Refiguring the Aerial in Human Rights Activism:
The Case of the Palestinian-Bedouin Village of al-Araqib

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This article argues for the exploration of and experimentation with the potentials of civic technoscience as a way of materializing counterdominant practices in human-rights activism that may challenge conventional uses of technology and rooted understandings of expertise. It examines the Ground Truth project, which addresses the Palestinian-Bedouin struggle for indigenous rights in the Naqab desert, in the southern region of Israel/Palestine. It focuses on the use of do-it-yourself (DIY) aerial photography with balloons and kites, alongside other collaborative practices, for mapping and visualizing Bedouin political and spatial claims. Against a backdrop of increasingly technologically savvy legal-professional cultures in human-rights organizations, this article proposes that a community-based DIY approach to truth making may challenge entrenched thresholds of participation and open opportunities for creating hybrid forums in the human-rights field. Finally, it suggests that civic technoscience can offer an experimental ground for training oneself in critical ways of thinking and engaging with technology.

Keywords: Israel/Palestine, human rights, activism, open hardware, civic technoscience, geospatial technologies, Ground Truth, photogrammetry, do-it-yourself, aerial photography, kite photography

What role do aerial tools and vision play in the development of diverse, embodied, and engaged perspectives on the politics of land, space, and place? This article addresses this broad question by focusing on the use of do-it-yourself (DIY) aerial photography with balloons and kites—alongside other collaborative practices, including archiving, performance, and public hearings—as a potential emancipatory practice in

human-rights activism. The Ground Truth project, analyzed in this article, focuses on the Naqab desert in the southern region of Israel/Palestine, and concerns the ongoing dispossession and displacement of Palestinian-Bedouin communities from their ancestral lands. Working closely with the Bedouin community of al-Araqib, the Ground Truth project set out to collaboratively create and gather aerial and on-the-ground testimonies that corroborate and visualize Bedouin claims of indigenous ownership, belonging, and sedentary presence.

Our analysis of the project is based primarily on three trajectories of critical research, focusing on the politics of mapping, technology, and human-rights law, and converging here on questions that challenge established understandings of objectivity and truth. The way political forces play out in the case of al-Araqib reminds us that scientific visualizations and objects, such as maps and aerial photographs, despite often being treated as matters of fact, are produced and shaped by sociopolitical relations and within specific contexts (Collins, 2014; Haraway, 1988; Latour, 1987). The modern scientific epistemology of maps and mappings has played a fundamental role in the construction of territory, sovereignty, imperialism, and colonialism since the 1500s. Typically, colonial maps conceptualized space as tabula rasa through the legal term terra nullius, or empty lands, from which indigenous spatial knowledge and presence would be erased and land seized, allocated, and managed (Harris, 2004; Yiftachel, 2017). The conceptual framework of terra nullius continues, explicitly and implicitly, to play a role in dominant discourses and practices of planning and redevelopment. It facilitates the dispossession and displacement of vulnerable and marginalized populations, particularly indigenous communities in settler-colonial societies, as in the case of the Naqab desert Bedouins (Blomley, 2003; Yiftachel, 2017).

Relatedly, the construction of international human rights law (IHRL) as universal in appeal and application, obscures how it is structured by politics, contingent in character, and serves as a site of oppression as much as resistance (Erakat, 2019; Perugini & Gordon, 2015). IHRL is not antithetical to the state—quite the contrary, it was established by European states that were colonial powers, and was enforced within state sovereignty and in accordance with state laws (Erakat, 2019; Gross, 2007; Hajjar, 2001; Perugini & Gordon, 2015). Therefore, as Perugini and Gordon (2015) show, while ostensibly universal, progressive, and emancipatory, human rights are in fact political tools that can just as easily reinforce domination.

Indeed, digital-mapping practices and civic uses of commercial geospatial technologies, such as satellite imagery, have created new avenues for making the rights of vulnerable populations visible by literally putting them on the map (Maedel, 2016; Pauls, 2017). Nonetheless, geospatial technologies and visualizations are depoliticized when they are understood, first and foremost, as scientific and objective forms of knowledge that project mimetic accuracy to scale. Their rapid proliferation enables a significant detachment from socially situated, political contexts. As such, their use tends to facilitate ever-more sophisticated multidimensional forms of Western control and domination (Burns, 2014; Givoni, 2016). The Ground Truth project attempts to address the problems that emerge in the convergence of corporate, market-driven geospatial technologies, with the liberal discourse of IHRL by offering embodied forms of visual and geospatial truth making that connect political with technoscientific activism.

Reworking the Geospatial Evidence Through Civic Technoscience

At the onset of the drone era, the aerial perspective has become an ostensibly public perspective, accessible through off-the-shelf drone technology and free Web-based applications such as Google Earth. Startups, in collaboration with human-rights and humanitarian-aid organizations, are developing technologies that allow unrestricted numbers of remote individuals to categorize and analyze various forms of data.[2] Likewise, the recent adoption of drone use in crisis areas compensates for the limitations of satellite imagery by enabling the production of high-resolution, low-altitude imagery for the mapping of disaster areas, or the delivery of essential cargo in real time or shortly thereafter (Choi-Fitzpatrick, 2014; Meier, 2016; Sandvik & Lohne, 2014).

Indeed, information communication technologies (ICT) play a huge role in facilitating the rapid production and dissemination of information from faraway crisis areas through digital networks. Yet, in this technological configuration, anonymity and remoteness are key and may contribute to perpetuating a knowledge politics that reinscribes existing power structures (Burns, 2014; Duffield, 2015; Givoni, 2016; Haklay, 2013; Turk, 2017). Recent scholarship has shed light on the links between innovation and exploitation, which are amplified by market mechanisms and neoliberal governments (Duffield, 2015; Jacobsen, 2010; Sandvik & Raymond, 2017).

