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On the Aesthetics of Environmental Data. The Work of Forensic Architecture between Forms of Reporting and Artistic Practice

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Abstract

In the framework of theoretical analyses proposed by studies of the "geographies of the Anthropocene", attention is focused on the representation of territories in the convergences between media, technologies and digital cartography. This aesthetic approach finds favourable ground in protest movements which remain as yet unexamined in any depth. Among these, Forensic Architecture – the University of London's whistleblower research centre at Goldsmiths, founded in 2010 – stands out. Composed mainly of scientists, architects, journalists and filmmakers, the team carries out rigorous mapping of environmental data which focuses on imaging as a diagnostic practice, analysing the environmental situation, transforming the way in which data is visualised in civic practice through artistic and performative initiatives, and expanding the canonical boundaries of the fruition of forensic art. This paper aims to focus attention on the practices of Forensic Architecture, whose work is regularly shown in international art or architecture exhibitions, and its reuse of images which find form in denunciation and collective awareness. The article will also examine the audiovisual products documenting a decade of research in the territories of Palestine: "Counter-forensics in Palestine" (2012-2022).

Awareness of the emerging environmental crisis, which has resurfaced strongly in the last decade, is largely defined by the media (Fay 2018; Cubitt 2017; Rust, Monani, Cubitt 2013; Maxwell, Miller 2012), thanks to which there has been a proliferation of representative and self-representative images of social change that has contributed to modifying "or even modulating the ways in which we look at the world" (Lancioni, Villa 2021: 5-11). This has resulted in an iconographic environment 'connoted by' and at the same time 'connoting' a witnessing dimension: the image has become the embodiment of experience and awareness, but it is above all a tool for initiating debate and a necessary part of the social practices of protest (Wilson, Serisier 2010).

From the global communication infrastructure to humanitarian organisations and from community forums to mobile platforms, social networking sites and pages, the media demonstrate that this iconographic environment has become an essential part of the discourse, launching effective alerts and consolidating key elements of a broader information landscape on the crisis (Vaughan 2018). As Josh Greenberg and Joseph Scanlon point out, they do this by hosting the voices of a range of actors, including governments, humanitarian organisations, civic groups and corporations important for the construction of "an imagined community of fate (Anderson, 1990) through which people are bound by a shared experience, however traumatic it may be" (Greenberg, Scanlon 2016: 3).

The element that unites and makes the experience and actions of these actors a community, as Greenberg and Scanlon state, is the image as the embodiment of experience and awareness and as the instrument of a social practice of protest. Image narration takes on a double connotation in this context: firstly, it reproduces reality, raising awareness of events and catastrophes and documenting an event in space and time (Taffael 2016). Secondly, when possible points of view of the event are obscured – and a reconstruction is necessary – it depicts them in an enunciative key: this is a computational image (Eugeni 2021). This view is also chosen because it neutralises the point of view, guaranteeing in addition to the immediacy of the reading - objectivity about the facts. A nearing of the image and what is represented is effectuated, becoming an operational reading of the world.

It is also though a theory of the social uses of technology and data. As a practice – as repeatedly stated by academic Miren Gutierrez, to whom we refer for a more detailed discussion – this data activism practice is becoming prevalent due to the expansion of technology, open-sourced software and surveillance tools (Ottinger 2010), emerging from the hacker and open-source movements and spreading to non-governmental organisations (Milan, Gutierrez 2015). Data activism can include a range of practices

> from digital humanitarianism that uses crowdsourced data collected from victims of disasters and crises (Gutierrez 2018) to environmental sensing by communities concerned with how climate change affects them […]. Several universities – including Amsterdam, Sheffield and Cardiff – and scholars are producing systematic studies to capture the activist practices enabled and constrained by the data infrastructure (Gutierrez 2021: 3).

