sufficient territory. At fixed times, each textual message was encrypted into numbers, which were then read out loud and transmitted via the radio channel for each secretariat. Incoming encrypted messages were captured via a normal radio receiver, written down and decoded. If a mistake was detected by the speaker, the message needed to be repeated. This posed a security risk: the Colombian army listened to the encrypted messages, and repetition increased their chances of breaking the encryption key. To deal with this risk, the codification key had to be exchanged roughly once every six months. At the same time, FARC-EP combatants were listening to transmissions by the Colombian army and tried to decrypt their messages.

Computer-aided encryption. To make telecommunication more efficient, FARC-EP introduced computers to aid with the coding of the textual messages. They identified US American software suitable to their needs. The communication specialist now had to type the messages into the computer which encrypted it and - using a modem and antenna - transmitted via radio. The diminished risk of breaking the encryption by the enemy and the increased ease of secure communication meant that the density of the communication could be increased. After the year 2000, each front had a different cryptography code and was equipped with two computers, one modem, one antenna, two batteries, a compass, and one generator. The radio specialist would be supported by five people to help carrying all the equipment. Each time, it was necessary to find a different place to transmit the data. The communication specialist had to set up the antenna on top of a tree and dig a hole for the generator, to avoid any noise.

Technologies of Sensing, Localization and Targeted Bombing

The introduction of high frequency radio improved FARC-EP's operative capabilities considerably. However, it also made them more vulnerable at the point where a new Colombian government introduced advanced sensor and localization technologies into the war. The use of these technologies

by the Colombian army put high pressure on FARC-EP: it enabled targeted bombing which cost many lives among the guerrilla community. A former fighter, Diego, who was also playing the role of a political educator inside his FARC-EP unit described the new mode of warfare in the following manner: *"It was the war of cowards. The government army was not fighting against us but bombing us from planes while we did not have any air force."* He explained that these bombings were often followed by soldiers arriving with helicopters to kill those who had survived the bombing. Aware of the long-term history of cooperation [12, 38], he stated that the technologies were provided by the USA under Plan Colombia. Several former combatants told us of small electronic devices the Colombian army applied as localization technologies. They called them 'microchips,' and believed they were clandestinely placed in many types of supply such as clothes, food, or even lighters, and aided the localization of FARC-EP. FARC-EP suspected that the intelligence units of the army were able to identify materials which were ordered by the guerrilla through friendly farmers. If a farmer was found by the army to be ordering large amounts, unlikely to be needed by immediate family, the army would suspect a collaboration with FARC-EP and, it seems, added their devices to the order. The consequences of this location tracking and precision bombing were often devastating. A story which we heard from different members was the killing of Mono Jojoy, at the time of his death the second in command in the hierarchy of FARC-EP. Laura told us: *"Jojoy had problems with his legs so he needed special boots. We assumed that the boots which had to be produced specifically for him in Bogotá contained a microchip. At the moment of his death he was inside a larger camp with many fighters around him. The bomb targeted him directly. It is hard to believe that this was an accident."* Another commander called Fabio, a student of chemical engineering before joining FARC-EP, mentioned that the microchips were just one element of the high-tech equipment used by the government against FARC-EP in the civil war. The government's high-tech strategy also included cameras to observe strategically important places, goniometer devices to locate anything that could transmit signals, and sensing equipment to detect the amount of bodies passing in front of it. He also spoke about the danger created by surveillance planes the government used which were equipped with sensors to detect heat emitted from bodies, radio waves from the guerrilla's equipment, and location data from microchips inside their supplies. He called IT "imperialist technologies" and stated: *"You go only in through the front door but they [the enemy] also have the backdoor"*. Another commander explained that the technological strategy of the Colombian army was specifically directed against FARC-EP's ability to (tele-)communicate, especially aiming