Taken together, this expansive technocultural apparatus reveals patterns of making the vulnerable more vulnerable (Sandvik & Raymond, 2017; Turk, 2017). It demonstrates and contributes to the increasingly entangled relations between the liberal discourse of rights and existing forms of Western domination (Givoni, 2016; Perugini & Gordon, 2015). Against this backdrop, Ground Truth's deployment of DIY and collaborative aerial photography techniques offers directions for developing conscious alternatives to some troubling phenomena that hinder the critical course of human-rights discourse—namely, the increasing reliance on legal strategies intertwined with technoprofessional cultures related to the production of geospatial information as cutting-edge modes of testimony and truth.

The balloon/kite mapping toolkit used in al-Araqib was developed by the open-source community and nonprofit Public Laboratory for Open Science and Technology (Public Lab).[3] It is part of a broader practice and discourse termed "civic technoscience" or "community science."[4] Civic technoscience is an antidote to what is commonly known as "citizen science," a broad umbrella term used today for various forms of public participation in scientific research and activity since the 1980s.

The recent proliferation of online, networked citizen-science projects has, in many cases, shaped participation in science as a crowdsource-based science. In this formulation, citizens play a role as collectors or interpreters of data by carrying sensors or fulfilling tasks that require minimal training; as a distributed

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[2] Examples include Amnesty International's The Decoders Project (2016), Humanitarian OpenStreetMap Team (HOT), Ushahidi, and CrisisMappers—The Humanitarian Technology Network.

[3] https://publiclab.org

[4] We use the term "civic technoscience" because it captures the role of both technological engagement and scientific activity. See also Wylie, Jalbert, Dosemagen, and Ratto (2014).

network of observers, they report back to scientists and allow them to pursue ambitious, large-scale research projects (Cooper, Dickinson, Phillips, & Bonney, 2007; Haklay, 2012; Raddick et al., 2010). As many critics point out, the crowdsource-based, distributed model of public participation in science is far from advancing a critical discourse and practice of civic engagement in science (Breen, Dosemagen, Warren, & Lippincott, 2015; Haklay, 2013; Lave, 2015).

By contrast, civic technoscience, as understood here, is grassroots and community-oriented technological engagement and scientific activity. It is a vehicle through which public participation is investigated, rather than predefined: materially through the development and use of participatory technologies and collaborative practices (such as do-it-yourself techniques and open hardware/software); and conceptually by exploring the role of material objects and matters of concern in the construction of expertise and democratic politics (Latour, 2005; Lave, 2015; Marres, 2005; Powell, 2012).[5]

Experimenting with civic technoscience as part of the Ground Truth project sought to develop technoscientific tools and practices that emphasize the importance of locally situated technological engagement and action in human-rights activism (Keysar, 2018). This link between human-rights practice and civic technoscience suggests a technosocial dimension to Nora Erakat's (2019) articulation of "legal-work." As she puts forth, for IHRL to serve an emancipatory function, legal work must embody and attest to the imbrication of law and politics; it cannot be accomplished by legal strategies alone, and must directly challenge the structure of power through political action. In that sense, civic technoscientific tools, such as DIY aerial photography, allow reworking legal-professional human-rights practice by developing critical and interventionist approaches to technology that directly challenge the power structures that are embedded in technology itself.

The Ground Truth project grew out of a collaboration between the community of al-Araqib (the Al-Uqbi, Al-Turi, and Abu-Frieh families), the Israeli NGO Zochrot,[6] and the London-based research agency Forensic Architecture.[7] Though civic technoscience was not practiced by these organizations, their work and agendas were already inclined toward participatory and community-oriented practices. The photographic mapping efforts made during the course of the project consisted of eight kite/balloon mapping sessions conducted in 2016–17 and covering approximately 5.5 km^2 of land. This aerial survey laid the groundwork for the Naqab.org archival platform, developed by Forensic Architecture; it includes historical and commercial aerial views and an up-to-date, three-dimensional, photogrammetric composite view of al-Araqib and its extended lands based on kite-and-balloon photography, annotated with text, photos, video, and other documents.[8]

Ground Truth has been described and analyzed at length by Eyal Weizman in recent publications. Weizman's analysis, discussed below, frames al-Araqib as a case study for understanding what he describes as the "conflict shoreline," which demonstrates how the displacement of indigenous communities globally goes hand in hand with environmental destruction and climate change (Weizman, 2017; Weizman & Sheikh, 2015).

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[5] Open hardware is based on open-source licensing for protecting a generative space of technological development. For more, see: https://www.oshwa.org/

[6] https://zochrot.org/

[7] http://www.forensic-architecture.org/

[8] http://naqab.org/

This article develops another dimension to the analysis of Ground Truth by bringing into focus the potential of civic technoscience as an innovative, locally situated, and socially contextualized alternative. As we show, the adaptation of Public Lab's DIY technique in this project highlights the need to challenge boundaries and hierarchies of expertise and to democratize modes and practices of truth making in human-rights activism.

Figure 1. Balloon photography of JNF terraces and afforestation in the area of al-Araqib.

Al-Araqib: A Resilient Struggle Against Ongoing Dispossession

In the wake of the Palestinian Nakba ("catastrophe," in Arabic) beginning in 1947–48, about 85% of the Palestinian Bedouins in the Naqab desert were dispossessed by the Zionist paramilitary forces and had to flee to Jordan, the West Bank, or Gaza.[9] Only 11,000 people managed to remain in what had become the state of Israel after the war. Today, almost a quarter of a million Palestinian Bedouins live in the Naqab and are considered the poorest and most marginalized communities in the southern region of Israel/Palestine. More than 80,000 people live in 40 unrecognized villages rendered "illegal" by the state, and another 135,000 reside in government-planned poor townships.[10] Those living in unrecognized villages are denied basic services such as water, electricity, education, health services, and housing. They live off the map and out of sight.

As Ahmad H. Sadi and Lila Abu Lughod (2007) argue, the Nakba is not a singular event that happened in 1948, but rather an ongoing reality of past and present injustices, dispossession, and displacement. The Palestinian Bedouins are a striking case of the "ongoing Nakba": a colonized indigenous people within a settler-colonial society, rendered trespassers on their ancestral lands by Israeli law (Nasasra, 2012; Yiftachel, 2008). Most of the remains and physical traces of their settlements and cultivation of lands before 1948 were eliminated by Israeli colonialism through the proliferation of state-sponsored Jewish settlements, forced urbanization, and afforestation efforts (see Figures 1 and 2) advanced by the Jewish National Fund (JNF).[11] These were common practices that served the Israeli regime to prevent the return of Palestinian refugees while covering the remains of their past with an Israeli present (Kadman, 2015; Nasasra, 2012; Weizman & Sheikh, 2015; Yiftachel, Roded, & Kedar, 2016).

