

Forensic Architecture

VIOLENCE AT THE THRESHOLD OF DETECTABILITY

Eyal Weizman

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Preface

FORENSIC ARCHITECTURE—the investigative practice that this book introduces—refers to the production of architectural evidence and to its presentation in juridical and political forums. It regards the common elements of our built environment—buildings, details, cities, and landscapes, as well as their representations in media and as data—as entry points from which to interrogate contemporary processes and with which to make claims for the future.

Forensic Architecture is also the name of a research agency I established in 2010, together with a group of fellow architects, artists, filmmakers, journalists, scientists, and lawyers. We undertake independent research or act on commission from international prosecutors and environmental and human rights groups to investigate state and corporate violence, especially when it bears upon the built environment. The agency produces evidence files that include building survey, models, animations, video analyses, and interactive cartographies, and presents them in forums such as international courts, truth commissions, citizen tribunals, human rights and environmental reports, and, on one occasion, in the UN General Assembly.

We use the term “forensics,” but we seek, in fact, to reverse the forensic gaze and to investigate the same state agencies—such as the police or the military—that usually monopolize it. For this purpose, our investigative work tends to exceed the procedural limitations and necessities of the legal forums in which we present. We locate incidents in their historical contexts and pull from their microphysical details the longer threads of political and social processes—conjunctions of actors and practices, structures and technologies—and reconnect them with the world of which they are part. We also try to use our investigations as an opportunity to embark upon longer-term theoretical and historical inquiries about the relations between architecture, media, and violence, which we make public in exhibitions and

texts, such as this book. Architecture, in our practice, to paraphrase Carlo Ginzburg, is “not a fortress but a port or an airport, a place from which we leave to other destinations.”¹

Following an introductory chapter that presents, by way of a historical narrative, the forensic condition of “the threshold of detectability” — a concept central to our understanding of the challenges and limitations of our practice — the book proceeds in three parts. The first, “What Is Forensic Architecture?” is, as its title suggests, a kind of practical manual. Its aim is to outline the methods, assumptions, and critical vocabulary relevant to the field, but also to discuss its constraints, potential problems, and double binds. The issues discussed in this part are interspersed with brief examples from the investigations our agency has pursued in various places worldwide as well as relevant reference materials.

The second part of the book, “Counterforensics in Palestine,” presents a sequence of recent investigations in Palestine — a place where the trajectory that led to the establishment of forensic architecture had its origin. It describes the way our practice evolved in relation to recent political challenges and to changes in the nature of human rights that have seen the most relevant evidence increasingly produced by the people experiencing conflicts firsthand.

In the third part of this book, “Ground Truths,” the site that typically organizes the optics of forensic architecture has grown to the size of a larger territory, perhaps even to that of the planet, which appears as simultaneously both a construction site and a ruin. The investigation at the center of this part was presented in a citizen-organized truth commission on the site where the Bedouin village of al-‘Araqib on the northern threshold of the Naqab/Negev Desert, a place of habitation that was destroyed and rebuilt more than one hundred times. Part 3 connects the history of this local land struggle to larger-scale and longer-term environmental transformations, to desertification and climate change along desert thresholds worldwide, and to the conflicts that such changes have provoked.

Despite there rarely being a simple “who dunnit” logic to our investigations, accounts of the cases presented in this book follow something of the convention of the detective genre, to the extent, at least, of having two entangled plots: one involving the crime in the past, the other the investigation in the present. The two plots connect with the evidence, whether material, testimonial, or media-based. Both “forensics” and “architecture” refer to well-established disciplinary frames. Brought together, however, they shift each other’s meaning, giving rise to a different mode of practice.

Architecture turns the attention of forensics to buildings and cities. Forensics turns architecture into an investigative practice, a probative mode for enquiring about the present through its spatial materialization. It demands that architects focus their attention on the materiality of the built environment and its media representations. It also, importantly, challenges architects to use their disciplinary tools to make claims publicly and politically in the most antagonistic of forums.

At the Threshold of Detectability

THE NEW MILLENNIUM began with a bizarre legal battle. The David Irving trial, which unfolded at the English High Court between January and April 2000, involved one of the most detailed and intense presentations of architectural evidence undertaken in a legal context—drawings, models, aerial and ground-level photographs of buildings—as well as aggressive cross-examinations of it. The case involved a libel suit filed by David Irving against an American historian, Deborah Lipstadt, and her publisher, Penguin Books, for calling him “one of the most dangerous spokespersons for Holocaust denial” and a falsifier of history.¹ Awkwardly, the process forced the veracity of the events of the Holocaust to be put on trial, subject not to historical methods, but to legal rules of evidence.² On the tenth and eleventh days of the trial, January 26 and 27, the legal debate revolved around the architecture of one of the gas chambers—an underground structure that was part of Crematorium II in Auschwitz-Birkenau, the deadliest of the five Auschwitz crematoria, where in a space of 200 square meters, approximately half a million people were killed.

It was also one of the only structures related to the extermination process whose destruction was incomplete. There were, in fact, two stages in the attempt to destroy Crematorium II. After the extermination process was stopped in November 1944, SS operators attempted to erase the evidence for the killings by dismantling the gassing instruments. On January 20, 1945, after most of the camp already had been evacuated, Crematorium II, along with all other Auschwitz crematoria, was dynamited. The concrete roof of the underground structure was supported by seven columns. The demolition team might have placed dynamite next to all of them, but only six detonated. The concrete roof snapped around the single surviving column at the southernmost end of the structure and remained held

up like the peak of a devastated tent. This detonation failure made it possible, decades later, for Holocaust deniers, or negationists, as they were sometimes referred to, to enter a small part of the original chamber. On one occasion, Fred Leuchter, a former US penal system execution specialist, was smuggled in there to chisel out concrete samples from the interior and check for cyanide traces (as depicted in Errol Morris's documentary *Mr. Death*). That random samples taken more than four decades after the last gassing didn't contain the level of cyanide that Leuchter would have expected to find in an execution gas chamber in the United States proved nothing, but was presented by Irving as an argument to counter the determination that the building ever functioned as a homicidal gas chamber.³

Many of the other details of the structure were subjected to close scrutiny. One, however, became the center of debate. Irving, representing himself, focused the cross-examination of the expert witness facing him — an architectural historian specializing in the history of Auschwitz, Robert Jan van Pelt — on the existence of four small holes in the ceiling of the concrete roof of the structure.⁴ According to the few surviving witnesses, both victims and perpetrators, it was through short chimney shafts connected to these holes that the Zyklon B canisters containing cyanide were introduced into the room.



Robert Jan van Pelt pointing to the ruins of Crematorium II in Auschwitz-Birkenau. The gas chamber is on top, and the arrows point to the probable location of the holes in the ceiling.
HOLOCAUST HISTORY PROJECT, 2000

Van Pelt had been studying the architecture of Auschwitz since the late 1980s. His analysis concentrated on the surviving plans, in which he read not only the meaning of lines drawn, but also traces of those erased. On one occasion, he noticed razor-blade erasure marks around the icon that architects use to mark doorways—a quarter circle—on the tracing paper on which the Crematorium II was drawn. In 1942, when the morgue that occupied this building was turned into a gas chamber, the direction of the door hinges had to change. When the bodies inside the room were pressed against the doors, they could no longer be opened inward, and the door had to open toward the outside. This erasure thus confirmed the beginning of a process of industrialized mass killing.

In the trial, Judge Charles Gray addressed van Pelt directly: “You have not seen any holes in the roof, have you, in the . . . when you went there?”⁵ Van Pelt answered in the negative. His expert report, submitted to the court in advance of the trial, presented convergent photographic and testimonial evidence for the existence of the holes, but it conceded that “these four small holes . . . cannot be observed in the ruined remains of the concrete slab.” He explained that finding the holes was impossible due to the state of the roof. Not only had the concrete roof slab broken and crashed as a result of the explosion, but it was exposed to the elements in the following fifty-six years. He also suggested that it would have been logical for the Nazis to backfill the holes with concrete before they evacuated the camp in November 1944, in the same way that any murderer would get rid of a gun. Irving claimed that it was impossible to condemn the Nazis (and him) without producing the weapon itself. Traces of the holes would be discovered in an examination that was undertaken a few years later,⁶ but in 2000, the court heard the following exchange.

IRVING You do accept, do you not, that the whole of the story of the 500,000 people killed in that chamber rises or falls, rests or falls on the existence of those holes in that roof?

VAN PELT No.

IRVING [Without it] we only have the eyewitness evidence.

VAN PELT I disagree with that. The whole story rises and falls on the evidence that this room was a gas chamber, which is a slightly different issue.⁷

At the end of this cross-examination, Irving offered van Pelt nothing less than a deal:

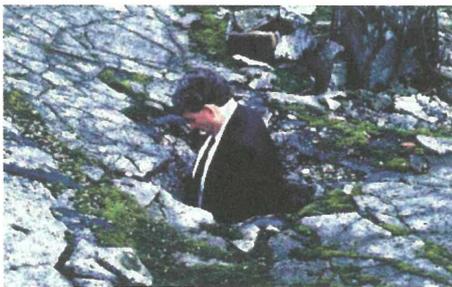
IRVING And you do accept, do you not, that if you were to go to Auschwitz the day after tomorrow with a trowel and clean away the gravel and find a reinforced concrete hole where we anticipate it would be from your drawings, this would make an open and shut case and I would happily abandon my action immediately?

VAN PELT I cannot comment on this. I am an expert on Auschwitz and not on the way you want to run your case.

IRVING There is my offer. I would say that that would drive such a hole through my case that I would have no possible chance of defending it any further.⁸

Irving seemed to enjoy the pun—“I am going to keep on driving holes in this case until your Lordship appreciates the significance of the holes, or their absence”⁹—but there was also some logic, albeit a hermetic and elliptical one, to his argument: without these holes, the cyanide in Zyklon B canisters could not have been introduced into the room, and without cyanide, the room could not have functioned as a gas chamber. In that case, the witnesses were either deluded or lying. If the structure was not a gas chamber, Auschwitz could not have been a death camp. Without Auschwitz as the functional and symbolic center of the extermination process, the Holocaust, as a premeditated industrialized policy of racially motivated killing, could never have happened. “No holes, no Holocaust” already had been the formulation of master denier Robert Faurisson for several years.¹⁰ And if the Holocaust didn’t happen, Irving could not be accused of falsifying history—*quod erat demonstrandum!*

While Irving was satisfied with proclaiming the Nazis innocent of genocide and himself a victim of libel, the cascading linear logic of denial was extended by some groups that, since the US designation of the Pol Pot regime as genocidal, supported Holocaust denial as an anti-imperialist practice. Without the Holocaust, the entire apparatus of “Western democratic



Fredrick Töben, an Australian Holocaust denier, going through a break in the roof of Crematorium II at Auschwitz-Birkenau. He is trying to demonstrate that the opening was too large to have been one of the lethal holes. FREDRICK TÖBEN, “TO THE MANNHEIM JAIL: JUSTICE AND TRUTH IN CONTEMPORARY GERMANY,” *JOURNAL OF HISTORICAL REVIEW* 20.3 (2001), AVAILABLE AT COMMITTEE FOR OPEN DEBATE ON THE HOLOCAUST, CODOH.COM/LIBRARY/DOCUMENT/2978

uninvited, Irving shouted: “Check the ink!” before being thrown out.¹⁴ The ink was dated to the 1950s.

