

# Ground Truth

## Reading Aerial Images of the Naqab from the Ground Up

Eyal Weizman

By the time this text is printed, the residents of the Bedouin village of al-‘Araqib, a dozen or so kilometers north of Beersheba on the northern threshold of the Naqab/Negev desert, will have recorded the village’s 174th demolition. The largest of these demolitions, in 2010, involved almost a thousand Israeli policemen riding fleets of trucks and bulldozers, using clubs, tear gas, and rubber bullets to drive the residents forcefully out of their improvised ramshackle structures. At its most populous, the village numbered about four hundred people, mostly from the extended al-Turi family. Now only a small core of a dozen or so inhabitants remains, within the grounds of the old al-Turi cemetery, right next to the graves. The current demolition count started only in the early 2000s, but the first expulsions had already begun in 1951, three years after the end of the 1948 war, when the Israeli military turned its attention to the Bedouins and started expelling them, as it did with other Palestinians.

Almost ninety thousand Bedouins, some 90 percent of their population in the Naqab, were pushed over the Egyptian and Jordanian borders. The rest were scattered internally and concentrated in a limited area in the more arid parts of the desert. Since then, at irregular intervals that sometimes lasted months, other times decades, the original inhabitants of al-‘Araqib and their descendants have exercised their “right of return,” physically, persistently, continuously, on the ground, rebuilding after every cycle of demolitions. Traces on the ground – wells, structures, ruins, and,

most importantly, the cemetery – keep that possibility of return alive. Returns are followed by expulsions, as the Bedouin Nakba continues.

The cycle of returns, demolitions, and confrontations escalated in the early 2000s after al-Turis returned to build their village next to their ancestral cemetery. By then, the area had been radically transformed: al-‘Araqib was no longer part of the open frontier of the desert’s edge, but had become a small landlocked “island” surrounded on all sides by Israeli agricultural settlements, forests, military bases, a highway, a railway, and a major waste disposal facility.

The recent cycle of demolitions, like those of other illegalized Bedouin settlements, form the most recent chapter in what the Israeli establishment and the media now calls “the battle over the Negev”: a systematic state campaign meant to uproot the Bedouins, concentrate them in purpose-built towns located mostly in the desert’s more arid parts, and hand over their lands for the purpose of Jewish settlement.

When, several years ago, Sayah al-Turi filed a claim for his lands in the district court in Bir Sab‘a, he was ambivalent about engaging the Israeli legal system after already experiencing the way Israeli courts had refused to protect his and other Bedouin claimants, and after being imprisoned and fined several times for staying in his land. In all previous cases, the courts had ruled against the Bedouin plaintiffs and had upheld state policy.<sup>1</sup> Al-Turi was also aware that appealing to the court’s arbitration would give it and the Israeli state an aura of legitimacy. But the al-Turi family had gathered much evidence for his family’s ownership of his land – aerial photographs, land sale documents, and tax receipts; correspondence with Ottoman, British, and Israeli officials; and military orders testifying to his family’s and other Bedouin tribes’ settlement and cultivation practices in the northern threshold of the Naqab over the past 150 years that he believed no one could contest. The aim of the case was thus not only to reverse the dispossession of a single family, but also to confront the very foundations of the legal regime that enabled the dispossession of other Bedouins in the area.<sup>2</sup>

## **The Earth Photograph**

One part of the case involved the interpretation of aerial photography. While it is on the surface of the earth that the entanglement of land use, politics, conflicts is played out, it is from the aerial perspective that it most clearly comes into view.<sup>3</sup> The surface of the desert appears to be different, depending on the season when the photographs were taken. In late summer, the vegetation is closely shaven off the surface, and the territory appears translucent, revealing features on and under it that would otherwise be obscured by the light plume of seasonal weeds. The enhanced shadows of early mornings or late evenings can reveal subtle undulations in the topographical surface, traces of erasure that would not be visible from the ground. The relative dryness of the terrain conserves traces better than any other environment. The surface of the desert thus resembles a photographic inscription,

exposed to the direct and indirect contacts of human and climatic forces in a way similar to how film is exposed to light. This makes aerial images artifacts of double exposure: they are photographs of photographs.<sup>4</sup> For those willing and able to read its surface closely, the desert can reveal not only what is present, but also the subtle traces of what has been erased: traces of ruined homes and small agricultural installations, of fields and wells that can sometimes be noticed under the grid of newly planted forests, as well as the dark stains of long-removed livestock pens.

Beyond the threshold of the desert, climate and photography interact in other ways, too. There is an inverse relation between humidity and visibility: the farther south one flies, the drier the air and the thinner and more conducive to vision and photography it becomes.<sup>5</sup> From 15,000 feet, it is not only the surface of the earth that is being photographed, but also the air that is between it and the lens. The thicker and more humid the air, the less focused the rendering of the surface becomes. Atmospheric blur and distortion are thus not only reductions in information, but, inversely, a source of information themselves – a rough indication of the level of humidity.