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[9] The Nakba refers to the dispossession and displacement of about 800,000 Palestinians from their homeland in 1948 by the state of Israel.

[10] Over the past 15 years, Israel has recognized 10 Bedouin villages in the Naqab, but the question of land ownership has not been settled in any of these villages, and their structures are still considered "illegal." For more, see http://www.dukium.org/

[11] The Jewish National Fund is a Zionist organization founded in 1901 for the purchasing of lands in Palestine. Ever since, it has been advancing a massive enterprise of afforestation in Israel/Palestine, contributing to the erasure of the Palestinian landscape.

Figure 2. JNF afforestation works in the area of al-Araqib. Balloon photography, December 5, 2016.

The village of al-Araqib (literally, "soft hills located between streams") has become a symbol of Palestinian-Bedouin resistance to ongoing dispossession and displacement in the Naqab. The families of al-Araqib managed to stay on their lands after the 1948 war and were soon evicted with the promise that they would be able to return after six months. During the period of the Israeli military regime (1948–66), they were still not allowed to return; however, they continued to cultivate their lands (Yiftachel, Kedar, & Amara, 2012). From the 1950s onward, some have returned to build shacks and houses and live on their ancestral lands, despite Israel's relentless efforts to suppress and delegitimize their resettlement (see Figure 3).

Figure 3. A tent belonging to the al-Turi family in al-Araqib, built and rebuilt despite recurring demolitions. January 2016 (Image: Ariel Caine).

Following is an extract from a testimony given by Aziz al-Turi, a Bedouin activist and current resident of al-Araqib (see Figures 4a, 4b), during the Ground Truth aerial mapping session, conducted on December 5, 2016:[12]

Can you say whose well this is? And what happened to it?

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[12] The aerial mapping session and interview (in Hebrew) were conducted by coauthors Debby Farber and Hagit Keysar.

"This *harabeh*[13] belongs to Ali Ahmad al-Jwabr al-Turi. JNF[14] filled the *harabeh* with earth."

Why did you build this belt of concrete around it?
"So we can see it and recognize it."

But how can you use it, now that JNF filled it with earth?
"We can't use it, but we want it to stay. So that people will see exactly what JNF is doing. We can see how the terraces built by JNF prevent the water from flowing into this *harabeh*, and the next one, and to all the other wells after it. Year after year these wells are being erased by this forest. Now . . . they [JNF] will conceal all the places and resources that belong to the families that own these lands. Just to the east of this well, there was a tree. It was almost the only tree in the area, and they uprooted it. . . .Over there, there used to be a *wadi* ['valley,' in Arabic]; you cannot recognize this *wadi* anymore. JNF's terraces destroyed all the evidence."

Figure 4a. The harabeh, a pit for rainwater, blocked-up by JNF, December 5, 2016.

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[13] A Palestinian-Bedouin term for a pit in the ground for collecting rainwater.
[14] See footnote 11.

Figure 4b. Aziz al Turi sits next to the harabeh, during an aerial mapping session, December 5, 2016.

Does this erasure damage your ability to recognize the area?

"When I see the tree, I know that this is the point where I'll find the well to the west. If there is no tree, I get confused and I don't see the well. Today, many people cannot recognize the boundaries of their own lands. . . . They destroyed all these natural features and people don't know their own lands.

That's the basis for JNF's practices; . . . they destroy the relationship between the Bedouin and his property, his land, his culture, his history. In the media they say that they are making the desert bloom. But actually, they ruin the beauty of the desert, because I, the Bedouin, have sown. I planted fig trees, carob, prickly pear, with my bear hands, I worked and cultivated the land. Who taught them how to build these terraces? We did, the Bedouins."

The situation in al-Araqib escalated in the first decade of the 2000s, culminating in the first destruction of the village by the Israeli Land Authorities on July 27, 2010, which left about 500 people without shelter. Since then, the village has been destroyed more than 170 times and rebuilt by a small group of families, including the al-Uqbi, al-Turi, and Abu-Frieh families. The residents continue to realize

their right of return through ongoing nonviolent acts of resistance, resilience, and *sumud* ("steadfastness," in Arabic) on their lands. The few families that have remained in al-Araqib, despite the recurrent evictions, build and rebuild their tents on lands claimed by the al-Turi family in the vicinity of their ancestral cemetery. Despite the various measures taken by the Israeli authorities to expropriate al-Araqib's lands, evict its dwellers, and demolish its structures, the ancestral cemetery was preserved and serves today as a relatively shielded place for the descendants of the buried.

Aerial Testimonies: A Legal-Professional Battle Over Truth

The battle over truth for the Naqab Bedouin, and specifically in the case of al-Araqib, has a strong core of legal-professional discourse that revolves around Israel's interpretation of the Ottoman "dead lands" (*ard mawat*, in Arabic) law. Originally an Islamic tradition, it was coded into the 1858 Ottoman Land Law and later adopted by the British, whereby uninhabited and uncultivated lands were considered "dead lands," deserted and unpossessed (Meir, 2006; Yiftachel et al., 2012). On this basis Israel created "the dead Negev doctrine"; as a variation of the colonial use of terra nullius (empty land), this doctrine enabled the erasure of previous Bedouin ownership rights that had been recognized by earlier imperial regimes (Yiftachel, 2017).

This doctrine is the central tool used by Israel in its persistent refusal to acknowledge Bedouins as indigenous people or grant them indigenous land rights. Indigenous rights, which have become the international norm since the early 1990s, include the right to preserve cultural traditions, regional and cultural autonomy, and continuity of native title on ancestral lands (Kedar, 2006; Nasasra, 2012; Yiftachel et al., 2012). A corollary to this denial of the Bedouin as indigenous people is the dismissal of various forms of documentation and evidence (such as oral testimonies and tribal agreements) as valid and reliable proof in courts of law. With this long chain of refusal and denial by the state, the articulation of the issue in court has been relegated almost exclusively to the hands of legal and scientific experts.