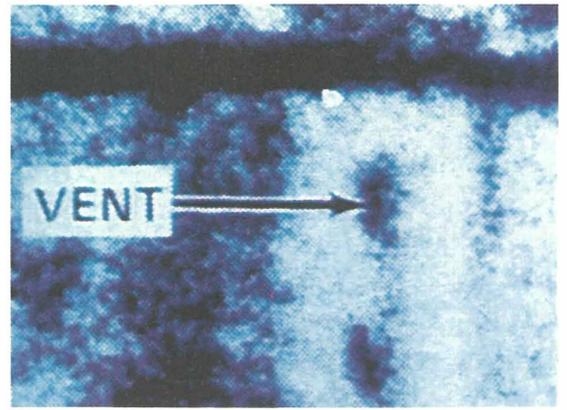
In the London trial, it was not ink, but architecture — or more precisely, the absence of a particular piece of material-architectural evidence — that Irving sought to mobilize against human testimony. It was not positivism that led him to insist on materiality — there would be nothing wrong with adding a material dimension to other evidentiary techniques — but rather negation, which fundamentally meant negation of the ability of witnesses to speak to history at all. Posing matter against memory, he seemed to advocate a history without witnesses and beyond language.

Because the evidence concerned not only matter, but its absence — the absence of holes — the issue revolved around a rather confusing absence of an absence.¹⁵ The fact that the holes could not be found was presented by Irving as “negative evidence” for the process of extermination. “Negative evidence” is an oxymoronic term that legal professionals and scholars employ when the very absence of material evidence is used as evidence in its own right. In legal terms, it is a kind of antibody meant to disrupt and dismantle the assemblages of evidence on which cases rest. Defense teams mobilize negative evidence to disrupt prosecution cases: despite overwhelming converging evidence, they hope a crime cannot be proved if there is no body or no weapon, or, as in our case, if there are no holes. For prosecutors, on the other hand, negative evidence can also indicate that evidence was destroyed and that this act of cover-up might be considered incriminating evidence in its own right.¹⁶ By blowing up the building, the Nazis were engaged in Holocaust denial, but inadvertently confirmed that a crime had taken place inside.

TOWARD A FORENSIC ARCHITECTURE

Harun Farocki’s 1989 film *Images of the World and the Inscription of War* presented an inadvertent prequel to this story. On a cloudless day, August 25, 1944, a US reconnaissance mission was sent to photograph a petrochemical factory — Monowitz-Buna — located next to the Auschwitz-Birkenau extermination camp. The five-by-three miles of ground territory captured by one of the 35-millimeter negatives shot by a US Air Force Mosquito plane included the roof of Crematorium II, somewhere close to the edge of the frame in the lens’s area of barrel distortion. The fact that this image, along with a few other aerial photographs from the spring and summer of 1944, captured the crematorium was noticed only in 1978, by two CIA image

Harun Farocki, *Images of the World and the Inscription of War*, 1989.



analysts named Dino Brugioni and Robert Poirer. When the image was enlarged, Brugioni and Poirer spotted four blurry marks on the roof of the crematorium building and simply annotated them as “vents.”¹⁷ These were the small chimney shafts that led to the infamous holes.

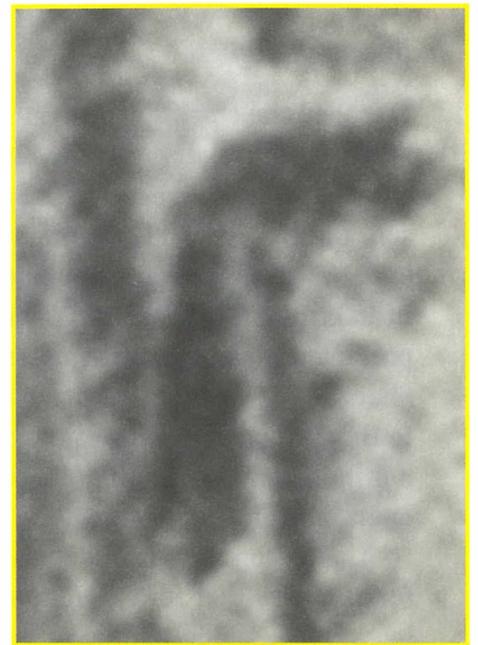
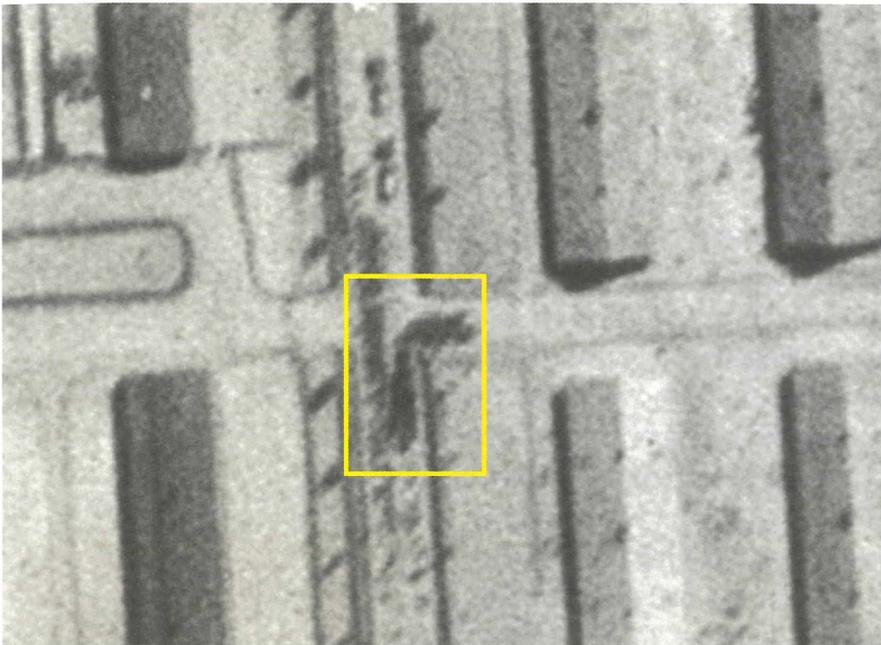
Irving claimed that the film on which the shafts were recorded was inauthentic. When he looked at it under high magnification, he noticed a strange interference pattern at the place where the vents were marked.¹⁸ This, he claimed, indicated that the negative had been tampered with by the addition of “brush strokes” sometime after the film was shot.¹⁹ But the court was also provided with a report prepared shortly before the trial by Nevin Bryant, “supervisor of cartographic applications and image processing applications” at NASA’s Jet Propulsion Laboratory in Pasadena, California, and an expert in the analysis of aerial and satellite images.²⁰ Bryant used state of the art digital magnification to peer into the molecular composition of the film. At stake was the way in which the photographic process captured and recorded objects on the scale of the silver halide crystals or “salts” that make up the chemical composition of the film. Film resolution depends on the distribution and the ranges of sizes of these grains. Bryant determined that from the altitude of 15,000 feet and at the resolution of the negative, a single grain represented an area of about half a meter square on the ground. He suggested that the interference pattern identified by Irving was a phenomenon that occurs at the level of the grains in the emulsion of the film when images of objects on the ground are captured at or close to the size of the grains in the film. The same kind of interference patterns occurred also in another part of the same roll. The photograph there captured a group of prisoners being marched within the camp. Irving referred to these interference patterns as “brush strokes,” as well. Responding to

the judge's request for clarifications, van Pelt quoted Bryant's conclusion: the interference pattern was caused when "the size of a head of a person is the same as the size of a grain in the emulsion of the film, and the result of that was that [of] a *moiré effect*, which occurs also in the newspaper when you photograph a picture which has been screened twice."²¹ That the indivisible unit of photography represents half a meter square of ground, roughly the same as the size of a person seen from above, is a coincidence that continued to haunt the practice of forensic architecture, as I will explain later.

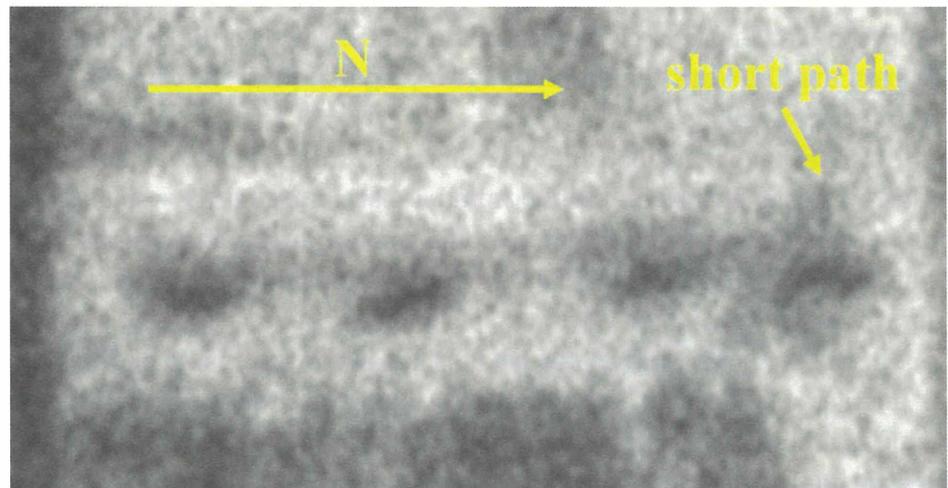
The shafts on the roof of Crematorium II were also the same size, half a meter by half a meter. It was the shadow cast on that cloudless day that created the blurred interference pattern.

When the size of an object recorded on the negative—here, a person or a shaft—is close to the size of the material element that records it—the single silver salt grain—it is in a condition that I refer to throughout this book as the *threshold of detectability*: things that hover between being identifiable and not. They leave a chemical signature on the negative, but cannot be verified. At the threshold of detectability, both the surface of the negative and that of the thing it represents must be studied as both material objects and as media representations.²² In other words, this condition forces us to remember that the negative is not only an image representing reality, but that it is itself a material thing, simultaneously both representation and presence.²³

As the cross-examination went on, it became clear that against the linear argument mobilized by Irving's negative evidence, van Pelt had woven a complex and overwhelmingly convincing network of converging evidence, both for the existence of the holes and for the entire operation of the structure as a death chamber. These included architectural plans, letters, diaries, logbooks, testimonies, and ground-level photographs.²⁴ Irving lost the trial and later also lost the appeal. My aim here is not to reopen the case, but to show how it turned on the condition of the threshold of detectability. It also demonstrates the ongoing tension between testimony and evidence—material and linguistic practices, subject and object—and the complex interdependencies between violence and the negation of evidence that are central to the field of forensic architecture. I also begin this book with the Irving trial because it serves as a warning: an independent forensics analyst challenging officially sanctioned truths with the typically limited means afforded to activists is not a guarantee of progressive politics.