But reading aerial photography must not only concern itself with reading the surface captured digitally or on film. It must also be concerned with the technology and politics that placed the camera up in the air in the first place, and it is often the military or other state agencies that have generated these images. The Naqab's airspace is currently the largest and busiest training area for the Israeli Air Force and has one of the most cluttered airspaces in the world. This airspace is partitioned into a complex stratigraphy of layers, air boxes, loops, and corridors dedicated to different military platforms: from bomber jets to helicopters to drones.

But it was not only the Israeli Air Force that has taken aerial photographs there. Two sets of aerial photographs have become important in relation to Bedouin land claims. The first was captured during the summer of 1918, at the end of World War I, by the German Imperial Air Force, and the second by the British Royal Air Force in the winter of 1945, toward the end of World War II. The reason that the area had been overflowed by both militaries is that during World War I, the threshold of the desert was a military frontier and a battle zone. In World War II, it was expected to be one. The black-and-white military sequences did not aim to record Bedouin life, agriculture, and cultivation, but did so inadvertently, mainly at the edges of military sites, in the margins of the photographs, always slightly out of focus. These two sources document the state of the Naqab during two different periods and in opposite seasons, capturing the threshold of the desert in each of its alternate states, arid (summer 1918) and in cultivation (winter 1945), and are thus important resources in confirming Bedouin presence and land use across time and different seasons.

To understand what is made visible within them, the photographs need to be put into context and compared with contemporary aerial images, as well as with images from the ground. These days, one can easily access satellite images of the area. But the publicly available satellite images of Israel are degraded, as a result of Israel's lobbying with the U.S. administration, to the coarse resolution of one meter

per pixel (it is half a meter per pixel almost everywhere else), one in which most structures in a Bedouin village lie under the threshold of visibility.

They are invisible to the state agencies that undertake continuous high-resolution aerial surveys of these sites, closely monitoring their expansion, but this top-down perspective is not available to the inhabitants of the villages. Google Earth and other mapping software, in line with the policy of the Israeli state and its cartographers since 1948, does not mark the illegalized villages or their access roads. They have also been written off all travel maps, to the extent that travelers, guided by GPS navigators, often encounter these communities unexpectedly.



The Bavarian State Archive in Munich contains 2,872 glass plates of aerial photographs of Palestine dating from 1918. Most were taken by the Bavarian Squadron 304 (Königlich Bayerisches Fliegerbataillon 304) which, together with four other German squadrons (about eighty-five aircraft in total), was part of the expeditionary force of imperial Germany that flew in support of the Ottoman military. These were the early days of aerial reconnaissance, a technology that became operational only toward the end of the war.

The context was the British invasion of the Ottoman Empire. In 1917, as the imperial British Egypt Expeditionary Force (EEF) progressed north from Sinai, the Ottoman armies fortified along the line they perceived to be the threshold of the desert – from Gaza through Bir Sab‘a to Hebron, about fifteen to twenty kilometers of today’s 200-millimeter isohyet, or rainfall measure. Their calculation was simple: attrition along the desert edge would keep the European soldiers in the arid part, with less water and pasture to irrigate and feed the tens of thousands of horses and mules on which their military campaign depended. The strategy was successful, and the EEF got bogged down south of Gaza. But the British forces finally broke through Bir Sab‘a, taking the town in a massive charge on the last day of October 1917. Some of the Ottoman units managed to escape and retreated a few kilometers north, stabilizing a second line of defense right through the hills of al-‘Araqib. From 1 to 6 November, the armies fought “several sharp little actions,”<sup>6</sup> and the EEF managed to withstand an Ottoman counterattack along the al-‘Araqib stream. The battle incidentally coincided with another major political development. The Balfour Declaration – promising a national home for the Jews in Palestine – was signed on 2 November and published on 9 November, while the imperial armies were clashing along the aridity line in al-‘Araqib.

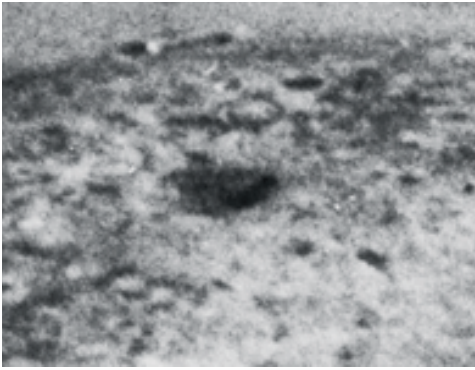
The Bavarian aviators of Squadron 304 joined the retreat of the Ottoman military. Understanding they were fighting a lost war, the pilots also took to photographing archaeological and religious sites with no strategic importance. This made them among the first to use aerial imagery for archaeological purposes.<sup>7</sup> Their last task in the summer of 1918, a year of constant defeats and retreats, was to return and overfly

British military positions in the Naqab. Most of their photographs are oblique shots taken from hand-held cameras as the airplane tilted its wings. On 20 September 1918, a few days after the last documented photograph was taken, they surrendered to the British at the Afula airstrip in the northern valley. Surprisingly – perhaps because the significance of aerial imagery was not fully understood by all ranks of the British military at the time – they were allowed to keep their glass prints and brought them back with them to Munich, where they are now archived.<sup>8</sup>