to disrupt their use of radio transmitters. Their actions had two main effects on FARC-EP: 1) localizing radio emission enabled them to detect FARC-EP presence and direct their planes and bombs accordingly and 2) in the case where the local commanders stopped communicating due to the threat of being targeted, the actions of the guerrilla became uncoordinated and slowed down. While the Colombian army's appropriation of advanced technologies impacted the war considerably, there was a consensus inside FARC-EP that the army was also able to infiltrate FARC-EP ranks directly. Laura explained that however good the US technology was, the guerrillas learned how to deal with it and developed several strategies to decrease the risk the enemy's technologies posed for them: To ensure that supplies were not contaminated with 'microchips' they decided to store food outside their camps at a distance. New supplies would be stored away from the camps for several months and the guerrillas observed whether their location was attacked. Boots had their soles punctured with a sharp piece of hot metal to damage any microchip. To avoid detection by heat they cooked food only during daytime and instead of open fires they began to only cook on small gas heaters. The troops distributed themselves during the night over a larger sleeping area to lessen the heat signature their bodies emitted. Night guards no longer used torches but instead encircled the camp with ropes which they could use to trace their patrol routes. Another commander added that FARC-EP reduced the size of their units and moved them closer to populated areas. It took FARC-EP considerable time and effort to understand these technologies and how to protect against them. At a later point they identified technologies to help find and destroy 'microchips' in their goods: A former combatant explained, that FARC-EP received devices to create 'electro shocks' to destroy the microchips. From now on, they would treat all the incoming supplies with these devices to destroy the chips and mitigate the risk of targeted attacks. It needs to be noted that the effect of high technology and targeted attacks had devastating effects on FARC-EP: it cost thousands of lives and the group lost an entire generation of its leadership during the period of high-tech warfare. Nevertheless, in many ways they were able to adapt their tactics and deal with the technology of the enemy to avoid a decisive defeat.

Mass Media Production and Use

It is crucial to note that communication technologies were not only used by the FARC-EP for coordinative purposes, but also served more general communication aims — at times strategic, at times for social and cultural purposes. This included the use of radio as a mass communication medium to gain and broadcast information. Radio was also used by the national army and FARC-EP needed to again counter

radio-based activities by the enemy. In the following we will outline the role ICT played as mass communication media for FARC-EP.

The role of Radio. Radio programs are still important mass media in Colombia and were certainly crucial for the information needs of a guerrilla group permanently on the move. Radio was the main source of information for the majority of FARC-EP members - only very few people had access to TV. Many fighters owned their own radio receiver, and even those taken prisoner by FARC-EP were given radios to listen to news or for entertainment purposes. To influence public opinion and to produce programmes for their fighters, FARC-EP was also running its own radio stations during the civil war. As the urban activist, Maria, told us, such a station was for example based in the high mountains south of Bogota. She explained that the cold weather at altitude made it a relatively safe location as the army would not pursue them there. The elevated location high in the mountains also helped to distribute the programme widely. The group of radio activists was producing a nation-wide program for several hours at a certain site and then would wrap up their equipment to escape detection by the army's localization technology. They would carry it manually to a new location, to build it up again, and start producing the next program. FARC-EP also used the radio communication infrastructure for non-encrypted transmissions of speeches by members of the secretariat. At such events the emission time was communicated beforehand to all units so that everybody could listen. FARC-EP members were generally encouraged by commanders to listen to FARC-EP radio. However, several radio stations in Colombia were controlled by the army, who actively used this channel to reach FARC-EP members. These stations constantly distributed the government's ideology and tried to demotivate fighters. A commander we spoke to, remembered the calls well: *"Demobilize!" "Surrender!"*, constantly, attempting to destabilize FARC-EP. These stations were sending targeted messages straight to specific commanders or troops, discouraging them from continuing the war. Messages like: *"Your mother is waiting for you at home"*, or *"Come take care of your child, he/she is waiting for you"*, spoken with the voice of a child, were often repeated on the military radio stations. Given the limited communication options, listening to it was a default option.

The introduction of internet. At a later stage in the history of FARC-EP, the internet also took on an important role in the group's ICT provision. Since an internet connection was largely unavailable in the jungle or the remote countryside, guerrillas that operated in the urban areas were responsible for the task of collecting internet content such as text, audios and videos files. The data arrived in the fighting units on

USB sticks to the communication specialist who would hand it over to the local commander. The commanders would select what would be accessible to their unit. One of the commanders we spoke to admitted that he had a certain interest in controlling the flow of information to his unit. This very restricted access to mainstream media such as TV or the internet created the ground for the emergence of a distinctively independent culture within the camps. Largely deprived of cultural media, FARC-EP members started writing their own songs, developed their own dances style and cultural outfits. Each camp had its own group of dancers which developed and performed specific choreographies for important celebrations.