A group of prisoners being marched through a gate in Auschwitz, U.S. Air Force, 25 August 1944. As the prisoner group turns 90 degrees, the narrow neck seems to be a gate. There is another group of prisoners moving along the main north-south route. The size of the head of a single prisoner is the same as that of a single silver salt particle in the film. COURTESY OF NEVIN BRYANT, NASA



The roof of Crematorium II, rotated 90 degrees clockwise in relation to the first image on page 17, Auschwitz-Birkenau. US Air Force photograph, August 25, 1944. Nevin Bryant explained that the four dark areas are the shadows cast around the Zyklon B chimneys. He identified the short interference path next to the rightmost hole as a person, possibly a member of the SS, standing on the roof. It is possible that gassing was going on at the time when the image was taken. COURTESY OF NEVIN BRYANT, NASA

DRONE VISION

I recalled the story above about the holes and the Irving trial when Forensic Architecture began its investigation of Western drone strikes.²⁵ At the end of 2011, we were commissioned by several organizations: Ben Emmerson, the UN Special Rapporteur on Human Rights and Counter-Terrorism, asked us to investigate a number of strikes for a report on drone warfare in Pakistan, Afghanistan, Yemen, Somalia, and Gaza that he eventually presented at the UN General Assembly; the Pakistani human rights lawyer Shahzad Akbar asked us to prepare evidence for a legal action he presented to the UK Court of Appeal; and the UK-based Bureau of Investigative Journalism asked us to collaborate to uncover patterns of drone strikes in built environments.²⁶

The reason we were commissioned (despite having only recently been formed) was that for several years drone strikes had shifted from targeting vehicles along roadways to targeting buildings in dense urban environments. The evidence had an architectural dimension, and there were no other organizations providing architectural analysis. Two years into the drone campaign, the Taliban forces in the Federally Administered Tribal Area (FATA) on the Pakistani frontier with Afghanistan learned to avoid, or at least to minimize, traveling between remote bases and moved into towns and cities. The CIA killer drones followed them there.²⁷ While testimonies and evidence of civilian casualties in the towns of FATA started to emerge, the CIA was still persistent in denying that its drone campaign was taking place at all.

However, a particular type of evidence also started to emerge. The effect of drone strikes on buildings had a distinct signature—small holes in the roof. The targeted building would remain intact, except for a hole that the missile had pierced on its way in to detonate within a room inside the structure.

These holes, our study later established, were the result of the kind of missiles employed in these strikes. As long as drone strikes targeted vehicles, the CIA munitions of choice, primarily Lockheed Martin Hellfire antitank missiles, would do.²⁸ Since 2007, the US had invested millions in modifying these missiles for the task of striking buildings within urban environments. The “Romeo” Hellfire II or AGM-114R was tested in 2009 and put into action in 2010. It was, in fact, a counterarchitectural technology. One of the important developments introduced in this model of the missile had to do with improving its charge and delay fuse. A few

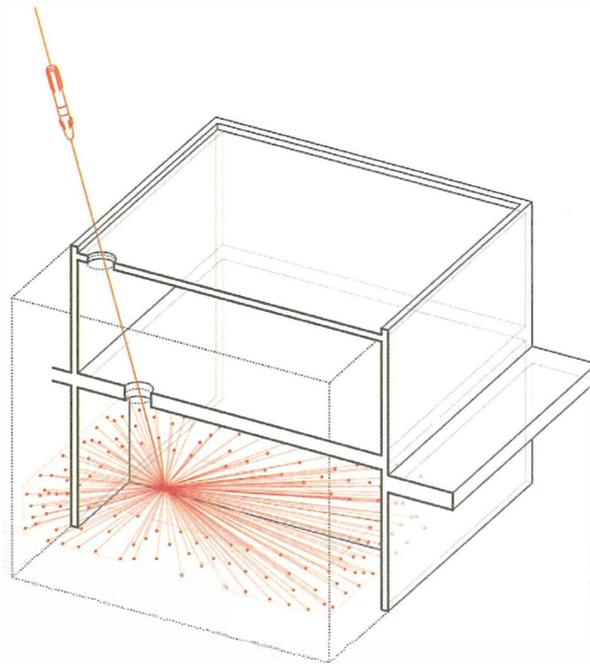


Diagram of the path of a delay-fused missile through a building.
FORENSIC ARCHITECTURE

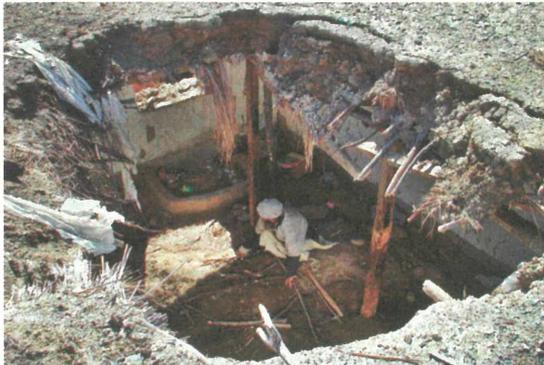
milliseconds delay between first impact on the roof and detonation, which could be differently set for each strike, allows a missile to break through several layers of roof, walls, and floors made of adobe, brick, or concrete before detonating in a room deeper within the structure, where a payload of hundreds of lethal steel fragments is designed to destroy flesh, but leave the structure intact. Most other airborne munitions detonate upon impact, leaving most of the blast force outside the structure. To ensure the deaths of the people inside, large payloads are needed to bring the structures down.

The apologists described their drone missiles as a “humanitarian technology” because they saved lives and produced less collateral damage than those authorized and used by other military planners.²⁹ The argument rested on the idea that they are “saving people” from what the United States otherwise would have done to them. The “humanitarian violence” of drone warfare could thus be presented as one that both kills and saves.

The critics of drone warfare objected to the Pentagon’s account of the missiles’ accuracy (deviation from aiming point) and precision (dispersion of damage).³⁰ They were not always as accurate and precise as they claimed to be. However, in general, criticism of covert drone warfare shifted between two seemingly contradictory positions: it was both too precise, allowing operators to kill from half a world away, and not precise enough, unable to distinguish between civilians and combatants.



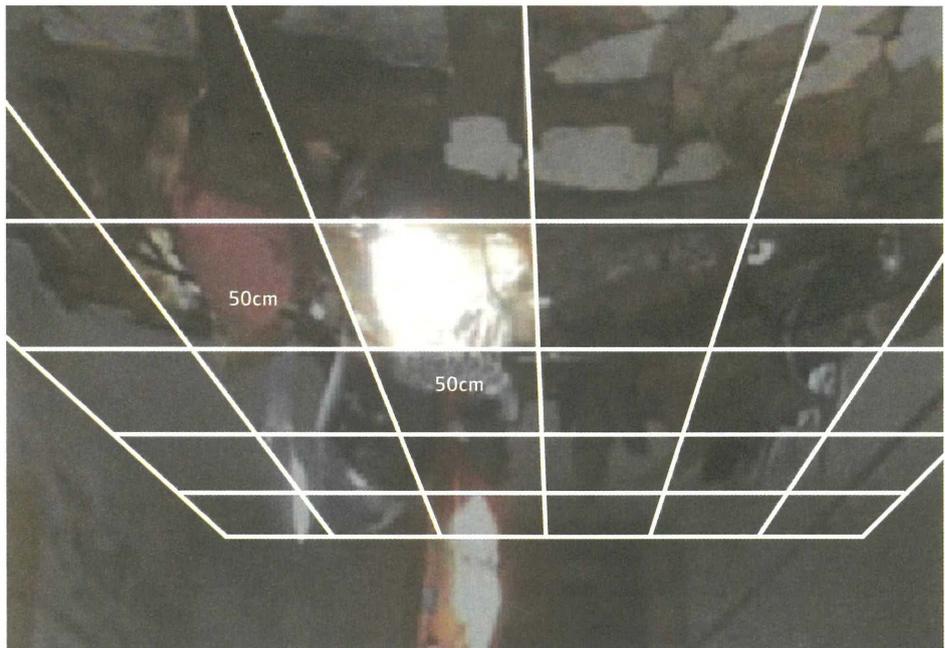
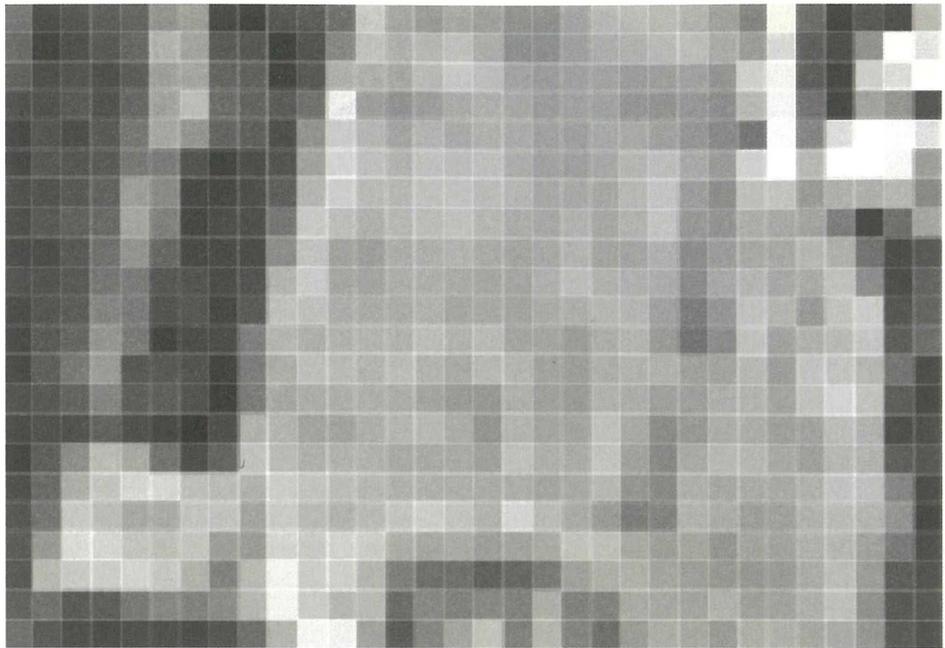
Traces of roof-penetrating munitions. Tuffah, Northern Gaza, 2009. Being able to study similar strikes in Gaza assisted the analysis undertaken remotely in Pakistan. KENT KLICH