Despite exhausting the archive and its archivists, the closest photographs to the al-‘Araqib hills I could find were about one kilometer away in each direction. Because the surface of the desert appears barren in these photographs, the Bavarian images were presented by state lawyers seeking to demonstrate that Bedouins never settled in these parts.<sup>9</sup> The photographs were taken in the summer months at the end of the war. The Bedouin tribes had been expelled from the area by the Ottomans because, after the fall of ‘Aqaba to Bedouin forces led by Auda Abu Tayi and T. E. Lawrence “of Arabia” in July 1917, the Ottomans believed, not without reason, that the Naqab Bedouins harbored animosity toward their empire and sympathies toward the British.

Reading these images requires a careful study of their surface at the highest possible magnification. It is then that these photographs start to reveal elements that are typical of Bedouin life at the threshold of the desert. These include structures and ruins, fields of cultivation next to the streams.

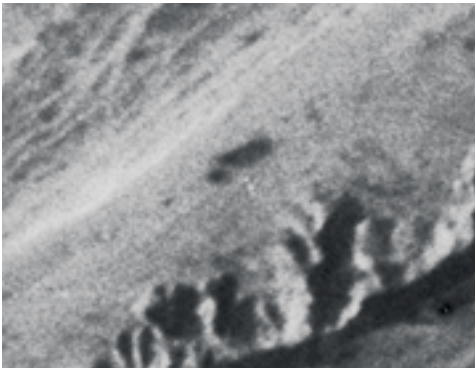




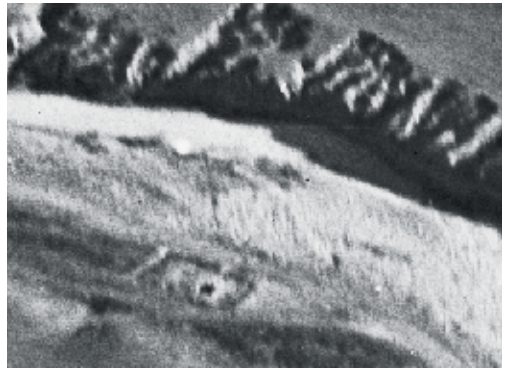
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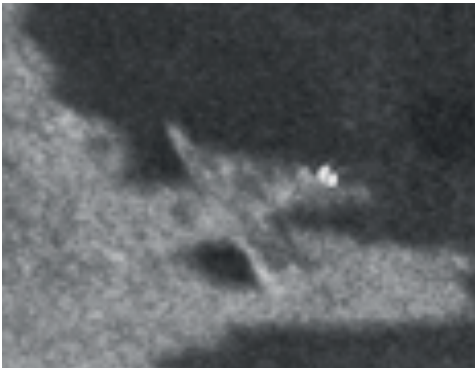
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Figures. 1 and 2. Tal al-Shari'a, Bavarian Squadron 304, 24 August 1918. This site is about one thousand meters northwest of al-'Araqib. The 1918 image contains traces of abandoned Ottoman trenches and fortifications. Marked within the white frames (nos. 1–6) and reproduced in the enlargements opposite are possible traces of Bedouin settlements consistent with Bedouin land use at the threshold of the desert.

## Life at the Threshold of Detectability

A systematic air survey of Palestine was conducted only toward the end of World War II, when the techniques and technologies for producing a photographic series that could be tiled into a cartographic grid were developed as part of the war effort. The PS series (named after Port Said, the airport at the north of the Suez Canal from which the aerial flights took off, but often mistakenly referred to as the Palestine Survey) was produced between December 1944 and May 1945 by RAF squadrons transferred from the European front.<sup>10</sup> During World War II, reconnaissance planes could fly longer and higher, and the cameras were now integrated into the aircraft's structure.

The photographic mission progressed from south to north. The reconnaissance pilots overflew al-‘Araqib on 5 January 1945.<sup>11</sup> After the survey was completed, the Hagana, the largest Zionist paramilitary force, managed to convince a sympathetic archivist to smuggle some of the negatives of the aerial photographs out of RAF archives. They printed and returned the originals before their absence was noticed. A number of these reproductions were included in the “Arab Village Files” – intelligence documents on Arab localities that were used by the Hagana in 1948 to occupy and ultimately expel the villagers<sup>12</sup> and that are now available in Israel's cadastral center in Tel Aviv – providing a benchmark record for the condition of Palestine before the establishment of Israel and, ironically, evidence for the existence of these villages.

January is the peak of the rainy season. The black-and-white photographs captured the northern threshold of the Naqab in a state of cultivation, almost completely covered with a patchwork of small agricultural fields. The photographs were submitted in a number of previous cases.<sup>13</sup> But the state's argument that there are not many clear visible traces on the ground, benefited from the fact that Bedouin life leaves only gentle marks on the land and the inability of film to render these marks clearly, in the way that Western agricultural settlements would render.