Informal Communication and Use of Mobiles

Given the secretive nature of the FARC-EP, members were required to cut most of their ties to the outside world and communication happened predominately within the group. Minimal contact with friends and family however was maintained. In addition to contact via public telephones, written messages were also passed on to families of FARC-EP members. The message was transported through the FARC-EP support organization to a certain location and then the recipients could pick them up. At certain points combatants were allowed to go in groups to a landline telephone and make private calls. To ensure their security, they would conduct their phone calls together, and everybody could hear what was said. These informal communication practices changed with the extended availability of mobile networks. The availability of mobile phones challenged FARC-EP's discipline and leadership. We learned that some FARC-EP fighters, for instance, started to own private phones. In one case a fighter was carrying his private mobile and whenever he got network connectivity, he called his family who were living in another country. When we inquired about security concerns, he explained that they would not mention their location on the phone and that *"the army was mainly behind the big commanders!"* - implying that their practice may not have been dangerous. The technologically savvy FARC-EP leadership was well aware of the risks such behavior theoretically posed to other members of a unit and the organization as a whole. These practices were therefore deemed unacceptable and strictly forbidden, Laura explained to us. Each commander had to check the bags of their soldiers regularly. When a mobile phone was found disciplinary measures had to be taken. However, she acknowledged that an informal use of mobiles existed. Especially in the months before the Havana agreement the use of private mobiles was widely practiced inside FARC-EP. In order to prevent spies from leaking vital information Fabio had ordered that the tower that supplied the signal to the region over about 50 km² be destroyed. "We

wanted to make it as difficult as possible for them". He also expressed his general worries about the presence of mobile phones and other devices amongst his troops: *"I would have loved to put all of these devices into a Faraday cage, so nothing, no signal, could go in and out of there!"*

Learning within Farc

Throughout the entire existence of FARC-EP, obtaining knowledge and spreading it amongst its members was a crucial component of the activities of the guerrilla. In fact, knowledge was such a central aspect of FARC-EP that some of the ex-combatants we talked to stated that their main reason for joining the FARC-EP was the possibility of learning. In the rural areas where FARC-EP mainly acted, there was little to no public education and peasants were frequent collaborators of the organization. One ex-combatant told us *"I was almost nine years old when I decided to join FARC-EP, I knew how to read and write, so I started reading the statute."* While the importance of education to the organization was empowering to its members, it was also used as a form of punishment: members that were found to be lacking discipline, for example, by carrying a private mobile phone, were subjected to punishments which included a didactic element, such as copying a book chapter by hand or giving a lecture about security. Learning activities were constant and daily: in daily school activities political science, history in general and even reading was practiced. In classes, they used a dialectical method: *"a discourse between people holding different points of view about a subject, to establish an agreement through argumentation"*, Diego explained to us. Members were encouraged to study by themselves and discussions on various topics would take place every 15 days. FARC-EP also offered 30 to 120 days learning activities, especially focused on political science, ideology or military strategy, conducted by FARC-EP experts. Students would move to a safe place in the jungle for the duration of the class. There were also strategies for obtaining new knowledge from the outside, especially when it came to communication technology, economics, medicine or defense and weapons systems. Groups of three students would go to urban areas for a duration of three to six months. Upon their return they were required to teach what they learned to chosen representatives from each front. Depending on the subject, knowledge would be circulated further internally, but often the new skills would stay with the chosen specialists inside the front. Learning also happened in informal ways within FARC-EP, often through trial and error. This approach was especially valuable when it came to technology. FARC-EP members would acquire much of their understanding of technology through experimentation. As Juan told us: *"FARC was always learning things. Almost everyone had a small radio, so we had to know how*

to fix it. We used to open not only the radio, but the computer, cellphones, every electronic device, to check what was inside and rebuild." The thorough technical, practical but also social understanding of technology amongst some members became especially apparent in a discussion we had with Fabio: *"We want to appropriate the technology available, it is a collective good. Technology is a human sacrifice; every piece of technology has a drop of blood ... But are we condemning the use of it? No, we should go slower, in a responsible way. ... I would like to adapt the technologies to my needs and instead of myself adapting to the technology."* Others had a much more practical approach, one person told us: *"I just need to know enough to make it work."*

7 DISCUSSION

In this paper we present a unique account of a guerrilla army's efforts to use old and (relatively) new information technology for their own aims, while at the same time countering the enemy's employment of much more advanced technology against them. This has caused tremendous losses amongst soldiers and leaders within the organization and weakened FARC-EP considerably. Yet our data also shows how the group managed to diminish the threat with typically low-tech solutions. In times where warfare is often unbalanced, and national armies find themselves in conflict with distributed and fragmented armed groups, our narrative has implications for how we understand the role of advanced and other technologies in such situations. In the following chapter we will discuss how it was possible to resist 50 years of attrition. We will also discuss how FARC-EP managed to employ the rather simple technology at their disposal to achieve coordination of distributed groups over a large terrain.