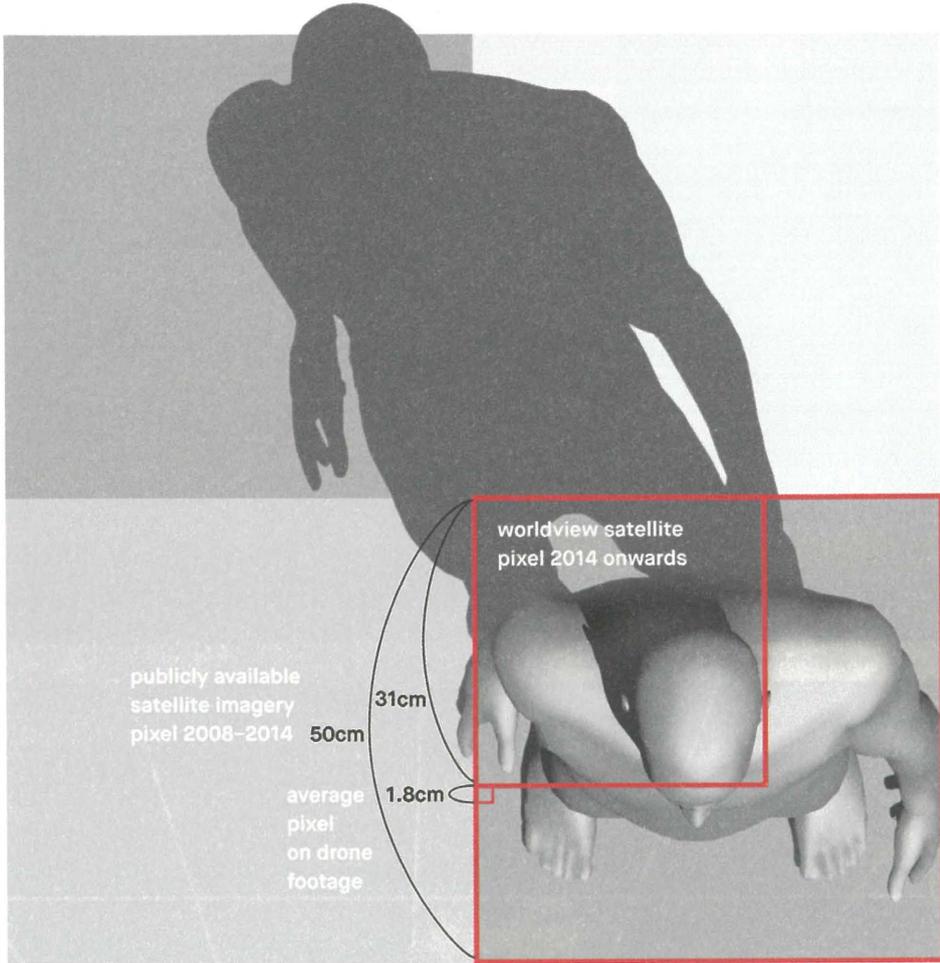
A man is seen through a hole made in his roof by a US drone strike in Damadola, Bajaur region, Pakistan, on January 13, 2006. © TARIQ MAHMOOD/AFP/GETTY

The issue, we believed, related to the fact that decisionmakers authorized their use because drone munitions were perceived as highly precise. Like other techniques and technologies of the “lesser evil,” the perception that drone munitions could be precise was an important factor in allowing for drone strikes to be continually authorized in densely inhabited civilian areas, in markets, in homes, in mosques, and in schools, leading, cumulatively, to the proliferation of civilian casualties. Of the 380 strikes that one of our partners, the Bureau of Investigative Journalism (BIJ), recorded in Pakistan from 2004 and 2014, we have established that more than 234, or about 62 percent, were targeted domestic buildings. The holes in the roofs across FATA thus demonstrated the relation between the microscale technology of drone missiles and their effects on a larger territorial scale in an extended campaign that according to the BIJ, by the end of 2014 resulted in as many as 1,614 civilian casualties in Pakistan alone.³¹

However, the confirmation of such architectural traces of drone missile strikes was not easy to come by. The areas where drone warfare took place were made inaccessible to journalists and human rights investigators from



top: An enlargement of a satellite image at the presumed location of a March 30, 2012, drone strike in Miran-shah, FATA, Pakistan. We were unable to identify the hole in the roof because it is smaller than the size of a single pixel. bottom: The hole in the roof through which the drone missile entered the same building. DIGITALGLOBE, MARCH 31, 2012; MSNBC BROADCAST, JUNE 29, 2012



The photographic modulator: pixel sizes in relation to the dimensions of the human body. FORENSIC ARCHITECTURE

Pakistan and worldwide; as such, there were very few images in public circulation. The most common way to investigate would have been satellite images. From their perspective, however, the hole in the roof was smaller than the area captured by a single pixel in the resolution to which publically available satellite images were degraded.

This resolution posed a digital version of the problem that had emerged with the silver salt particles in the negatives of the 1944 reconnaissance photographs of Auschwitz. In both cases, the hole indicated that the room under it was an execution chamber, and in both cases, such holes and the violence they evidenced were at or under the threshold of detectability. The point here is not to compare attempts to exterminate a whole people in gas chambers to a secret and largely illegal assassination war conducted in civilian areas, but to show that the forensic-architectural problem was analogous in the sense that it forced us to examine the relation between an architectural detail, the media in which it could be captured, a general policy of killing, and its acts of denial.

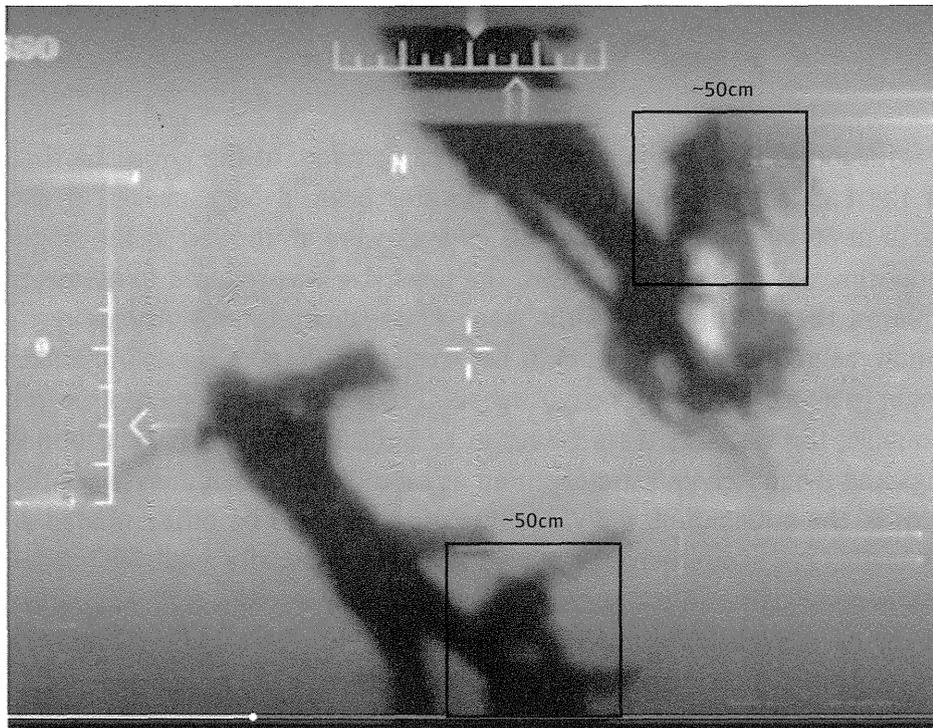
Unlike the randomly disturbed grains of analog photography, digital images, such as satellite images, are divided into a grid of equal square units, or pixels. This grid filters reality like a sieve or a fishing net. Objects larger than the grid are captured and retained. Smaller ones pass through and disappear. Objects close to the size of the pixel are in a special threshold condition: whether they are captured or not depends on the relative skill, or luck, of the fisherman and the fish.

Throughout recent decades, the resolution in which satellite images were made publically available gradually improved. In the 1970s, the first of the Landsat earth-observation satellites beamed back images of the earth at 60 meters per pixel. Small villages were swallowed in the single monochrome square. In the 1980s, the pixel size was reduced to 30-meter squares, then, at the turn of the 1990s, it was down to 20.³² At that resolution, as architect Laura Kurgan has explained, human rights violations begin to be recognizable as environmental transformation: one can see, for example, the traces of mass graves in agricultural fields; however, buildings and neighborhoods are captured as an undifferentiated mass. At the turn of the millennium, individual buildings came to be differentiated at 2.5 meters per pixel, then a few years later, the publically available images sharpened further to 0.5 meters per pixel. However, this gradual process of the earth's coming into focus was then halted. The pixel resolution of contemporary, publically available satellite images is not only a product of optics, data storage, or bandwidth capacity, but of legal regulations that

bear upon political and even geopolitical rationales. Throughout the height of the drone campaign and for the entire duration of our investigation, the resolution at which satellite images were made publically available was legally kept at 0.5 meters per pixel, with each pixel representing half a meter by half a meter of ground's surface—incidentally, also approximately, the same ground surface area captured by a silver halide grain in the analog aerial images debated in the Irving trial.

The reason for halting the process of improving the resolution of publically available satellite images was that at 0.5 meters, the pixel resolution corresponds to the dimensions of the human body—an area 0.5 meters by 0.5 meters is roughly the size of the human body as seen from above. As such, the pixel could be thought of as analogous to what Le Corbusier called a “modulor”—a system of proportions and measurements that relate to the human body.³³ The satellite images’ modulor was not meant to help organize space, but rather to remove the human figure from representation. The human body was now drowned within the pixel resolution available to independent groups to analyze human rights violations.

The 0.5-meter resolution was selected as a limit for publically available



Leaked footage from Italian military drones flying in Iraq—originally published in December 2015 in *L'Espresso*—helped us estimate that the rough pixel resolution of these drone-mounted cameras is between 1 and 2 centimeters per pixel. The black squares on this image, marking the size of a single pixel in a satellite photograph at the time we undertook our investigation, contain 1,681 pixels in this image. *L'ESPRESSO*

images because it bypassed risks of privacy infringement when recording people in public spaces, much in the same way that Google Street View blurs the faces of people or car license plates. But the regulation also has a security rationale: important details of strategic sites get camouflaged at the 0.5-meter resolution, as are the consequences of violence and violations such as drone strikes on buildings.

In a further radicalization of the geopolitics of resolution, US satellite image providers make an exception to the 0.5-meter rule in Israel and the Palestinian territories it occupies. An amendment to the US Land Remote Sensing Policy Act of 1992, which established the permitted resolution of commercial US image satellites, dictates that these areas are shown only at a resolution of 2.5 meters (later effectively eased to 1.0 meter per pixel), a resolution at which a car is depicted as two pixels and a roof, another common target, is depicted by four. The screen thus placed over Israel's violation of Palestinian rights in the West Bank and Gaza contributed to Turkey's decision, after the Gaza Flotilla incident of May 2010, to send its own image satellite into space and make available 0.5-meter-per-pixel images of Palestine/Israel.³⁴ Eventually, in June 2014, the 0.5-meter limit was changed to 31 centimeters per pixel after an appeal from a commercial satellite company to the US Department of Commerce convinced them that a person could still not be recognized at this resolution—a change that, again, applied in all places but Israel.³⁵

The resolution of satellite images also has direct, if inadvertent, consequences for our ability to investigate drone strikes. Although at a resolution of 0.5 meters (in use until the end of our investigation in early 2014) the general features of individual buildings can be identified, a hole in a roof—the signature of a drone strike, often no wider than 30 centimeters in diameter—would appear as nothing more than a slight color variation, a single darker pixel, perhaps.

UN bodies—primarily through the UN satellite analysis unit of UNOSAT—tend to undertake investigations by studying before-and-after satellite images. Because satellite images render people invisible, the scale of analysis shifts to architecture or to the environment—to buildings and ruins or cities and landscapes. The analysis depends on what difference can be detected in a before-and-after image. But when examining sites known to have been struck by drones, no such difference is noticeable. This might give another meaning to the helplessness captured by the term “UN resolution.”