Analysis of aerial images also requires some understanding of the material properties of negatives. From a cruising altitude of 15,000 feet, each of the nine-inch (twenty-three-centimeter) square films used by the RAF captured an area of about three-and-a-half square kilometers. The resolution of analog aerial photographs is measured by a unit called “line-pairs per millimeter” (lp/mm). It designates the number of pairs of white and black lines that could be captured within every millimeter of film. The Kodak Aerocon High Altitude panchromatic negative film used for aerial photography in full sunlight conditions at the end of World War II had a fine-grain resolution of thirty-five lp/mm – that is, it could potentially show seventy lines (half black, half white) within every millimeter of the negative. The width of a grain – the narrowest that a line could possibly be – is approximately 1/70 millimeters on the negative, which translates to 214 millimeters – roughly 20 centimeters, or 0.2 meters, on the ground.<sup>14</sup> However, the 15,000 feet of atmosphere between the ground surface and the film surface reduced the effective resolution

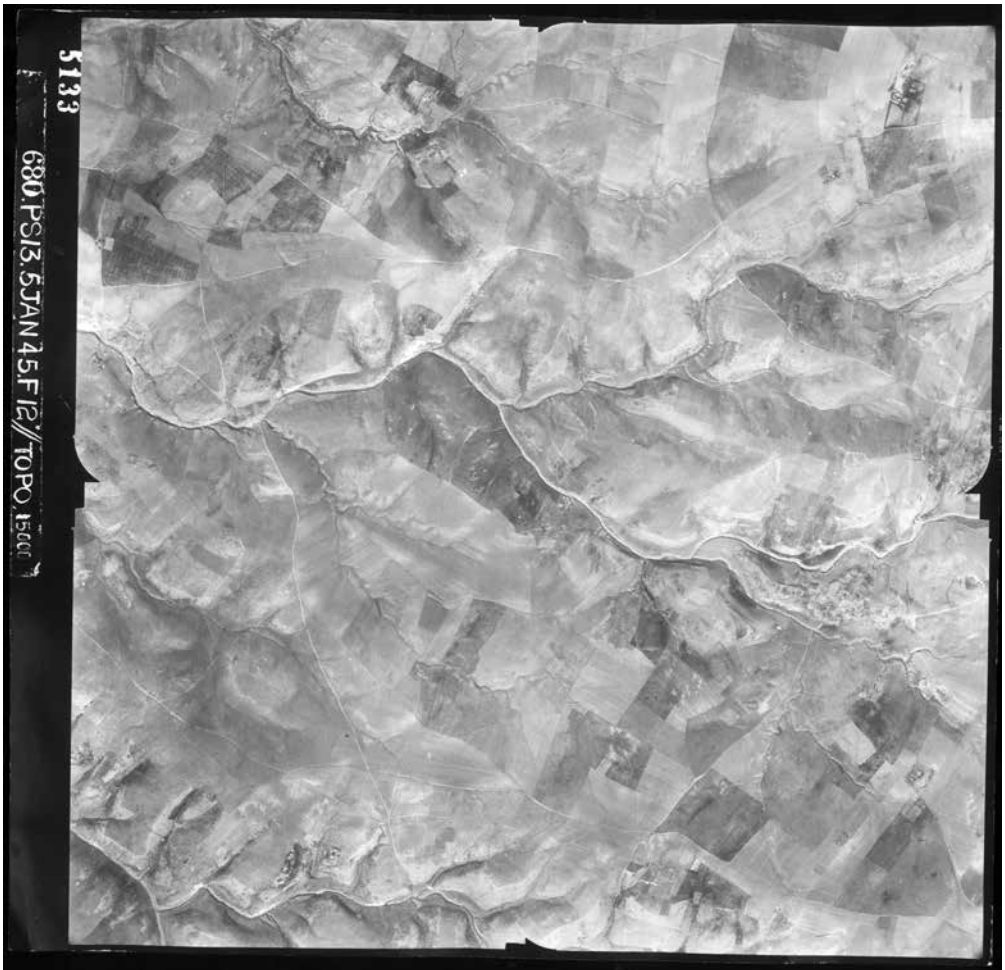


Figure 3. The area of al-'Araqib, image 5133, British Royal Air Force, 5 January 1945.

of the film to 50 centimeters, which means that the grain represents an area of half a meter in diameter on average on the ground,<sup>15</sup> close to the image's "threshold of detectability."<sup>16</sup> At this resolution the holes of wells and the gentle mounds of graves – crucial elements to identify – were close to the size of a single grain in the negative. It was thus necessary to consider both the materiality of the objects represented, a well or a hole, and the materiality of the surface representing it, the photographic negative.

Aerial images, such as the RAF photographs from 1945, are not unmediated copies of the world, but products of material relations between objects: one composed of celluloid plastic coated with gelatin emulsion with silver halide crystals, the other of stone, earth, and vegetation, a relation mediated by the prevailing conditions of the climate between them.