Data activism can therefore be conceptualised from various perspectives. Firstly, the different methods of data collection can include the use of informants, open and public platforms and registries, crowdsourcing platforms, scraping and appropriation tools, sensors, drones and other primary research (Gutierrez 2018), so the study amounts to an analysis of the devices used. Secondly, it is possible to study the way activists communicate their findings, the practices they adopt – the aesthetic and formal modes (Vercellone 2022). Maps and timelines are the methods most often used to visualise data, but these vary aesthetically depending on the domains in which they are required: human rights sharing and networking platforms, museums, urban spaces, courts and film festivals, to name a few.

The orientation allowed by this image is what Felix Guattari theorised as a possible "response to the ecological crisis […], a political, social and cultural revolution that knows how to reorient its objectives" (ecosophy). The French philosopher stated that this could only happen on a planetary, through practices of experimentation on a social level on shared planes: these practices should be closer to the way of working "of an artist, rather than of the professionals psychiatrists who are always haunted by an outmoded ideal of scientificity" (Guattari 2000: 35).

Instead, we propose to consider a more recent initiative: the whistleblowing action promoted by Forensic Architecture, which investigates violations 'of

human rights, state and corporate violence, but especially what concerns the built and natural environment' (Weizman 2017: 14).

Unlike other agencies,

> FA's participatory practices and new forums build bridges to connect counter-stories with audiences. FA employs what Ristovska calls strategic testimony or new approaches to content distribution (Ristovska 2016). Similarly, FA videos build bridges between counter-stories and different audiences, using new spheres of dissemination and performance. Several elements of FA's activist practices translate into credibility (Gutierrez 2021: 16).

The basic idea is that when applied as a method of scientific investigation to the destruction of the environment (be it built or natural), architecture, a constructive science, can historicise its process by identifying causal chains, making them visible through the tools of the trade and thus leading to the identification of causes and culprits.

In contrast to the usual practice of representing data collected and analysed by other institutions (Parikka 2015; Goddard, Parikka 2011), Forensic Architecture also demonstrates the methods and tools of observation and measurement: inept attempts at concealment or denial of facts, beyond the threshold of perceptibility, are often unmasked. We will give an account of this in the following pages in which an initial analysis of forensic investigation methods is proposed.

With the intention of clearly highlighting the elements that characterise the evolution of the working methods and applications used by Forensic Architecture, the paper will then proceed to an analysis of the audio-visual products documenting a decade of research in the territories of Palestine: "Counterforensics in Palestine" (2012-2022).

Forensic Architecture

Forensic Architecture is a whistleblower research centre at the University of London at Goldsmiths. The agency was founded in 2010 by Eyal Weizman together with a group of fellow architects, artists, filmmakers, journalists, scientists, and lawyers, who undertake independent research or act on commissions from international prosecutors and environmental and/or local groups.

Dealing with the work of Forensic Architecture involves engaging an expressive language characterised by *assemblage* in the first phase of work (until 2019) and visual layering in the second and more recent phase. This contributes to the creation of unique documentaries. The performative character of its work is the rendering of the environment through an analysis and contextualization of amateur visual material, time-lapse (reference to the works of Godfrey Reggio) and infographics as the outcome of studies and research at the Centre.

Recently, in line with the latest forms of spatial representation and in dialogue with interactive spatial and temporal cartographies, from traces either open source – images of control produced "from below" and circulated on blogs and social media – or released by governments (only in the environmental sphere; on other macro-themes such as violence, Forensic Architecture's analysis starts from audio files), the spaces where crime or violence have occurred are reconstructed.

As Weizman, Forensic Architecture's founder, recalls, there are three phases of work (Weizman 2017: 31-42) through which the collective moves: the *field*, where data is sought and collected; the *laboratory*, where it is analysed; the *forum*, that is the moment of publication of the data and thus of visibility, as the very etymology of the forensic word suggests.