US agencies are not limited to the satellite image resolution that the public is. The resolution of cameras on US spy satellites is much higher.

The satellites of the Pentagon's Keyhole program can see to a resolution of about 15 centimeters, or 6 inches, per pixel, but these are not available to the public or to human rights groups.³⁶ The United States can also use other platforms, such as airplanes and drones, to peer into the territory of the publically available pixel. The optical resolution of military drone cameras is still kept secret. Former operators have said that the images are sharp enough to identify individuals by their faces. Others have said that the resolution is not sharp enough to differentiate between children and adults and that spades could be mistaken for guns. The images and footage that have been made public recently seem to be in high resolution and in color, but examples of visual misidentification abound—in Gaza, medics loading gas canisters were attacked when the Israeli military mistook the canisters for missiles.³⁷

The difference in resolution demonstrates the imbalance of power. While the human body is the scale to which drone optics are calibrated, it is the very thing that publically available satellite images are designed to mask.³⁸

In contemporary conflicts, both the killing and its investigation are image-based practices. However, investigating drone strikes by analyzing satellite images inverts one of the foundational principles of state forensics as practiced since the nineteenth century, namely, that to resolve a crime, the investigator, the police, must be able to see and know more than the perpetrator, the criminal, to have better access to vision and to historical and comparative data. This principle led to the introduction of photography, chemistry, and fingerprinting to police work, notably by such pioneers as the Italian criminologist Cesare Lombroso, the Swiss forensic photographer Rudolphe A. Reiss, and the French police officer Alphonse Bertillon.³⁹ In our case, however, it is the killer who has had access to better optics, data, and information than the investigators.

This inversion is nested in another: in police work, the state investigates the crimes of individuals, but here, a state is the alleged criminal, undertaking both secret assassinations and their denial, and individuals and independent organizations undertake the investigations. The visual spectrum between the high resolution used for killing and the low resolution available for monitoring the killing is the space exploited by deniers. The practice of counterforensics at the heart of this book has to engage a condition of structural inequality in access to vision, signals, and knowledge, and to find ways to operate close to and under the threshold of detectability.

VISUAL EXTRATERRITORIALIZATION

The threshold of detectability intersects with other important threshold conditions, both territorial and juridical. Targeted assassinations almost exclusively take place in particular kinds of place—frontier regions such as those of FATA, on the border region between Pakistan and Afghanistan, or in Northern Yemen, Somalia, and Gaza that are all, to a lesser or greater extent, outside the effective control of the states in which they exist.

Between June 2004 and 2014, FATA was the central focus for the drone campaign. It is an area governed under the Frontier Crimes Regulations (FCR), a vestige of British colonial rule that in 1901 rendered the region extraterritorial to the Raj—physically within its borders, but outside its full jurisdiction. In FATA, the juridical rule of law was replaced by regulations and executive rule. On the one hand, under this regime, the area benefited from limited local autonomy, but on the other, it was subjected to collective punishment if individuals or organizations were perceived to be threats to state security. Villages were destroyed, and mass exile and imprisonment were enforced without judicial oversight or the possibility of appeal. This extraterritorial condition was retained by Pakistan after independence in 1947, and although the regulations were continually revised, FATA is still considered exceptional in relation to the rest of the country. It is also outside the threshold of its civic responsibility: Pakistan's central government is still not obligated to provide infrastructure, such as schools or hospitals, for FATA's seven million residents. Child mortality and levels of illiteracy there are the highest in the country.

The maintenance of the region's extraterritorial status, now against the will of most of its inhabitants, has been essential in the pursuit of the drone campaign. People cannot be detained and brought to trial because, according to the Pentagon legal advisers, targeted assassinations can be permitted only if they are undertaken as imminent self-defense and where "a viable arrest opportunity" does not exist. The United States thus repeatedly has referred to FATA as "lawless" in order for violence to be legitimately imposed from the outside, and this without noting the role both it and Pakistan have played in imposing that very status. It is thus precisely the closing of juridical options that opened the door to targeted assassinations.⁴⁰

The extraterritorialization of FATA also enabled a peculiar temporal inversion. According to US executive regulations, targeted assassinations cannot be justified as retributions for crimes that individuals have

perpetrated in the past—this is the role of the judiciary and requires habeas corpus, the presentation of evidence, and a fair trial—but rather can be employed only in a predictive manner in order to stop “imminent attacks” that otherwise would be committed in the future. Gradually, the category of imminence has become elastic and its applicability has been pushed back in time, losing its sense of immediacy.⁴¹

Predictive forensics—the futurology of contemporary warfare—studies the future mathematically by using tools that most closely resemble those of risk management by financial or security companies and those employed in marketing.⁴² The pattern analysis undertaken by the CIA in Pakistan and Yemen scans various bits of data about people’s lives—for example, their movement along certain roads determined by the Pentagon to be “toxic,” telephone calls to specific numbers, congregation in particular religious buildings—for patterns that might “correspond to a ‘signature’ of preidentified behavior that the United States links to militant activity.”⁴³ Until 2015, when this process, referred to as “signature strikes,” was officially discontinued, the CIA assassinated people who were determined by an algorithm to pose an “imminent risk,” without their identities or names being known.

The legal extraterritorialization of FATA is enforced by an old-fashioned territorial siege. FATA is officially considered a “Prohibited Area” that non-residents require special permission to enter. Pakistani military checkpoints established along the border of the region filter movement in and out of it. But it is not only suspected militants whose movement is interrupted. These military checkpoints, along with others established by the Taliban themselves, also disrupt the movement of journalists and human rights researchers, and informal regulations intercept the bringing in and taking out of electronic equipment, including mobile phones, cameras, and navigation equipment.

These checkpoints are thus part of a media siege, which in the early years of the campaign was largely successful—only a few photographs and eyewitness testimonies were made available outside of these regions. So while other conflicts, in Syria, Ukraine, and Palestine, for example, generated massive amounts of images and data, the ones in FATA, much like those in parts of Yemen and Somalia, remained in the shadows in both social and mainstream media. In the early days of the drone campaign, this fact helped Pakistani and US spokespersons deny that it ever existed and misleadingly claim that the casualties of drone strikes died instead in “bomb-making accidents.”⁴⁴

Thereafter, when the facts of the campaigns could no longer be refuted, the form of denial employed by US agencies took the form of the “Glomar Response,” so named for the *Glomar Explorer*, a ship built by the CIA in the 1970s to recover a Soviet nuclear submarine that had sunk in a deep area of the Pacific Ocean and operated under a cover story that it was a marine geology research vessel. Under the terms of the Glomar Response, US agencies “neither confirm nor deny the existence or nonexistence” of such covert activities and of documents requested under freedom of information acts. Simply to say, “This is untrue” or “This did not happen” requires a plausible counternarrative. Glomarization, however, is a form of denial that aims to add no information whatsoever. Everybody knows, not least the people terrorized by airborne violence, that drones constantly hover over their cities, but Glomarization is a form of denial that enabled the continuation of the assassination campaign: it allowed the United States to avoid questions about the legitimacy of its preferred mode of killing and the Pakistani government to deflect protests over its collusion. Glomarization continued even after Obama publically acknowledged, in 2012, the existence of the covert drone campaign in Pakistan.

Glomarization is not only a rhetorical formulation, however; it is also based on a territorial blockade meant to make unavailable access to ground-level images and testimonies and on the fact that traces of the violence cannot be identified in the resolution of available satellite images. The resolution of satellite images themselves often can “neither confirm nor deny the existence or nonexistence” of holes in roofs that would otherwise constitute evidence of drone strikes.

Drone strikes can thus be understood not as a direct, linear relation between a drone, via a missile, and a target, but rather as a set of operations enabled by the production of thresholds—territorial, juridical, and visual. Juridical thresholds extraterritorialize entire territories, physical thresholds filter the movement of people in and out of regions, and photographic thresholds filter objects in and out of visibility.⁴⁵

PATTERN OF DRONE STRIKES

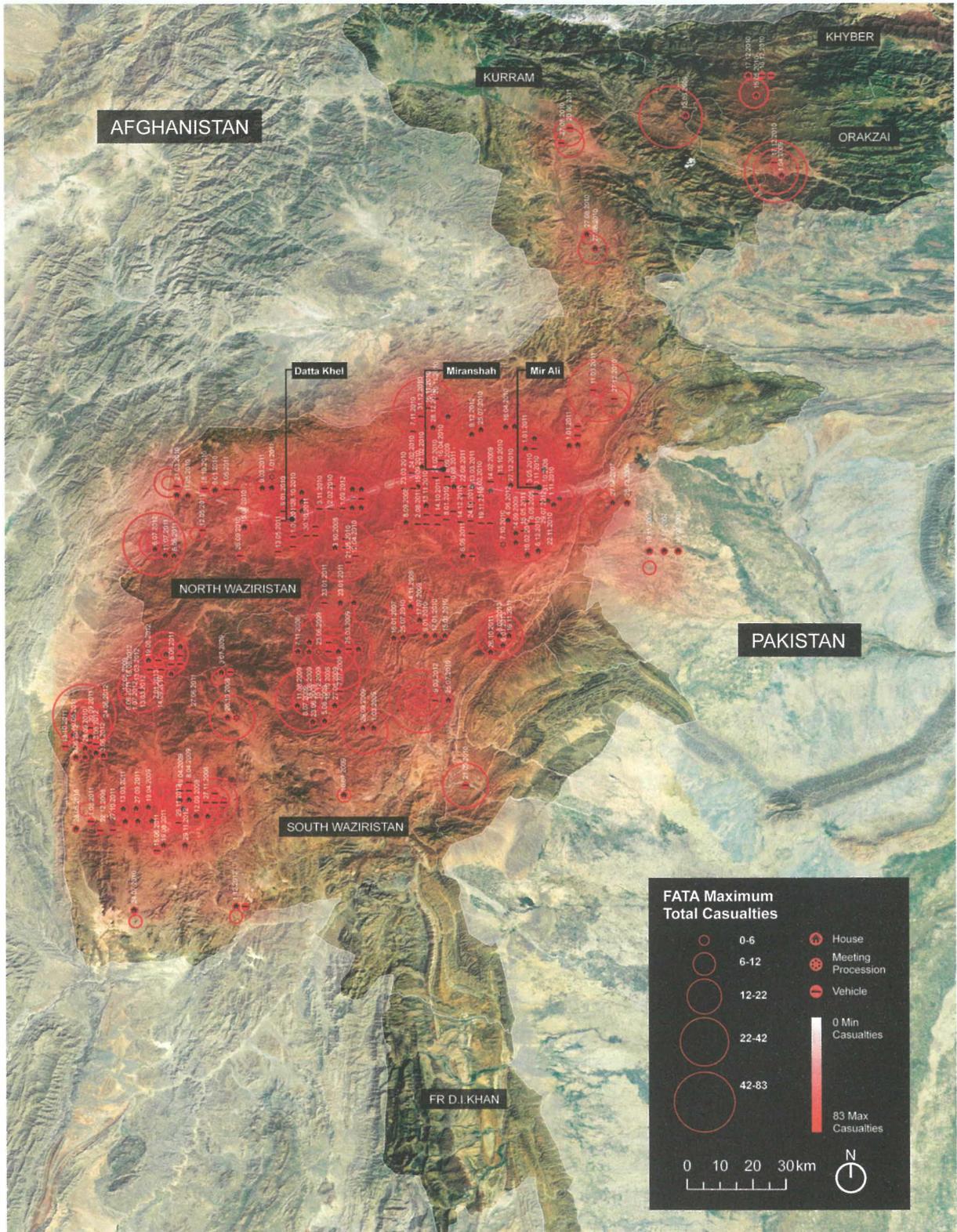
Pattern analysis can also be used as a counterforensic technique by investigative journalists and human rights groups seeking to unveil some aspects of state violence. In 2012, Forensic Architecture was asked by the BIJ to analyze patterns of CIA drone strikes in FATA/Pakistan. Our analysis sought to examine the relation between strikes on buildings and civilian casualties. The research was based on an extensive database compiled by the BIJ that logged in thousands of news reports, witness testimonies, and field research on drone strikes between 2004 and 2014.⁴⁶