## Ground Truth

A form of translation from the surface of the film to the surface of the terrain is referred to as “ground truth.” A variation of this process is used by meteorologists, remote sensing, or aerial interpreters to calibrate the analysis of images to the ground. This is necessary because there is never a one-to-one relation between aerial photographs – indeed between any photographs – and the reality they capture. Our interpretation of the “ground truth” method sought to establish relation between differently shaded silver salt grains, or between differently colored pixels, and the patch of earth they represent by patiently reading aerial images from the ground up. Inverting the process of aerial image interpretation, we first endeavored to study an element on the ground, then check how it registers in the historical aerial image, and then deduct how all other elements may do so.

A collaboration – between the al-‘Araqib village council; Forensic Architecture (an investigative agency I ran in London); Zochrot, an association committed to the memory of the Nakba; and Public Lab – sought to establish and socialize the production of “ground truth” in relation to the RAF photographs from 1945.

We did that by studying different elements on the ground, photographing them, and then taking a different kind of aerial image survey using cameras attached to kites. The way the latter task was achieved was by attaching a standard digital camera to the bottom part of a kite using rubber bands. Because this process involves communities in the task of aerial photography, it is also referred to by Public Lab as “community satellites.”



Figure 4. Images of kite photography survey, Ariel Caine and Hagit Keysar, 2016.

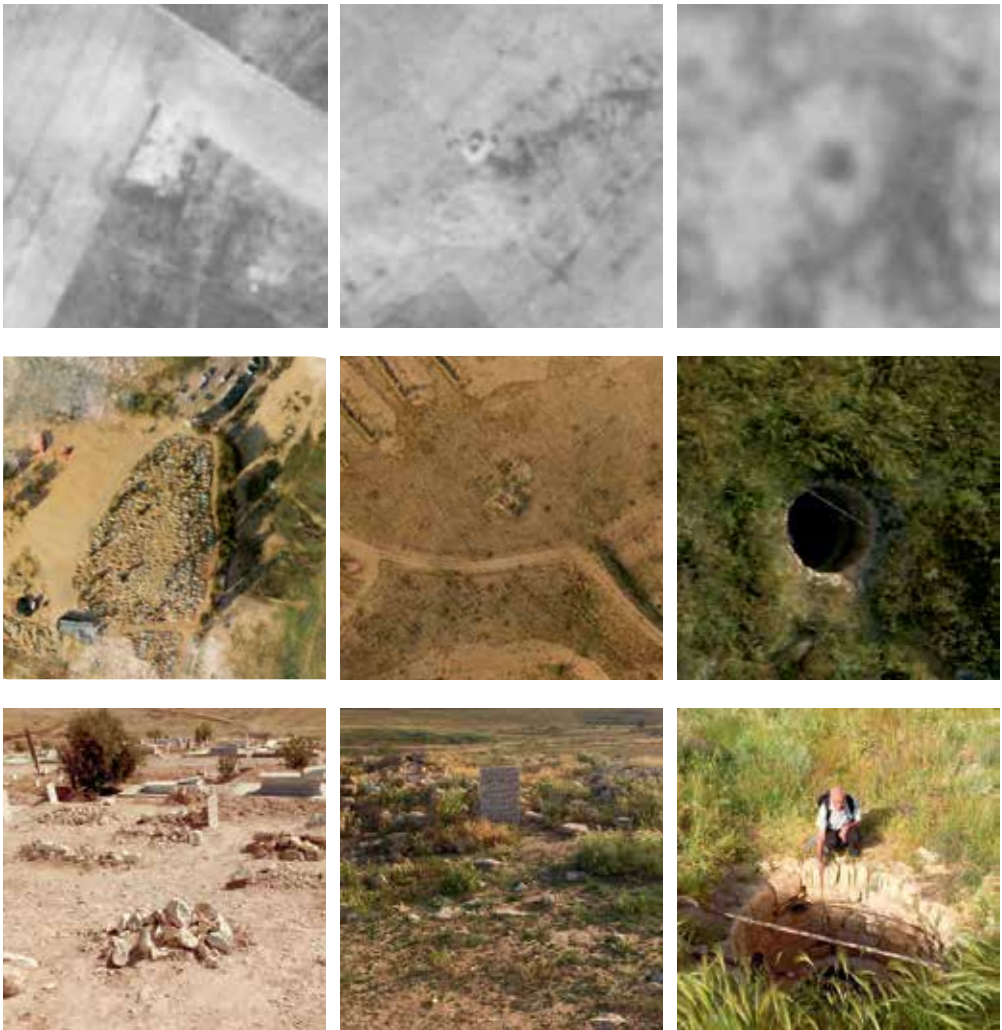


Fig. 5. Top row: RAF aerial photograph from January 1945; middle row: the aerial image taken from kites in 2016; lower row: ground images (2014–16). Left column: The al-Turi cemetery; middle column: The house of Sulayman Muhammad al-'Uqbi in al-'Araqib. The stone in the image below reads: “This is the house of Sulayman Muhammad al-'Uqbi (1914–1993). The house was built in 1936 and demolished after he and his clan were expelled in 1951. Right column: The well of Sulayman Muhammad al-'Uqbi, Nuri al-'Uqbi’s paternal grandfather.