Weizman says: "We use the term 'forensic', but our work seeks to reverse forensics as currently practiced and to restore the *forensic turn*", understood as the ways in which state agencies, police or intelligence services examine the people they seek to control. Forensic Architecture monitors state agencies (and sometimes corporations), challenging their claims and, to the extent possible, their near monopoly on information. Implementing a reversal of gaze produces a process called 'counterforensics', a neologism of Weizman's. Counterforensics turns the state's means against the violence it commits. This depends on both opacity and transparency, with the former being the condition for the latter: "camouflage from state and corporate surveillance, data protection and anonymization, as those who work in this field know well, are the necessary prerequisites for reporting political crimes" (ivi: 68).

The task of the forensic architect, in addition to investigating the state's means of inquiry, is to examine the politics of the forums in which evidence is presented. The forensic architect must assume that no forum is neutral: it is necessary to dig into sources and produce real data, an action that is not always immediate. Most investigations take place in border areas with extraterritorial conditions that are outside the established state jurisdictions and their criminal justice frameworks. These are places where sovereign jurisdiction is not clear

> such as in the Mediterranean Sea, [she] has disintegrated (as in some parts of Somalia or Yemen, where militants headquarter and drone assassinations take place), or has been suspended and is under siege (Waziristan, Gaza, the West Bank, or the remote highland frontiers of Guatemala in the 1980s). To that extent *forensis* is forensics where there is no law (ivi: 69).

In order to make their research accessible and thus to reach the third and final phase of work – the *forum* – the group carries out rigorous mapping centred on imaging as a practice of environmental data diagnostics: it processes the environmental situation, transforming ways of visualizing data through artistic and performative action (Fuller 2005; Montani 2017) – in the perspective proposed by Guattari (2000) – as a univocal language.

The procedures that mobilise the collective are condensed into three, sometimes converging, tendencies: the emergence of telling a fact, the inability of locals to publicize the issue, and the availability of footage or documentation to be made public. This network of implications is grafted onto the productions attributable to whistleblower artists and to videoactivism (Wilson, Serisier 2010; Waltz 2005) practices,[1] Harding's definition dating back to the late 1990s (Harding 2001). It refers to authors who use video as a tactical tool to deter violence, document abuse or expose misconduct of a government authority: three actions that form the basis of Forensic Architecture's research activity.

Through a wide and sophisticated range of technical detection, calculation and representation systems, Forensic Architecture fabricates in the laboratory the scientific and media perceptions of stealthy, widespread and potentially environmental dangerous phenomena on a daily basis.

> It is at this level – that of sensors, calculators, data processing and rendering – that the sensory delegation and replacement of human perception by technological media takes place, in a deployment of totally non-human capture and projection equipment oriented towards equally more-than-human environmental processes. The result of these processes is a modeling and a data design that algorithmically elaborates and translates the *insensitive* into a variety of informational outputs (D'Aloia, Rasmi 2021),

with the intent of rationally raising awareness. The laboratory itself spreads across space in Guattari's vision of creating a device aimed at ensuring a production of collective subjectivity that is free and capable of reforming itself within and through the device itself.

The next phase is the forum, which is no longer confined to closed arenas but is increasingly spread across a broad spectrum of forms and channels of media. The data collected and transformed into data visualization (graphs and 3-D models), footage from above (satellites, drones) or below (helmet cameras, social media, electronic devices) and interviews are made edited into videos of between 10 and 20 minutes in length. These present not only the issue in question but also the way of working, the types of sources and the methods of investigation which are meant to be presented in restricted environments such as international tribunals, truth commissions, city courts, human rights and environmental reports and, as was the case on one occasion, at the UN General Assembly. Above all, the goal is to expand the canonical boundaries of fruition. The researchers display their work in exhibitions and in cultural, architectural or art institutions that allow the work to be presented in its historical and theoretical context, in publications in order to generate debate on the issues and on their own personal websites in order to nurture shared knowledge and consciousness: "Evidence never speaks for itself, but it does speak through its surrogate experts" (Weizman 2017: 68) says the founder of Forensic Architecture. Such visual elements are an integral part of the ecological activism promoted by the agency, which, as stated above, are not activated through media events or shared protests on a local or global scale, but rather create awareness-raising artifacts in a context of public entertainment.