We trawled through the BIJ's archive, looking for and tabulating spatial information that had not been previously looked at by them. We entered each incident into a new database that had multiple categories and tags: space/time coordinates, target type — domestic, public, religious, and commercial buildings, outdoor gatherings, or vehicles — and the extent of death, injury, and structural destruction caused. An interactive cartographic platform then spatially visualized the relations between hundreds of strikes. Different patterns, relations, and trends emerged across this aggregate data, helping to reveal relations between a large multiplicity of separate incidents that otherwise had not been obvious. We could notice a distinct escalation in targeting buildings and an increase in civilian casualties immediately after the December 2009 suicide attack in the CIA's Camp Chapman, for example.

Our pattern analysis also demonstrated the way in which the Taliban's tactics evolved in reaction to US strike policy and adapted to the hunter algorithms behind the CIA's signature strikes, with the result that both hunter and prey coevolved. Accordingly, the Taliban shifted their pattern of movement in space.⁴⁷ Adapting to CIA targeting patterns was the reason the Taliban retreated into the cities.

As strikes shifted away from vehicles, the analysis showed that domestic buildings became the most frequent targets and that the number of civilian casualties consequently grew. In total, our analysis with the BIJ revealed homes were the target of 61 percent of all drone strikes in Pakistan, and it was in their homes (often misleadingly referred to by Western media as a "compounds") that most civilians were killed. The shift in the pattern of targeting was supported by the development and introduction of the new generation of missiles with improved capacity of penetrating walls and roofs.⁴⁸

RIGHT: Casualty heat map of drone strikes in FATA/Pakistan, 2004–14.
FORENSIC ARCHITECTURE WITH THE
COLLABORATION OF SITU RESEARCH



UNDER THE VEIL OF RESOLUTION

Investigating a number of drone strikes, we sought to engage the testimonies of people who experienced drone strikes first-hand. I will recount only two such cases, each involving another form of testimony. The first involves analysis of video testimony shot in the aftermath of a drone strike by an unidentified person and smuggled out through the blockade that cordoned FATA off. The second involves using architectural modeling as a way to enhance the testimony of a survivor of a strike who managed to escape the region and return to Europe.

Both these testimonies added precious information where there was little else, but also had the potential to confront sovereign denial with the moral force of first-hand experience. They also had another aspect in common: both testimonies involved risk-taking by the people who spoke out. As such, they exemplified the power of *parrhesia*, a classical Greek term that Michel Foucault took to mean the courage to risk one's life in order to speak an unpopular truth. *Parrhesia* "demands the courage to speak the truth in spite of some danger. And in its extreme form, telling the truth takes place in the 'game' of life or death."⁴⁹

The video testimony was recorded using a handheld camera, likely a mobile phone, in the aftermath of a March 30, 2012 drone strike in Miranshah, North Waziristan, FATA, one in which four people were reportedly killed. It was a rare piece of evidence, one of very few videos documenting a site destroyed by a drone strike to be made available outside of Waziristan, and it had to be physically smuggled out to be seen. NBC screened forty-three seconds from it. Amna Nawaz, NBC's Islamabad bureau chief, who obtained the video clip, explained how they got the video to their Islamabad offices. "In order to take this piece of video out, we actually had to take a couple of weeks to move the video from place to place until it was safely in the hands of somebody we knew can transmit it back to us."⁵⁰ When screened, the video showed a rather indistinct architectural ruin, confirming only its own destruction.

Photography theorist Ariella Azoulay urges us to study the circumstances by which images are produced, broadcast, viewed, and acted upon, as well as to follow the set of relations that the photograph establishes between the people photographing and the spaces and subjects photographed. In this case, such relations extended to those moving and smuggling the footage, those broadcasting it, those looking at it, and those, like us, modeling and helping to decode it.⁵¹

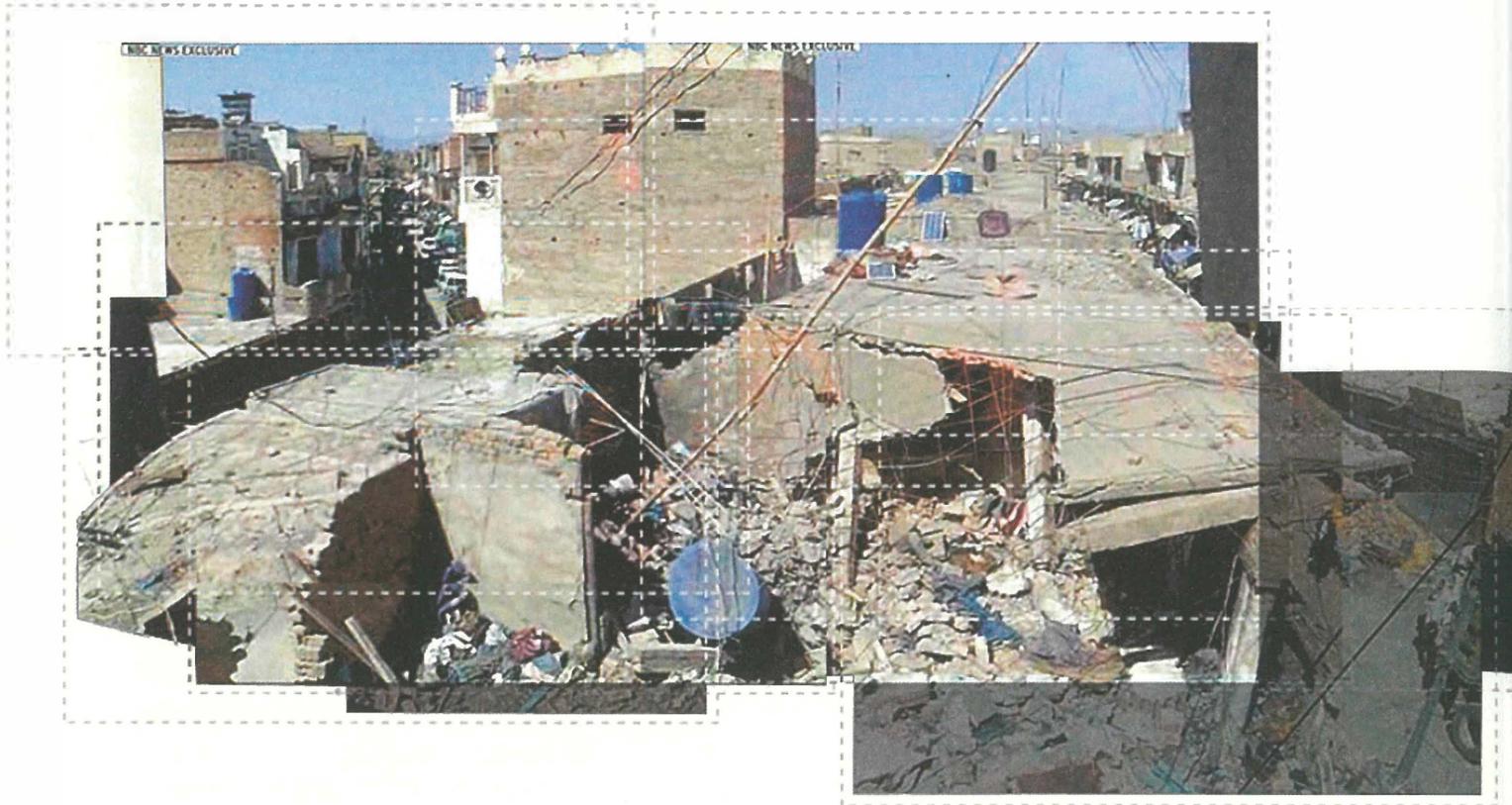


The aftermath of the March 30, 2012, drone strike in Miranshah, North Waziristan. The size of the dark area around the window opening suggests the videographer shot from some depth within the room. MSNBC, JUNE 29, 2012

The video clip had two distinct sequences, each shot in a different room. The first was shot out of an unfenestrated window opening on the third floor. Out of the window we could see the destroyed roof of a lower building, two stories high, located in a dense market street and surrounded by what seemed to be residential and commercial buildings.

The roof seemed badly damaged, likely because it was struck by several missiles. The video clip's second sequence showed the interior of a room in the damaged building bearing hundreds of blast marks on the walls. There was a distinct hole in the ceiling through which the missile entered and where sunlight now poured in. While the first room revealed something about the videographer, the second revealed something about the people killed in the blast.

In the first sequence, a large part of the image was masked by the window frame and the wall around it. This space around the window opening was rendered dark because the light meter was calibrated to the sunlit outside. However, it was not dead information. Its changing position and

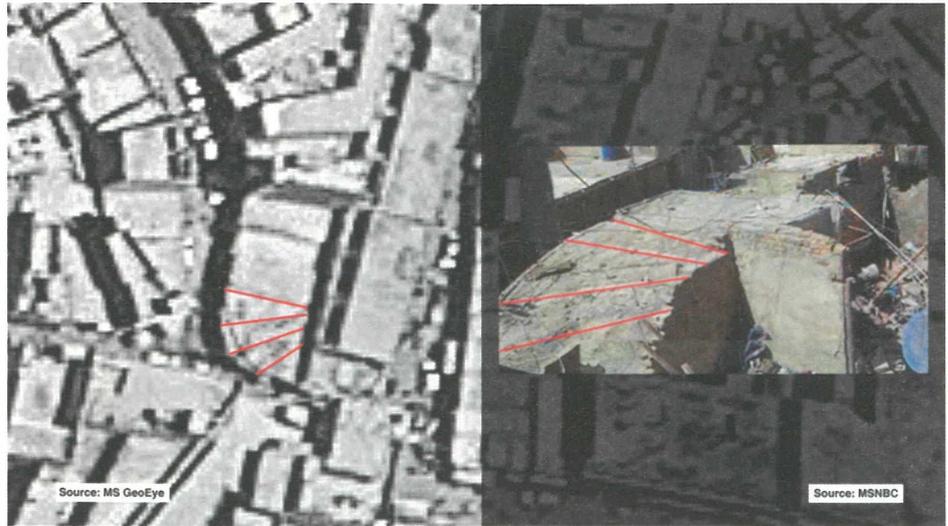


A collage pieced together from individual frames extracted from the footage allowed us to identify distinct features of the building that would later help find the building in a satellite image of Miranshah. On the left, closest to the videographer, is a series of beams that fanned out in a radial pattern, and there is a distinctly visible higher building on the left side of the building near the bend in the road.