Technology For FARC

Throughout the entire history of FARC-EP, it was a predominantly rural organization, and their foothold in cities was minimal. This strictly limited their access to new technologies and to related knowledge. As a result, the technology they had at hand was simple: the technological infrastructure on which their operations relied were mostly paper and radio, and at a rather late stage radio communication was aided through computer encryption. The perhaps most pervasive technologies of the last 20 years, mobile phones and the internet, were hardly used and at no point did they play any strategic role in their operations. Given that their operations relied on the successful coordination of large numbers of combatants divided into small units and distributed across a vast area, communication was crucial. That it was managed successfully with extremely limited resources, is remarkable.

Attritional Infrastructures and Counter-Appropriation

In many ways the FARC-EP avoided defeat by a technologically much more advanced enemy who enjoyed the support of the government and military of the USA. The availability of technological infrastructure in this war was radically asymmetrical: while FARC relied on rather simple technologies, the Colombian government had highly advanced warfare technology at their disposal. The practices described in this paper can largely be understood as a way to address this asymmetry by FARC-EP. The use of various kinds of localization technology to enable targeted bombing of FARC-EP's locations initially put the guerrilla under high pressure. A variety of techniques and technologies were employed to locate FARC-EP camps, to a large extent supplied by the USA under Plan Colombia [30]. Once a FARC-EP presence had been detected, they were attacked through targeted bombings. Building on the salient features of infrastructure as described by Star and Bowker (2002) [36], the use of these technologies by the Colombian army can adequately be described as an “attritional infrastructure,” one which evolves over a considerable period of time but with a specific aim in view: the destabilisation and eventual destruction of an opposition. Such evolving sociotechnical arrangements consist in a mutually informing set of actions and reactions, embedded in other material or social arrangements. For example, the army relied on knowledge of specific practices of FARC-EP such as ordering goods or carrying radios, places where localization devices can be hidden. These localization devices are made to be invisible to FARC-EP and are the foundation to the precision bombing attacks the army carried out. Through the attritional use of infrastructure, the warfare the army was engaging in, attempting to continuously degrade their capability in repeated attacks over extended periods of time, rather than seeking decisive victory. These losses forced the guerrillas to deal with these attritions: They gradually learned, and over time managed to develop, a set of strategies to evade the army's localization, with the support of technology but most often without. In fact, their strategies often consisted of simple security practices: To avoid localization through heat detection, combatants started to employ different cooking methods and to sleep in more dispersed arrangements, so as to emit less heat. To escape cameras or sensors they avoided using the same paths. Trenches were dug in different locations to provide increased opportunities to seek shelter in case of attacks. The devices that were described to us as ‘microchips’ probably provided a more difficult challenge. Without in-depth knowledge it is difficult to guess the function of an electronic chip from its appearance. Once FARC-EP members detected them in their supplies it was only possible through a very painful process

to learn their functionality. Their size made them hard to detect. It was unclear which goods contained them, and if they in fact were present in any suspicious goods. To avoid detection a simple strategy such as leaving new supplies in specific areas for an extended amount of time, to see if the location would be attacked, was adopted. Later on, technological support was also used to scan goods and treat some with electric shocks to destroy any tracking chips. FARC-EP's strategies and eagerness to acquire knowledge were likely crucial. Their experience with trial and error modes of learning, to understand technologies by opening, repairing and rebuilding them served as useful approaches to the detection and destruction of ‘microchips.’ Knowledge about microchips and strategies to mitigate their effect were then successfully shared across the organization. The painstaking learning process FARC-EP members had to undergo, and the changes in practices they adopted, to escape the threat of precision bombings is what we characterize as counter-appropriation: As Stevens and Pipek (2018) [37] mention, *“Appropriation refers to the establishing of new practices in the light of new technologies”* and *“such transformations may be a slow, unnoticed, quiet and evolutionary process”* [37]. This adequately describes the painful process of change FARC-EP underwent to mitigate the loss of fighters and friends: it was a gradual and slow development of new practices in light of new adversarial technologies. What distinguishes it from the established concept of appropriation is the fact that the technologies in light of which they changed their behavior were not their own, but those used by others. The term “counter-appropriation” is not entirely new. It has been used by other scholars to describe for example practices observed in post-colonial contexts, where inhabitants of former colonies re-integrate goods or practices into their daily practices that have been “culturally appropriated” by the West, and thereby counter-appropriate them [26, 44]. While in other contexts it describes the re-appropriation of technologies or practices in post-colonial or post-capitalist contexts, in the context of CSCW and HCI however, we emphasize a different reading of the term. Rather, we use the term to describe how, in asymmetrical conflict, one side is forced to adapt their behavior to the use of attritional technology by the other side, while the exact functioning of the technology remains opaque. Counter-appropriation can but does not necessarily need to involve technology use. Examples of non-technological counter-appropriation include FARC-EP's practice of storing goods outside their camp to ensure they had not been contaminated with tracking technology. Furthermore, it needs to be understood as a specific form of wider resistance to the political, economic and social system of the Colombian state. While it is a novel term for us, it is useful to describes phenomena that have been observed