Photographs of the same element taken from multiple viewpoints from the kite could then be processed using special process called “photogrammetry” into an accurate three-dimensional model of the area.<sup>17</sup> This survey can in turn be superimposed over historical aerial photographs.

The kite survey provided not only a precious record of al-'Araqib just before the last of its remnants – stone houses, dams, wells – are removed, destroyed or buried under new development or afforestation; it also helped us read the older set of aerial

images. The process of using the “community satellites” of kite photography lent itself to the task of “ground truth” because the aerial survey was undertaken while the feet of those taking the aerial images are firmly on the ground and every element captured in the aerial image can be simultaneously experienced on the ground. The process of establishing “ground truth” thus combines an archaeology of material traces on the ground with an analysis of the material properties of the photograph.

## The Cemetery

As mentioned before, the anchor for the al-Turi family’s return was an old cemetery existing on their lands. The claim that the al-Turi cemetery did not exist on the 1945 photographs was made by aerial image interpreters employed by state commissioned aerial image interpreters and in a report by an Israeli organization called Regavim, itself funded by government bodies to “establish state sovereignty and government control over state land and act against ‘illegal land grabs’ by Palestinians.” In the Naqab, it concentrates on “Bedouin trespassers.”<sup>18</sup>

In December 2013, the group published a report that used a series of aerial and satellite photographs, the oldest being the aforementioned 5 January 1945, RAF image, to claim that al-Turi cemetery was not present on the site before the establishment of the state. The report demanded that the state immediately evict the remaining members of al-Turi family still living there.<sup>19</sup>

Working on this legal case as an expert witness for al-Turi family, I ordered the relevant 1945 photographs at maximum resolution from the Israeli cadastral center (the original negatives are in the RAF archive in Edinburgh but unavailable for researchers). At Forensic Architecture, we superimposed the 1945 image with the kite survey by matching the twists and turns on the al-‘Araqib stream – the only identifiable feature on the site after almost seventy years of development and transformation. Together with Aziz al-Turi we travelled through the ground holding the contemporary kite survey and the 1945 photographs in our hands. Shifting back and forth between the 1945, the kite survey, and what we saw on the ground demonstrated continuity between an aerial image and a ground image. But such continuity is not a simple trajectory of translation – images do not “reconcile” easily – they require a complex process of translation and counter-posing. Working through this process of translation we identified elements that still remained. Most of the wells were still in place — in the aerial image they were only registered as single black dots, a single silver salt grain unexposed to reflected light—some of the stone houses of years past were now present as stone ruins, the terraces and dams that the inhabitants of this area built along the little streams were mostly at the same spot we saw them in the 1945 image, testifying for continuity of agricultural practice over the generations. Most importantly, many of the thin white routes we could see in the 1945 photograph, representing well-trodden paths, matched those paths taken today. The paths of dirt routes are created through repeated use, and record the continuity of movement. They are a testimony for the ongoing relation

between location on the ground and thus for the continuity of cultural habits and patterns of life. This is reminiscent – as advocate Michael Sfrad who represented the Bedouin families commented when we brought these paths to his attention – to one of the cities described in Italo Calvino’s *Invisible Cities* where the different associations between people were represented by strings tied from one house to another representing the relation between people and things that constitute urban life.<sup>20</sup> In al-‘Araqib, the dense and continuous network of dirt paths tied together across the generations the living areas of tents, the places of wells, the small gardens by the dams, and indeed, the cemetery, indicating the continuity of traffic.

Zooming further in we were able to locate the cemetery within the 1945 photograph. In a small part of where the al-Turi cemetery can be found on the ground today, in the 1945 photograph there is a small area of lighter surface, usually the result of a well-trodden ground as one would expect from a frequented place. It stood out in contrast to its less walked on surroundings. The extent of the lighter surface is smaller than the contemporary extent of the cemetery, but in 1945, the cemetery obviously would have been smaller.

In a visit to the site in September 2014, Sayah al-Turi led me to the oldest part of the cemetery, where the graves were marked only by small piles of stones. It was only several decades ago that the Bedouin families of the area started using stone gravestones. One of these piles was the first grave on site, dated, he said, to 1914.<sup>21</sup> By the time the 1945 photograph was taken, al-Turi explained, there were already about fifteen or twenty graves similarly marked with piles of stones. The piles of stone I could see on site were between a meter and a meter and a half long, and about half a meter in width. On the 1945 photograph, these would occupy the size of a single grain, or at most, two silver halide grains side by side. And indeed, in the lighter, distinctly frequented area of the cemetery, there were a number of darker grains indicating distinct objects.

The process of establishing “ground truth” allows us to read the graves back into the photographic grain. On the other hand, it also suggests that the state experts in aerial images, those claiming there is no cemetery to be seen on the ground – like other colonial travelers and cartographers – exercised an active form of “not seeing,” of visual denial undertaken both in the image and on the ground.