FORENSIC ARCHITECTURE WITH THE COLLABORATION OF SITU RESEARCH

proportion from one video still to the next helped us reconstruct the videographer's movements inside the room. The videographer moved from right to left and from as far as a meter away from the window to as close as a few centimeters from it, all the while panning to capture the full extent of the ruin outside, and this without ever crossing the window line. In this way, the videographer would have remained invisible to a person standing at street level outside and also to anyone looking from above.

Cameras record from both their ends: the objects, people, and spaces their lenses capture, as well as the position and movements of the invisible



top: Comparing similar elements in the video and the satellite photograph, we were able to locate the targeted building within the city of Miranshah. bottom: By analyzing video and satellite images of the scene and the shadows cast in them, we were able to build a computer model of the targeted building (in white) and the market area around it (in gray).

photographer. Blurs are important in revealing things about the photographer. Rushed and erratic camera movements might indicate the risk involved in taking some images. A blur is thus the way the photographer gets registered in an image. As such, looking at blurry images is like looking at a scene through a semitransparent glass in which the image of the photographer is superimposed over the thing being photographed.

Similarly, the concrete window opening captured in the image frame may have recorded the videographer's sense of danger and that the danger was perceived to come from outside. It might be that the videographer feared being seen filming by locals or by US drones overhead. Drones sometimes strike the same spot twice, killing first responders and people gathering in proximity in a process known as "double tap."⁵²

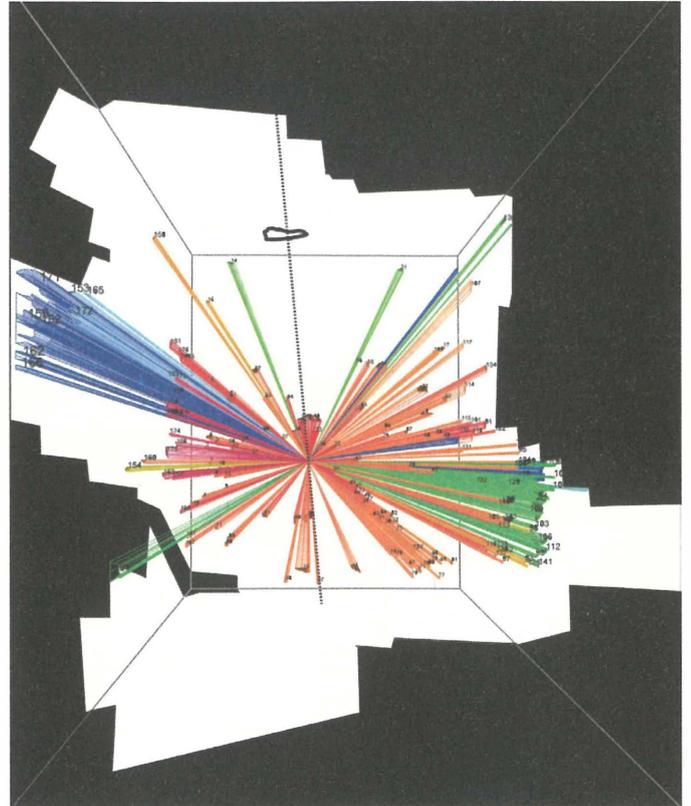
The second room captured in the video clip was the one in which people were reportedly killed. The hole in the ceiling is where the missile entered the room. The wall was scattered with hundreds of small traces from the explosion. These were caused by the metal fragments that the blast propelled outward. We inspected the interior wall and marked each one of the traces of the blast. Each fragment hit the wall at a different angle, allowing us to reconstruct the location and height of the blast. That the missile was detonated in midair confirmed it was a delay-fuse missile, likely the "Romeo" Hellfire II AGM-114R mentioned above. After marking all the traces, we also noticed two distinctly shaped areas in which there weren't any traces. If there were people in the room, their bodies would have absorbed the fragments and stopped them from reaching the wall. It is thus possible that the blank spots were the "shadow" of the casualties. In this case, the wall functioned as a photographic film, with the people exposed to the blast recorded on the wall in a similar way in which a photographic negative is exposed to light. It is an analogous process to the one in which the bodies of residents of Pompeii were exposed to the ash layer of Vesuvius or the way in which in Hiroshima, the nuclear blast left a shadow of a man on the steps outside the Sumitomo Bank.

The interior walls in the room in the building in Miranshah thus functioned as recording devices. It was through a process of double photography—the video stills of the room were photographs of a photograph—that the human bodies destroyed by the drone strike, which otherwise disappeared in the pixels of satellite images, could be made present. These shadows connected a representation of dead bodies with that of a destroyed building.

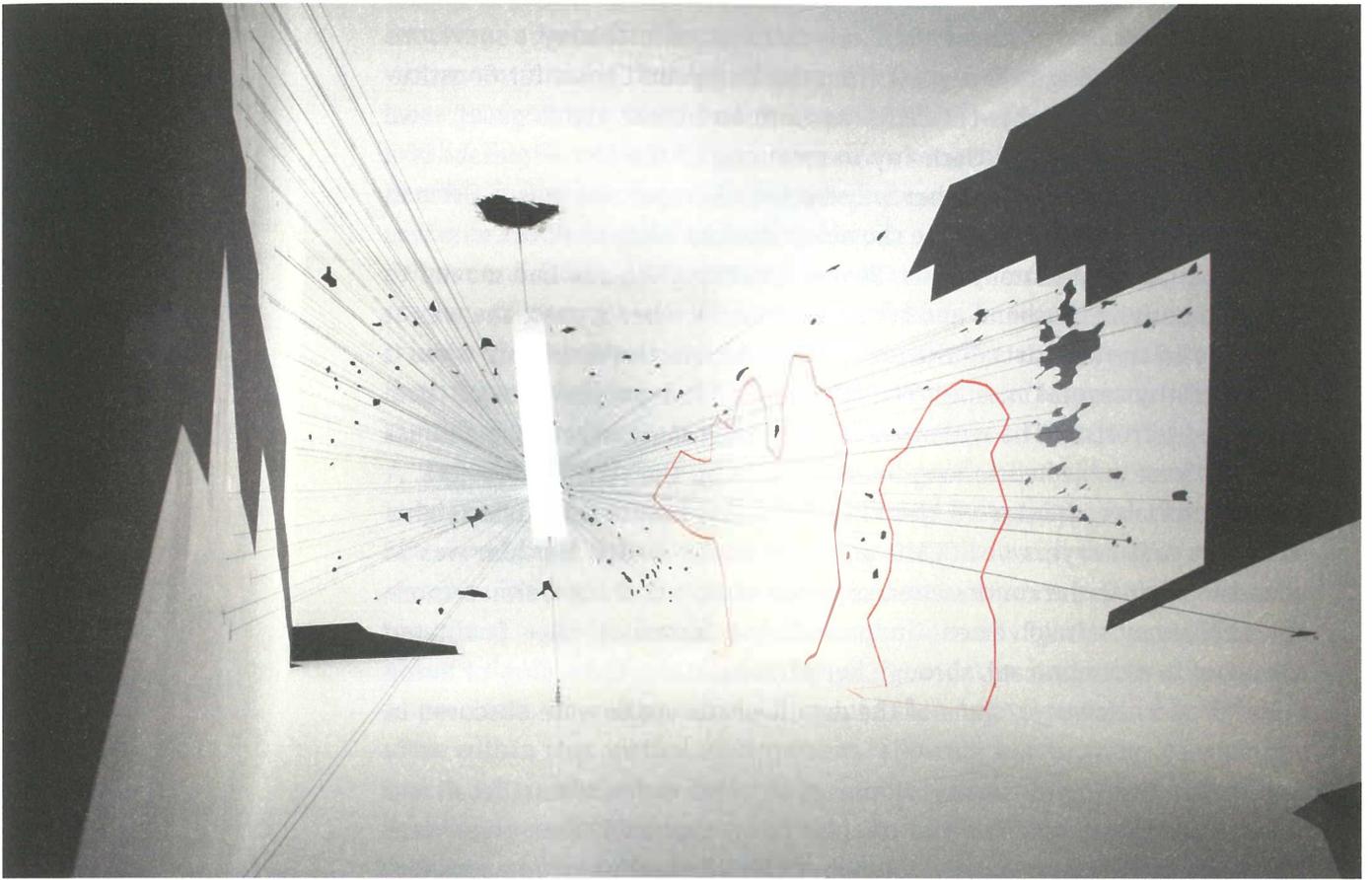
The still frames representing the interior of the targeted building from the MSNBC footage. The interior footage allowed us to reconstruct the location of the blast within the room targeted.

MSNBC, JUNE 29, 2012



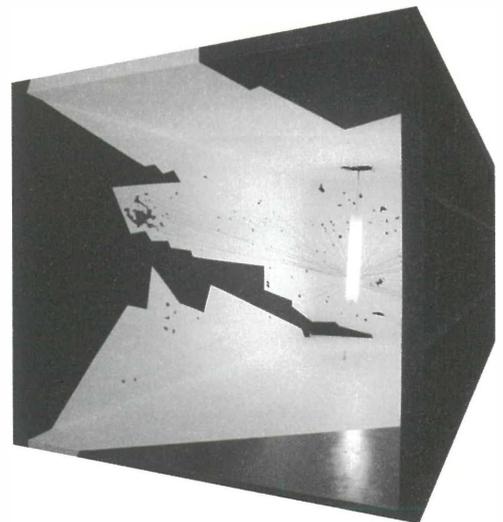


LEFT: All the video still frames from the interior of the room combined into a single panoramic collage. The parts in black are those not caught on video. We marked all identifiable blast traces on the wall. RIGHT: A reconstruction of the trajectories of shrapnel and the location of the blast. The different colors indicate distance from the blast point. FORENSIC ARCHITECTURE



A full-scale reconstruction of the targeted room in which the blast occurred, enabled by the occasion of the 2016 Venice Biennale of Architecture. This model allowed us to verify the blast point. Where the distribution of fragments is of lower density, it is likely that people absorbed them. The red lines mark the likely places where people were hit. This room/model is a spatial representation of video footage.