Expert Testimonies in Court: Between White and Real Lies

Historical maps and aerial/satellite imagery play a crucial role in representing and reifying the Israeli interpretation of the "dead lands" law. However, technoscientific tools and visualizations, such as maps, aerial photographs, and geographic information systems (GIS), play a double and often contradicting role in the hands of opposing parties. In the case of al-Araqib, they serve as raw materials in a battle of truths that culminated in Nuri al-Uqbi's legal struggle for reclaiming his ancestral lands in al-Araqib.[15]

Levin, Kark, and Galilee's (2010) GIS-supported analysis of dozens of maps and surveys dating from 1880 to 1948 formed the basis for an expert testimony delivered by Hebrew University professor Ruth Kark on behalf of the state in Nuri al-Uqbi's legal case.[16] In her testimony, Kark stated that no sedentary Bedouin settlements existed in the Naqab desert before 1948 beyond an aridity line of 200 mm—the border

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[15] Nuri al-Uqbi's court case began in 2005 and was concluded in 2015 when the Israeli Supreme Court rejected all claims of ownership by al-Uqbi and 14 others (Yiftachel et al., 2012).

[16] Israeli Supreme Court decision on the question of ownership in the case of al-Uqbi lands (Civil Appeal No: 4220/12): https://bit.ly/2ASGX76

of an uninhabitable zone where no cultivation can take place. Countering professor Kark's testimony, Yiftachel and associates (2012) cross-referenced historical maps with other cartographic surveys to demonstrate numerous mistakes and omissions in one of the historical maps used by Levin and colleagues (2010), as a central source of information; they found hundreds of errors, including six substantial mistakes in the area of al-Araqib (p. 96). The absence of locales on a map, they put forth, does not constitute sufficient evidence of its nonexistence on the ground. Moreover, beyond mapped evidence or lack thereof, Yiftachel and associates' work strongly suggests that this struggle over proof, truth and, objectivity must be situated within its violent colonial context, which extends far beyond the scope of maps and scientific visualizations.

The long and frustrating battle of the Naqab Bedouin against the state has been repeatedly dismissed. In the work of Levin and colleagues (2010), which supported Kark's expert testimony, the scientific truth attributed to GIS paved the way for the wholesale denial of Bedouin indigenous rights. Moreover, it enabled the reframing and isolation of al-Araqib's struggle as a discrete case in a land dispute, devoid of its colonial context. The rendering of unrecognized Bedouin villages as "illegal," the dead Negev doctrine isolates struggles, creating divisions between Bedouins in the Naqab, Bedouins in other areas of Israel/Palestine, and the wider, growing population of displaced and dispossessed Palestinians since 1948. Relatedly, the mainstream Israeli media has fixed the image of the Bedouin as an invader and trespasser, constructing an inverted image that portrays the settler-colonial society as the one being encroached by the Bedouin invasion of its lands (Perugini & Gordon, 2015; Yiftachel et al., 2012).

Eyal Weizman (2015, 2017) brings forth another angle that contests institutional, scientific visualizations that deny Bedouin sedentary presence in al-Araqib. By closely observing historic and recent aerial images, as well as satellite imagery of the Naqab, Weizman challenges the fixed scientific category of the 200-mm aridity line used by the state in rejecting Bedouin claims over those lands. He shows that the border of the arid area no longer coincides with the 200-mm line on the maps, and has continuously shifted with patterns of displacement, afforestation, settlement construction, and uneven distribution of land and water resources. The threshold of the desert, he writes, marks the border of a zone of dispossession; it is the "conflict shoreline" (Weizman & Sheikh, 2015).

Hence, to interpret maps and aerial imageries, one needs to consider the material realities that constitute them. According to Weizman, these material realities stretch from the shifting tides of the threshold of the desert to the fine-grain resolution of a photographic film that defines what can be seen and identified in the image: its "threshold of detectability" (Weizman, 2015, 2017). Any element on the ground that is smaller or similar in size to the photographic grain disappears into the materiality of the grain or turns into unidentifiable shades in the image.

An example to that is the cemetery in al-Araqib. The al-Turi family testifies to having buried its dead since 1914 in the cemetery that serves them today as a place of refuge. However, as Weizman (2015, 2017) notes, the early graves were marked by a pile of small stones rendering the cemetery invisible in aerial photographs taken in 1945 by the British Royal Air Force (RAF). These images were used in the Israeli courts to dismiss Bedouin testimonies of sedentary presence, claiming that the images show no evidence of cultivation or habitation in the area of al-Araqib. Refuting these claims, Weizman shows how the materiality of the photographic grain, which fixes a certain moment in time, "erases" the delicate marks of Bedouin life

in the desert (Weizman, 2017; Weizman & Sheikh, 2015). Wells, caves, cisterns, scattered and seasonal areas of cultivation, disappear into the threshold of detectability.

As the geographer Mark Monmonier (1996) notes, an accurate map must tell white lies to present a useful and coherent picture. Similarly, aerial photographs and other visual representations constitute projected and manipulated surfaces rather than simply objective representations of life on the ground. However, these "white lies" may become real lies that obscure structures of power, when they take central stage as scientific representations in professional and official discourses that shape lives and futures.

The Paradoxical Disposition of Human Rights

The nexus of the legal, procedural, and technoprofessional construction of rights, particularly in, but not limited to, the case of indigenous people, seems to work against radical, transformative claims. In this process, as we have seen, scientific categories such as the 200-mm aridity line and visualizations such as aerials and maps are used to assert power rather than bring about justice, and to cover up, rather than expose, the indecisive and contentious nature of truth.