The white spots left on colonial maps of the seventeenth and eighteenth centuries were means of erasure: acts of “whiting-out” that led to the wiping out of entire native cultures. Those promoting aerial and satellite photographs over cartography tend to argue that the former are objective and neutral renderings of the surface that capture all things without the cultural prejudice of drawn maps, where a cartographer could decide what is important enough to show and what to leave out.

But photographs, whether from the air or from the ground, require close reading and interpretative labor, which can be politically and culturally conditioned. Such reading requires putting into relation information of different kinds and a close attention to detail and grain and as such an inverse reading of aerial images from the ground up.



Figure 6. Al-Turi cemetery, al-'Araqib. Photography project by al-'Araqib village, Hagit Keysar/Public Lab, Forensic Architecture, Ariel Caine, Zochrot.

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#### Endnotes

- 1 Al-'Uqbi v. the State of Israel, heard in 2009.
- 2 Israeli High Court of Justice Civil Case 7161/06 [in Hebrew].
- 3 Nuri al-'Uqbi, interview, 20 July 2014.
- 4 In 1913, Frederick Laws was the first to develop the practice of aerial reconnaissance for the British military. Looking from a light aircraft at a moist patch of grass in the air force base in southeast England from which his light aircraft took off, Laws could make out the imprint of “a dog, following a parade of soldiers, being chased off by the Sergeant” shortly after they had all moved on. F. C. V. Laws, “Looking Back,” *Photogrammetric Record* 3.13 (April 1959), 28–29.
- 5 C. Donald Ahrens, *Meteorology Today: An Introduction to Weather, Climate, and the Environment*, 8th ed. (Belmont, CA: Thomson Higher Education, 2007), 110. A similar phenomenon is observed by Patricio Guzmán in his film *Nostalgia for the Light* (Nostalgia de la Luz), 2010. The relation between humidity and resolution is captured by a photographic term known as “dimensional stability,” which measures the size-changes of objects caused by small deflections generated by different levels of humidity and temperature. High-altitude photography and the demands of photo interpretation thus require special media.



- 6 A. G. Macmunn and Cyril Falls, *Military Operations Egypt and Palestine*, vol. 2, part 2 (London: HM Stationery Office, 1930), 84–85. Military reports of this battle included in this text note the water shortage and the problem of obtaining drinking water for the thirty thousand horses, mules, and camels employed by the EEF. Some charges were delayed so the horses could be taken back to Bir Sab'a for watering. In other occasions, horses were thrown into battle without drinking for three days.
- 7 They had arrived in Beersheba in early October 1917 – their planes packed in parts on freight trains – just in time to see the British storm through the town on 31 October. The squadron managed to fly out and to land at a Gaza airfield, but a few days later, the city fell, too. The aviators managed to escape again, relocating this time to the north of Palestine. Some pilots, among them several Jews, were shot down and are buried in the German military cemetery in Nazareth. Squadron 304 was one of the first to record systematically archaeological sites from the air. Sites included Christian churches in Jerusalem, Bethlehem, and Nazareth, as well as older ruins in Jericho, Caesarea, Acre, and the Dead Sea. The sorties were also part of the Heritage Commando (Denkmalschutzcommando), which undertook numerous scientific surveys of ancient monuments. The organization was led by Theodor Wiegand, who also employed aerial photographs obtained from specially equipped kites. The images became important for aerial archaeology, because many places in Lebanon, Syria, Israel, and the Palestinian territories have since been built over. See *Image Collection Palestine*, ed. Lothar Saupe (Munich: Bavarian State Archives, 2010), photographs of Palestine recorded 1917–18 by the Bavarian Squadron 304.
- 8 Nada Atrash, “Mapping Palestine: The Bavarian Air Force WWI Aerial Photography,” *Jerusalem Quarterly* 56 (Winter–Spring 2014): 95, online at (palestine-studies.org) tinyurl.com/s4n2x4y (accessed 12 March 2020).
- 9 Alon Tal refers to this presentation in *Pollution in a Promised Land: An Environmental History of Israel* (Berkeley: University of California Press, 2002), 350. The photographs were presented by Aviva Rabinovich, a Jewish National Fund botanist.
- 10 I wrote, erroneously, that “PS” meant Palestine Survey in *The Conflict Shoreline*; Fazal Sheikh and Eyal Weizman, *The Conflict Shoreline: Colonialism as Climate Change in the Negev Desert* (Göttingen: Steidl, 2015). The survey had a crucial part to play in the history of the area: less than a year after the photographs were taken, the Anglo-American Committee of Inquiry used these aerial images to calculate population numbers and levels of cultivation in order to draft one of the proposed lines of partition of Mandatory Palestine. In the Bir Sab'a district alone, they identified 8,722 tents and 3,389 stone houses (*baykat*) belonging to the Bedouin tribes of the area. Sandi Kedar, Ahmad Amara, and Oren Yiftachel, *Emptied Lands: A Legal Geography of Bedouin Rights in the Negev* (Stanford University Press, 2018). A map, “Distribution of the Nomad Population of the Beersheba Sub-district” was compiled from information that included the aerial photographs of 1945. Background information on the compilation of this map can be found in Appendices 3 and 4 of United Nations, General Assembly, Ad Hoc Committee on the Palestinian Question, Report of Sub-Committee 2 (1947), A/AC.14/32, online at (unispal.un.org) tinyurl.com/w3dmb67 (accessed 12 March 2017).
- 11 Dov Gavish, *A Survey of Palestine under the British Mandate 1920–1948* (London: Routledge, 2005), 245–48.
- 12 See: Ian Black and Benny Morris, *Israel's Secret Wars: A History of Israel's Intelligence Services* (London: Hamish Hamilton, 1991), 129; Gil Eyal, *The Disenchantment of the Orient — Expertise in Arab Affairs and the Israeli State* (Stanford: Stanford University Press, 2006), 85. For a good, accessible introduction to aerial photography and image resolution in World War II, see Denis Cosgrove and William L. Fox, *Photography and Flight* (London: Reaktion Books, 2010).
- 13 Yosef Ben Shlomo, “Expert Report for the Analysis of Aerial Imagery,” 15 September 2009, sent to Nuri al-Uqbi.
- 14 The following is a more detailed technical explanation: For the making of the Port Said survey series, the RAF reconnaissance airplanes were photographing at an altitude of 15,000 feet. The focal length of the lens was 12 inches or 1 foot. The scale of the film is obtained by dividing the altitude by focal length. The scale of the negative film is thus 1:15,000, which means that every millimeter on the film represents 15 meters on the ground. Because the size of the negative film is 9 inches or 228.6 millimeters, the area