FORENSIC ARCHITECTURE; PHOTO: MATTHIAS BÖTTGER

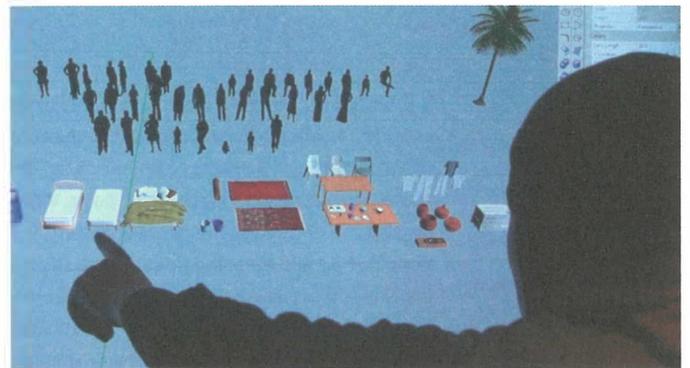
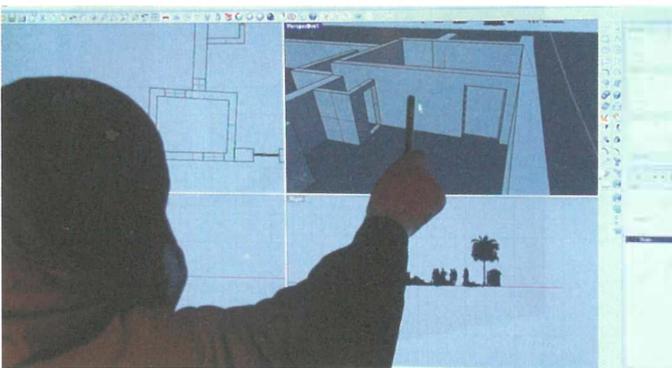


THE ARCHITECTURE OF MEMORY

The second case dealt with another limit condition of testimony: a survivor's memory. Responding to a request from the European Center for Constitutional and Human Rights (ECCHR)—a German human rights group—we traveled to Düsseldorf in Germany to meet one of the few witnesses of a drone strike who had made her way back to Europe. She was a German woman who wanted to publicize the event she had witnessed, but who was also keen to remain anonymous. Several years earlier, she had moved to Pakistan with her husband and his brother. On October 4, 2010, she was at her home on the outskirts of the town of Mir Ali, North Waziristan, when it was struck by several missiles. The attack killed five people, some of them suspected terrorists. The witness returned to Germany, where she and her husband were subjected to long interrogations by the security services. A few months later, she started speaking publically, first to the human rights advocates and lawyers of ECCHR and later in the media. Her aim was to advocate against the continuation of drone strikes and the German intelligence agency's involvement in providing information that facilitated them and to communicate, through her personal story, the reality of living under drones. However, some of the details of the strike were obscured in her memory.

When delivering testimony, victims of extreme violence must recall and reconstruct the worst moments of their lives, moments when they were physically hurt or experienced, at close hand, the loss of loved ones. Victims might remember what happened before a traumatic incident or after it, but the closer one gets to the essence of a testimony, to the heart of the most violent incidents, the more elusive memory can become. Such testimonies are rarely straightforward records of events and cannot be interpreted

LEFT: The computer modeling of the site and event of the strike in Mir Ali on October 4, 2010, took one full day.
RIGHT: The witness chooses objects to be located within the model of her house. FORENSIC ARCHITECTURE



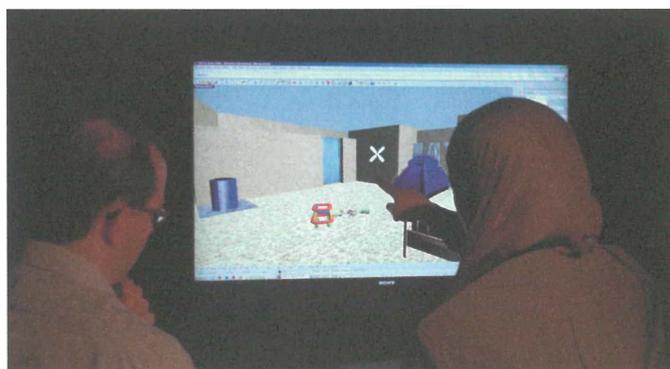
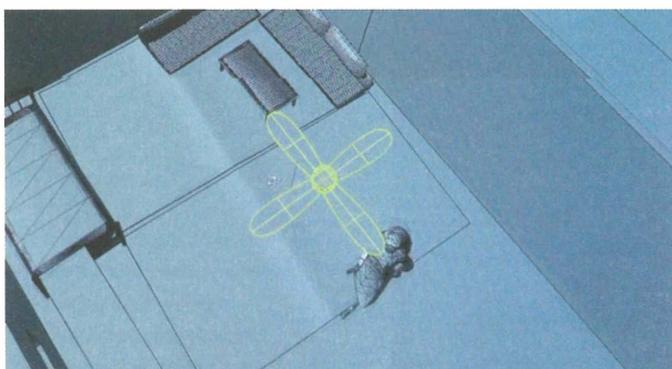
only for what exists in them, but, significantly, for what is missing, distorted, or obscured. Such testimonies are often riddled with memory loss, resulting in lacunas, contradictions, and blackouts. It is this dimension of victim testimonies that led deniers of all sorts of cases of historical violence to denigrate them and to consider them wrong or biased and thus invalid. But these memory gaps are somewhat analogous to disruptions and blurring in the video images discussed above. What blurs and masks part of the evidence reveals something else. In their book *Testimony*, Shoshana Felman and Dori Laub explained that it is often in the failings and shortcomings of memory—in the silence, confusion, or outright error—that the trauma of the witness and hence the catastrophic character of the events they experienced are inscribed. Paradoxically, it is testimony's imperfections that bear witness to the fact of violence.⁵³

Together with the witness from Mir Ali, we decided to try another route to memory. We would help our witness build a digital model of her house. She would build it as she remembered it and in as much detail as she could provide. We would not make any predeterminations regarding what is important to model, but furnish the model with all objects she could tell us about—doors, windows, rooms, furniture, utensils, and other objects—in as precise a way as possible. We would then try to position her point of view within this virtual environment, allowing her to walk through the spaces where the event took place. The presence of her lawyer, Andreas Schüller, from ECCHR, gave our witness confidence to speak. A German-speaking architect, Reiner Beelitz, digitally constructed the house as fast as our witness described it, employing the same software used by architects to present clients with a quick impression of an interior design.

The witness seemed empowered in directing the reconstruction process. Slowly, as she was sizing the rooms, locating the windows and doors, and

LEFT: The first location of the fan within the model of the house.

RIGHT: The second location of the fan in the model. FORENSIC ARCHITECTURE



placing mundane objects in this virtual environment, she started narrating fragments of life in this house and some of the aspects of the incident itself.

Here, the role of architecture was not that of material evidence. We had no access to the site, no ruins to study, and no photographs except a satellite image that showed nothing except the blurred contours of her house. Architecture, in this investigation, functioned as a mnemonic technique, a conduit to testimony. The model was a stage on which some of her memories could be accessed and performed.⁵⁴

An important reference point in our work was the classic and medieval tradition of mnemonic techniques as told by Frances Yates in *The Art of Memory*. The ancient and lost art reserved a special place for architecture as a medium for establishing relations between memory, narrative, and destruction.⁵⁵ The technique, made famous by the rhetoricians and orators of antiquity such as Cicero and Quintilian, advised orators tasked with remembering long and complex speeches to commit the spatial arrangement of known buildings to their memory or to construct new ones mentally. Every room in these buildings was to be furnished with objects relating to the issues that the orator needed to bring up — a fountain, a dagger, a plant, a chair, or a bed. In delivering the speech, the orators would imagine themselves walking through the building, passing through corridors, traversing courtyards, opening and closing doors, encountering objects, and in this way recalling different issues and ideas. The same building could be used for different speeches. All that was necessary was to remove one set of objects and bring in new ones, then “walk” through the building again.⁵⁶

WITNESS Here was a big heavy iron door like on the other side. Correct. I would widen it a bit more. Yes, it is okay like this. Stop. I now remember. The door was over here and the window on this side. Can I see it from above?

LAWYER Does this visualization help to remember what happened two and half years ago?

WITNESS It helps me a lot. Without the plan I could have not remembered it like that.

The witness from Mir Ali and a female friend were in the house the evening it was struck. A group of men, some of them guests unfamiliar to the two friends, had just sat down to eat when a number of missiles landed. The witness's son, age two, was outside the compound walls with his father. “While we were eating,” the witness recalled, “we heard a very loud bang. The house shook, and a lot of earth fell on us from the roof . . . everything was covered in thick smoke.” She did not see the missiles land, but heard them and then screams, followed by the smell of burned flesh and

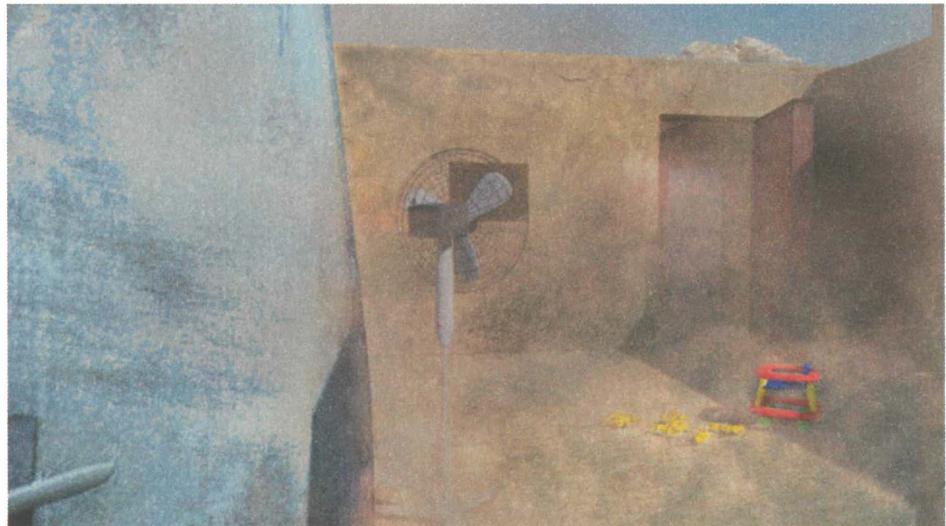
smoke, and then she heard the weaker moans of the dying. She ran outside. Later, she returned to the house. In the courtyard, she saw “a big black hole where the missile hit. Everything was burned. There were pieces of cloth, and metal from the rocket.” Her brother-in-law was killed, along with at least four others.

Elements modeled in the reconstruction that were significant to the investigation included toys and a child’s walker that we located, according to her testimony, in the open courtyard. These, when seen from above, should have indicated to the drone operator that a small child, the witness’s son, was in the premises when it was attacked. There was also, significantly, a fan. During the modeling process, the witness returned to it again and again. She seemed uneasy about it, repeatedly adjusting its location. Initially, she placed it as a ceiling-mounted ventilator. Later, she asked to place it as a freestanding fan inside the room. A few moments later, she again shifted its location, taking it outside and placing it within the small courtyard for the women. When “walking” through the model in the digital aftermath of the strike, she mentioned that she had found human flesh on the fan’s blades. Here, architecture and memory got entangled in a way that cannot be easily divided into subject and object, testimony and evidence, matter and memory.

WITNESS And the fan is still missing. Yes, in the courtyard, at this position here.

LAWYER A standing ventilator?

WITNESS Yes, standing and with a round shape...I found burned pieces of flesh and hair in the fan.



The interior courtyard with the fan and the child walker, modeled and rendered according to the description of the witness.

FORENSIC ARCHITECTURE