Therefore, the dominant legal-professional and public discourse in the case of al-Araqib erases the wider structural elements of colonial dispossession and displacement, which preceded and laid the foundation for the Bedouin's unauthorized return. Moreover, the failure of al-Araqib's court case demonstrates what Libby Porter (2014) describes as the "cost" of recognition and rights. It delineates how legal-professional discourse allows the state to cast emancipatory arguments within its own liberal logic while celebrating the democratic façade of its procedures (Porter, 2014). This situates us in a paradoxical disposition in which rights seem necessary, as Porter notes, yet thoroughly insufficient. The same is true for the role of technoscientific instruments and visualizations as evidence in the legal-professional articulation of rights.

"If the use of law confers legitimacy to the dominant," Perugini and Gordon (2015) write, "a short circuit has to be created, combining human rights with other political discourses and practices of emancipation in order to undo the law-legitimacy nexus" (p. 137). We join Perugini and Gordon (2015) and Porter (2014) in asking how human rights can be deployed within this paradoxical disposition, and what might be the material tools for counterdominant legal work in human-rights activism that goes beyond legal strategies (Erakat, 2019). In what follows, we shift to an ethnographic account and analysis of our collaborative aerial mapping efforts with the people of al-Araqib, exploring possible directions by combining the emancipatory discourses of human rights and civic technoscience.

DIY Testimonies: Experimenting With Collaborative Forms of Truth Making

Image making—from painting to DIY aerial photography—is a skill that enables one heuristically to decode the making of human vision by unraveling the inseparability of the tool and the body, hand and eye, technique and vision (Hockney, 2006). The methods and techniques used in the creative process have a profound influence on the nature of the work produced, as artist David Hockney (2006) writes, "the handmade image is a human vision" (p. 197).

Ground Truth was launched in January 2016, in the village of al-Araqib during the last gathering of Zochrot's Truth Commission, whose goal was to raise Israeli and international awareness of the Bedouin Nakba and its present-day implications.[17] Unlike truth commissions in other places in the world that were initiated by the state as part of postconflict reconciliation efforts, Zochrot's Truth Commission is a civil-society initiative taking place in the midst of ongoing conflict and colonization. In that sense, this commission imagines and forges the material and spatial settings for radical politics that are currently rendered unthinkable.

Figure 5. The Ground Truth tent, built for a two-day public event in the village of al-Araqib, January 1–2, 2016. (Image: Alina Schmuch & Jan Kiesswetter)

The Commission's concluding session was planned as a two-day event, launched by the symbolic and material erection of a large Bedouin tent (see Figure 5) next to al-Araqib's cemetery, where the closing session would be hosted.[18] The tent was built rapidly, just before sunset, knowing that any new construction in al-Araqib could provoke another demolition at any given time.[19] The event was designed as a forum for

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[17] Zochrot's Truth Commission in the South was active 2012–16; final report:
https://zochrot.org/en/article/56371

[18] The event was curated by Eyal Weizman and coauthor Debby Farber. The temporary tent was planned in collaboration with the architect Sharon Rotbard.

[19] It was agreed that at the end of the event the tent would be taken down to avoid exposing the residents to even more punitive measures by the authorities.

the presentation of evidence and testimony, and furthermore, it allowed for on-site and real-time production of testimonies, engaging the audience as witnesses and active participants in its modes of truth making. Constructing a new, huge tent in al-Araqib was a performative act of agitation that correlated with the latter goal. In a more subtle way, performances of participation were also mediated through establishing a field studio for photographing historical documents inside the tent, where more than 30 documents substantiating Bedouin ownership dating from Ottoman through British and Israeli rule, were brought by elder Bedouins (see Figures 6a–b).

Figure 6a. DIY lightbox prepared by photographer and activist Miki Kratsman for photographing archival documents (Image: Miki Kratsman).

*Figure 6b. Muhammad Ali Hussein Salman al-Turi brings his documents to be
digitized by Kratsman (Image: Ariel Caine).*

The photographic mapping created during the event was the first in a series of aerial surveys conducted in the wider area of al-Araqib, in collaboration with leading figures from the al-Turi, al-Uqbi, and Abu-Frieh families. We held a DIY aerial photography workshop, with the aim of producing up-to-date high-resolution aerial images of the area of the al-Araqib cemetery at the time of the event (see Figures 7a–b, and 8). These images were meant to visually capture the cemetery as well as signs of life in the depleted village: the animal pen, the cistern, and the family tents that had been rebuilt after the last demolition. They also served to visualize signs of ongoing demolitions and violent state interventions in al-Araqib that leave their mark on the ground.

Figures 7a and 7b. (Left) The children Sa'id (holding the kite's string), Muhammad, and Sujud (behind) al-Turi. (Right) Workshop leaders Ariel Caine and Hagit Keysar, with children Sayah and Sa'id al-Turi, during the aerial photography session, January 1, 2016 (Images: Ariel Caine/Eyal Weizman).

Figures 8. Sabah al-Turi cutting a bottle for the camera rig, January 2016.