captured on each separate negative film is about 3.4 by 3.4 kilometers, or 11.5 square kilometers. The resolution of the film used by the RAF is 35 line pairs per millimeter. This unit, lp/mm, measures how many pairs of alternating black and white lines would fit within a millimeter on a negative. If there are 35 line pairs, each the width of at least a single grain, then in a single millimeter on the film there are 70 grains. The size of a silver salt grain is 0.014 millimeters. At a scale of 1:15,000 the size of the grain represents 214 millimeters of ground. However, given the atmosphere, the effective resolution is 50 centimeters per grain.

- 15 Eli Atzmon, interview, 29 April 2014.
- 16 Eyal Weizman, "Matter against Memory," in *Forensis: The Architecture of Public Truth*, ed. Forensic Architecture (Berlin: Sternberg Press, 2014), 361–78, 365.
- 17 See the essay by Ariel Caine, "Granular Realism: Dominant and Counter-Dominant Practices of Spatial Photography in the Naqab" in this issue of *JQ*.
- 18 See: Regavim, "Bedouin Myth #2 — Are the Bedouin Villages Historical?" 16 December 2013, online at ([regavim.org](http://regavim.org)) [tinyurl.com/rym6ujl](http://tinyurl.com/rym6ujl) (accessed 12 March 2020); Regavim, "The Truth About the Bedouin in the Negev," online at ([regavim.org](http://regavim.org)) [tinyurl.com/vhx8yod](http://tinyurl.com/vhx8yod) (accessed 12 March 2020). Political theorists Nicola Perugini and Neve Gordon explain that, "according to the organization's human rights narrative, Jewish settlers are victims of discrimination and the colonized Palestinians are the 'invaders' and 'silent conquerors' of Israeli national lands as well as the perpetrators of human rights violations against Jewish citizens of Israel." Nicola Perugini and Neve Gordon, *The Human Right to Dominate* (Oxford: Oxford University Press, 2015). A good resource for thinking about the politics of NGOs can be found in *Nongovernmental Politics*, ed. Michel Feher (New York: Zone Books, 2007).
- 19 In addition to the 1945 photographs, the Regavim report also presented Israeli Air Force photographs from 1956, 1965, and 1987 and a satellite image from 2010. It is only in the 1965 photograph, and from that date on, Regavim's report claimed, that it was possible to notice the cemetery in its early stages and a single tent next to it. Regavim's conclusion is that "the 'historic' village al-'Araqib, which the Bedouin claimed was established during the Ottoman period, was built at the end of the 1990s and thereafter." They wrote that in "the area where al-'Araqib is today, in 1945, no village or cemetery [existed] whatsoever." Regavim, "The Truth about the Bedouins in the Negev."
- 20 Italo Calvino, *Invisible Cities* (1985), "In Ersilia [. . . ] the inhabitants stretch strings from the corners of the houses, white or black or gray or black-and-white according to whether they mark a relationship of blood, of trade, authority, agency. When the strings become so numerous that you can no longer pass among them, the inhabitants leave: the houses are dismantled; only the strings and their supports remain. From a mountainside, camping with their household goods, Ersilia's refugees look at the labyrinth of taut strings and poles that rise in the plain."
- 21 Interview with Shaykh Sayah al-Turi in the cemetery of al-'Araqib, 27 September 2014.