before in similar contexts. Previous studies have shown that surveillance technology employed in conflict situations has similar effects on activists working against governments, such as in Syria. As Rohde et al. [28] have found, members of the Free Syrian army were forced to acknowledge that they were being surveilled by the Assad government with devastating effects. It was impossible for them to know exactly how the surveillance technology of their enemy worked. In the absence of full understanding they had to develop beliefs that provided incomplete but sufficient explanations that allowed them to successfully minimize the risk of being caught. Activists in Tunisia's Arab Spring, for instance, had to develop strategies to escape specific use of technology by the Tunisian government against them, for example to circumnavigate upload controls by sending their video content abroad and upload it from there [43]. It is likely to occur in other asymmetrical conflicts such as the war against the Taliban in Afghanistan, Boko Haram in Saharan Africa and wherever else a similar imbalance in the access to technology in conflict situations exists. It is worth noting that the enemy's technologies were likely not well understood entirely by the guerrillas: for a remote and clandestine organization as FARC-EP it is difficult to maintain up-to-date technological knowledge and distribute such expertise across the entire organization. Some combatants exhibited distrust towards information technology, calling it imperialist technology, as our contact Fabio (see e.g. [32] for a discussion of this term elsewhere). Also, the nature of the technologies employed by the enemy was obscure: cameras and sensors were hidden, and electronic devices do not readily disclose their purpose. It is difficult or impossible in situations like this to know what the enemy knows. The obscurity of the enemy's power and the devastating effect this had resulted in a drop of morale amongst the combatants, as Fabio told us. Consequently, these devices were treated as mystical objects whose workings were to a certain extent mysterious, but whose effects were sadly well known. At times this also led to a certain amount of carelessness: some of the people we spoke to told us that they were convinced that the attacks were targeted at very specific people within FARC-EP in high leadership positions, and that the "footsoldiers" felt rather safe. As Laura told us: *"After the Peace Agreement I learned that I was an important target. But I was only a nurse!"* The private use of mobile phones was thereby, likely unintended, undermining the counter-appropriation efforts, a similar phenomenon as previously observed in the Ukrainian conflict [35]. As much as the FARC-EPs explanations for localization were perhaps incomplete, they managed to gain an understanding that was sophisticated enough to devise simple practices that diminished the destructive effect of their counterpart's advanced technology.

8 CONCLUSION

Our study demonstrates that technology usage in conflict situations and its effects need to be considered as embedded in a complex network of interrelations between culture, technology, geographical location and social practices. While this is arguably always true, specific relationships in the context we describe, in our view, are best understood through the lens of 'attritional infrastructure' and 'counter appropriation,' so as to distinguish it from contexts where there is a more symmetrical access to given technologies, or from other less conflictual situations. The processes we uncover above are specifically the result of a very radical asymmetry, one where the kinds of ICT and other technology taken for granted in the Western world were not available to one side in the conflict. Counter appropriation was possible, over time, as a result of the high value on learning inside their organization and their ability to communicate knowledge across their distributed organization. The term specifically describes the phenomena in this account, but also builds on other accounts within the HCI and specifically CHI canon. It traces the development of forms of technology appropriation in a variety of conflictual and post-conflictual situations and attempts, over time, to find a conceptual framework which accounts for shifting patterns of use. In line with these previous studies our account shows that counter appropriation of the use of technologies is a common phenomenon in conflict situations. Such processes may explain partially why technological superiority on one side does not lead automatically to decisive "victories". For practical reasons our account is limited to FARC-EP. The Colombian conflict was shaped by the involvement of many different actors, and we lack an understanding of the actual functions of the technologies we mention here, processes of appropriating these technologies on the side of the army, or their relation to any other involved parties such as paramilitaries, other leftwing rebels or crime syndicates.

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