During the first day, we began processing the images into photographic maps using MapKnitter, an easy-to-use open-source stitching software.[20] We also began experimenting with producing 3D environments with photogrammetry techniques, based on the kite images captured on the same day, which would later turn into the base layer for the Ground Truth archival platform (see Figure 9). The kite images produced presented a wealth of details at a resolution of 5 cm/pixel, standing in stark contrast to the Google satellite layer of the area that presented a resolution of 250 cm/pixel (see Figure 10).
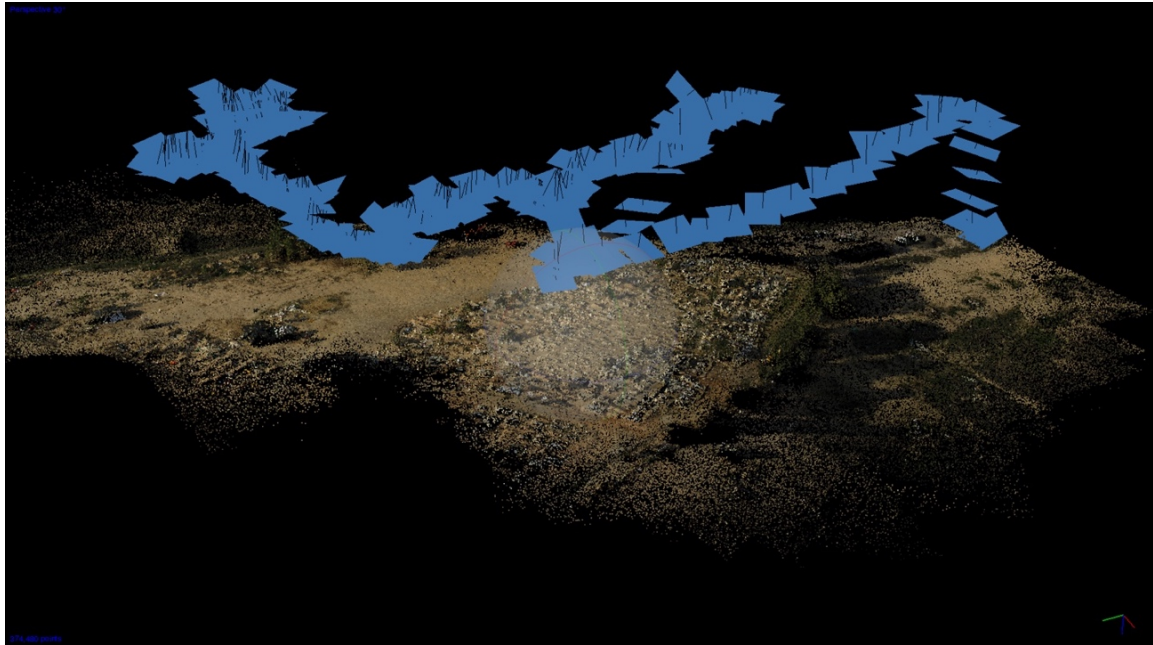

Figure 9. 3D point cloud showing the kite flight path above the cemetery of al-Araqib, January 2016. (Photogrammetry: Ariel Caine)

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[20] MapKnitter.org

Figure 10. The DIY photographic map of al-Araqib and the al-Turi cemetery overlaid on low-resolution Google satellite imagery in MapKnitter.org. January 2016.

Low resolution in Google's satellite platforms reflects a digital "threshold of detectability" (Weizman, 2015). It becomes a blatant, yet evasive, mechanism of censorship that is produced by determining how many centimeters of land are visible per pixel. In most publicly available satellite imagery, resolution ranges from 50 to 70 cm/pixel; however, because of agreements between the U.S. and Israel, resolution in imagery of Israel and the occupied Palestinian territories is limited to less than 250 cm/pixel (Zerbini & Fradley, 2018). For the purpose of creating a photographic map, MapKnitter uses Google Satellite as a reference layer for stitching together and rectifying aerial images, therefore the lack of features in the Google imagery made it difficult to manually stitch the images together.

Figure 11a. Ground photo of the well in the aerial photograph below. December 5, 2016.

Figure 11b . Balloon photography of lands around al-Araqib. In the white circle, a well can be seen, and next to it human shadows of the DIY mappers holding the balloon string. December 5, 2016.

Following this, mapping sessions were conducted again in May, August, September, November, and December 2016, March 2017, and February 2018, covering larger areas that together captured 5.5 km^2 of land (see Figure 12). During these sessions, we walked the lands of al-Araqib, and while the camera was taking photos from the air, we recorded oral testimonies of the Bedouin activists who were guiding our way as they pointed to ancient wells (see Figures 11a-b, 12), cemeteries, *baikas* (old stone houses; see Figure 13), cisterns, caves, and tents. The testimonies described the history of the place, its use, ownership patterns, as well as efforts made by the Bedouin to preserve the site and register its location in the face of ongoing processes of erasure advanced by Israeli authorities, including land works and afforestation.

Figure 12. Nuri al-Uqbi holding the kite string while guiding us through his ancestral lands. May 2016.

Figure 13. 3D dense point cloud of a baika (old stone house) owned by Abu Zheiri Ibn Bari(http://naqab.org/). (Photogrammetry: Ariel Caine/FA).

The aerial mapping sessions laid the groundwork for the Ground Truth website, developed by Ariel Caine at Forensic Architecture, which presents georeferenced 3D environments of the area. The aerial images were processed to create accurate, to-scale, georeferenced digital point-cloud reconstructions of al-Araqib lands through photogrammetry techniques. These 3D documentations show the form and volume of disappearing Bedouin structures while also facilitating a continued tracking of deterioration over time. RAF aerial images of the area were georeferenced to create layer overlays that enable a close comparison of the Bedouin environment across time and space (see Figure 14). An archive of photographs and videos documenting demolitions, evictions, and Bedouin resistance over the past 10 years was collected from photojournalists and Bedouin activists who used professional or mobile-phone cameras. These were georeferenced to annotate the 3D terrains.

Thus, using varied legal, historical, and material evidence, the platform aims to capture evidence of the continuity of the sedentary presence of the Bedouin population on this land, and to document traces of their repeated displacement and destruction by government forces.[21] As Ariel Caine (2019) notes, the 3D model is a spatial image, an operative environment, that enables analysis, data extraction, and simulation in ways that can testify to events on the ground that can no longer be measured. It defies the threshold of detectability in existing sources while making a composite use of these very same sources. Furthermore,

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[21] http://naqab.org/

due to the gradual destruction of Bedouin history and land through afforestation and settlements, the digital terrain acts as an archive that preserves the sites and their physical condition in space and memory for future narration (Caine, 2019).
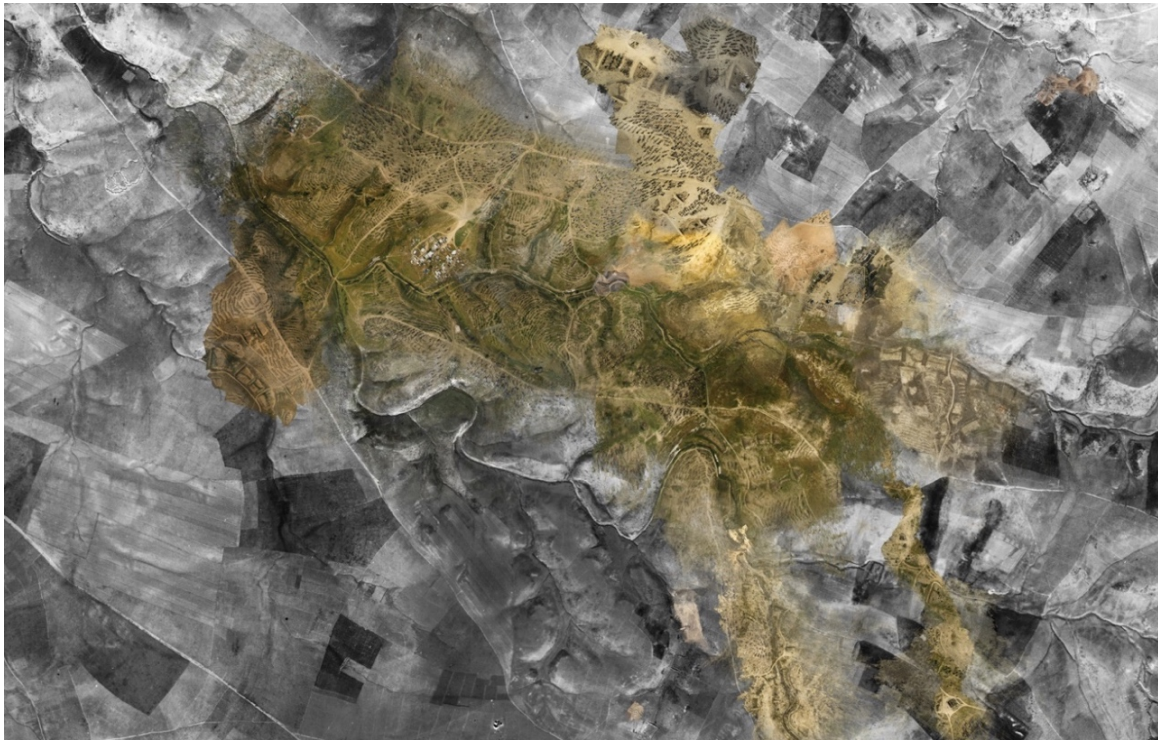

Figure 14. 3D point cloud showing a composite view of the area covered by several kite photography expeditions conducted during 2016–17, overlaid on RAF aerial photography (1945).

The Threshold of Participation: Toward Critique Through Engagement

Critical perspectives on the use of aerial/satellite imagery for producing evidence and testimony, as reviewed earlier, suggest that the progressive claims that accompany the use of these technologies lack a thorough critique of the politics and ethics they entail (Dorrian, 2007; Herscher, 2014; Kurgan, 2013). Likewise, the legal-professional disposition of rights as a necessary yet insufficient discourse demands awareness and careful examination of its limitations as a progressive emancipatory path (Kennedy, 2002; Perugini & Gordon, 2015; Porter, 2014). It seems that crossing the threshold of politicization with regard to both human-rights discourse and technoscientific practice necessitates an active probing of how they play out on the surface of existing power structures and forms of domination.

Ground Truth, we suggest, offers an experiment that challenges the opacity of the "black box" (Latour, 1987) and enables a deeper engagement with the technologies that shape the way we engage with

the world. It harnesses the "imperfection" of DIY tools while seeking to destabilize the scientific certainty embodied in the tools and methods of knowledge production. The DIY aerial survey and 3D environment, alongside other practices in the framework of the Ground Truth project, seek to challenge a deep-rooted threshold of visibility and participation and provoke critique through engagement with technology in the making.

There are three elements to this experiment: applying open hardware for reconfiguring scientific tools vis-à-vis the human body; stepping into the black box and establishing ground truth by addressing the underlying material conditions for truth making; and establishing hybrid forums for technologically oriented human-rights activism in participatory settings that leverage different kinds of tools, methods, and expertise.

The Participatory Settings of Technology in the Making

Drawing on the meaning of the term in the fields of remote sensing and GIS, Eyal Weizman writes that

> kite-photography lends itself to establishing ground-truth because the aerial survey is undertaken while the feet of those taking the images are firmly on the ground. Every element captured in the aerial image can be simultaneously experienced on the ground. (Weizman, 2017, p. 289)

Indeed, our aerial survey in al-Araqib, done in collaboration with the Bedouin activists, managed to connect between aerial and ground information; between the objectivity attributed to the aerial/satellite image and the subjectivity of those who experience life on the ground. It enables the verification, calibration, and corroboration of testimony and evidence by bringing together various forms of information to challenge the erasure inflicted by the conditions of settler-colonialism and the threshold of detectability in digital and historical images.

However, kite aerial imagery is more than a tool for locally corroborating information. We argue here that the adoption of the DIY technique allows to develop a counterdominant practice that departs from the mainstream tradition of ground truth by shifting its focal point from thresholds of visibility to thresholds of participation (Keysar, 2018). It should be seen as a critique of and response to the evasive mechanisms that control and condition visibility, and a practical exercise for training ourselves in critical ways of seeing and doing with technology. Kite/balloon photography and the bottle-rigged camera constitute a self-built instrument based on open hardware and community-science agendas that shed light on the legal, political, and material realities of technological development and use. In stark contrast to its more high-tech sisters, such as satellites, airplanes, or even small-scale drones, this DIY aerial instrument has been developed and modified by its users and can be intuitively unpacked and understood. Unlike the production of maps, which require expert knowledge and tools, taking photos with a small digital camera hung inside a plastic bottle is a skill that most people can relate to, imagine its effects, and replicate as a method (see Figures 15a and b).

Figures 15a and b. (Left) The camera rig used in al-Araqib. The camera is held by a few rubber bands and pointed at 90˚ to the ground within a plastic bottle cut in two. (Image: Alina Schmuch & Jan Kiesswetter). (Right) A 3D-printed DIY camera rig also used in al-Araqib (Image: Chris Fastie).[22]

These orientations toward accessibility and participation are embedded in the simplicity of the technique. The toolkit is based on off-the-shelf technological hacking and allows for local versioning (Dosemagen, Warren, & Wylie, 2011); the reuse of existing simple and affordable technology in a manner that was not intended by its original developer (i.e., a pocket camera for aerial photography or a plastic soda bottle as a camera rig) opens up the possibility of modifying the tool according to locally sourced materials and solutions.

The threshold of participation is summoned and challenged here at the intersection of human-rights discourse, civic technoscience, open technologies, and their corollary emancipatory promises. Yet these connections in themselves do not promise a counterdominant practice. As civic and open technologies become widespread and self-evident, they should be deployed and analyzed against their claims of openness. As critics show, technological openness tends to preserve and perpetuate the power structures and inequalities upon which it is founded (Dean, 2010; Haklay, 2013; Jeremijenko, 2015; Tkacz, 2014; Turner, 2010). In addition, for people living under conditions of dispossession and displacement, the use of open-source licensing, hacking, and sharing usually constitute a remote and alien reality.

Therefore, technological openness in the case of al-Araqib should not be seen as a solution to the problem of establishing proof of Bedouin sedentary presence in al-Araqib, but as an attempt to tamper with the broader contentious battle of truth making that had been shaped almost exclusively by expert discourse. The act of collaborative mapping with local activists, including children and women, worked against a high

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[22] For more on camera rigs:
https://publiclab.org/tag/camera-rig, https://publiclab.org/wiki/kaptery-aerial-rigs

threshold of participation that tends to prevent those who are affected from meaningfully contributing to the production and interpretation of aerial testimonies. As addressed earlier in this article, in the work of humanitarian and human rights organizations, geospatial technologies demonstrate not only a problem of participation but also of anonymity and remoteness. Though it expands participation and rapidly accelerates testimony through crowdsourcing, it nonetheless perpetuates a top-down culture and practice dominated by experts and corporations.

In al-Araqib, the deployment of geospatial technologies was not directed toward engaging large anonymous crowds of people in the production of testimonies. In fact, during the workshop and the various mapping expeditions, very few people participated, apart from the Bedouin activists. Nonetheless, it aimed at exploring new ways for creating a local and nuanced collaboration that can scale horizontally and become meaningful as a technosocial practice and hybrid forum (Callon, 2009) in the field of human rights. Ground Truth can be seen as an experiment in creating such a hybrid forum—a gathering in public space that addresses troubling issues through the heterogeneous involvement of various local, technological, and scientific expertise (Callon, 2009, p. 18). As a hybrid forum, it strives to create the spatial and material settings for transcending the legal-professional rights discourse to other emancipatory discourses and practices that politicize the production of knowledge through varied forms of participation.

Ground Truth's various elements contributed to that end: public testimonies by young and elder Bedouin activists; countercolonial photography and archival practices that asserted the legitimacy and validity of Bedouin documents and their importance for future truth making and reconciliation; the performative act of constructing and deconstructing the Ground-Truth tent, which created a temporary yet material space for subjugated radical politics; and the use of the DIY technique, not only as a "device" in the participatory process but also a mediating object, a "thing" that can stimulate variable forms of engagement, experiences, and relations (Haklay, 2015; Latour, 2005; Suchman, Trigg, & Blomberg, 2002). The latter's deployment in the Ground Truth project reconfigured the bonds in human-rights action between "experts" (researchers, developers, and human-rights activists), "victims" (the affected community), and technologies in the production of testimonies and truth.

Having said that, the Ground Truth online platform, launched as a prototype in August 2018, requires the use of advanced devices and some technological savviness for experiencing 3D environments, and therefore brings forth further challenges as to the long-term feasibility of meaningful collaborative work. At the moment, the question remains as to whether the platform will serve the residents of al-Araqib and contribute to making their ongoing struggle public and visible.

Conclusion

Paradoxically, it can be argued that the DIY view from above in the context of political conflict and rights deprivation connects with performances of mobile witnessing, coined by Kari Andén-Papadopoulos (2014) as "camera-mediated witnessing." As she writes, camera-mediated witnessing is the "ritualized employment of the mobile camera as a personal witnessing device . . . facilitating claims to truth by citizens recording their own oppression" (p. 756). Though the use of the technique in the case of al-Araqib is far from being as ritualized and networked as mobile cameras are, it cannot be separated from the operation

of global networks and the flow of digital information through ICT. The many examples of DIY aerial photography in political and environmental activism summon a new form of camera-mediated activism that embodies a similarly authoritative record and near-real-time testimony, created and mediated by the abused. In contrast to networked and crowdsourced forms of aerial or geospatial witnessing, the DIY aerial testimony shapes an active role for those who are directly affected and suggests a potential "mobilization" of aerial/satellite testimonies toward a more political and democratized form of witnessing.

Though the legal-professional discourse of rights isolates and classifies al-Araqib as a "case" in a dehistoricized land dispute, the civic appropriation of aerial technology allows for the reworking and reassertion of the broader settler-colonial context as well as creating connections between various human-rights struggles. It connects the Palestinian resistance in al-Araqib with other cases where DIY techniques were used such as Jerusalem (Keysar, 2018; Rey-Mazón, Keysar, Dosemagen, D'Ignazio, & Blair, 2018),[23] Gaza,[24] and south Lebanon (Martinez Mansell, 2016). It also draws links to citizen-driven aerial resistance through DIY mapping in places such as Brooklyn, NY[25]; Kampala,[26] Nairobi[27]; and others beyond the Palestinian context. Rather than isolated acts of refusal and despair, these many hundreds of kites are part of a broad movement of people contesting and working against political and technoscientific forms of control and domination by negotiating the public field of aerial vision and action.

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[23]   https://cargocollective.com/hagitkeysar

[24] See the use of kites as weapons and a form of protest and resistance in Gaza: https://www.independent .co.uk/news/world/middle-east/gaza-israel-attacks-fire-kite-flyers-blockade-palestinians-hamas-a8453536.html

[25]   https://publiclab.org/wiki/new-york-city

[26]   https://publiclab.org/notes/mlamadrid/05-15-2013/tool-for-stalling-mapping

[27]   https://publiclab.org/wiki/nairobi

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