To facilitate dissemination, the idea of meticulous-

ly archiving content which is otherwise difficult to find and analyse becomes important. This is where video activist action, in itself formally anarchic and a form of protest, adopts a revolutionary (social, cultural and visual) approach. And herein lies the putting into practice of the concept of ecosophy promoted by Guattari: in addition to identifying the methodologies of analysis (3D modelling, cartographic regression, machine learning, photogrammetry, virtual reality), the Thesaurus proposed by the site becomes a visual tool, whose references can be political (sorting the contents 'By Category', i.e. Chemical attacks, Environmental Violence, Fire, Forensic Oceanography) and geographical (sorting them 'By location' and through the map).

Despite the relative newness of the center, the immense amount of work it has produced prevents an analysis of all its video material to date. We will therefore proceed with an analysis of the most used practices that demonstrate an evolution in academics' treatment of environmental data by analysing the studies contained in the "Counterforensics in Palestine" series. Palestine is the birthplace of the story that led to the creation of Forensic Architecture. Also, these investigations mark the launch of the FAI Unit, the first of its kind in the Middle East: a new generation of visual investigations to monitor and document Israeli war crimes and apartheid.

Through the analysis of these works produced ten years later, we attempt to intuit what has been the ecosophical response of Forensic Architecture's research in relation to the recent accelerations in visual practice (mentioned in the first paragraph) and environmental changes, along with political and research challenges.

The Environment is not Collateral Damage: Only Time will Tell

The environment, whether built, natural, or a mixture of both, is not a neutral backdrop against which violence takes place. Whether the cause is world market domination or the Cold War, the environment is the main protagonist and not unintentional collateral damage of attacks. It is precisely the study of "Counterforensics in Palestine" that embodies the statement of the agency's founder. Fifteen videos, five of which incisively denounce environmental violence: *The use of White Phosphorus in Urban Environments* (2012); *Destruction and Return in Al-Araqib* (2017); *Conquer and Divide* (2019); *Herbicidal Warfare in Gaza* (2019); *The shelling of Khudair Warehouse: chemical warfare by Indirect Means* (2022).

A decades-long and ongoing history of colonisation, domination, partition, and violence, a history so generously offered by the Palestinian conflict, might otherwise seem futile. It is an example of how architecture is used to create "assemblages of evidence" that locate elements in space and study the spatio-temporal relationships between them.

Until *Herbicidal Warfare in Gaza*, the studies conducted by Forensic Architecture were characterized by a uniquely ecocritical reading. Let us look in detail at this 2019 work to better understand how the narration of this type of violent attack had changed in just three years. The 2019 study was conducted over a five-year period in collaboration with the Israeli NGO B'Tselem.

But let us make some preliminary remarks. The occupied Gaza Strip has been slowly isolated from the rest of Palestine and subjected to repeated military incursions. These incursions intensified from September 2003 to fall 2014. Over the decade the borders have continued to be changed, with the local population losing more and more territory.

The borders around Gaza – one of the most densely populated areas on Earth – continue to be hardened and heightened into a sophisticated system of under- and overground fences, forts, and surveillance technologies. Part of this system has been the production of an enforced and expanding military no-go area-or 'buffer zone'-on the Palestinian side of the border (Forensic Architecture).

Since 2014, the Israeli army's clearing and demolition of agricultural and residential land near Gaza's eastern border has been supplemented by unannounced aerial spraying of crop-killing herbicides. This continued practice has not only destroyed entire areas of what was once arable land along the border fence, but also crops and farmland hundreds of meters deep into Palestinian territory, resulting in the loss of livelihood for Gaza farmers. Working closely with the Gaza-based Al Mezan Center for Human Rights, the Tel Aviv-based Gisha Legal Center for Freedom of Movement, and the Haifa-based Adalah Legal Center for Arab Minority Rights, Forensic Architecture examined the environ-

mental and legal implications of the Israeli practice of aerial herbicides spraying along the Gaza border. The result is the extirpation of the local culture by destroying vital resources, drying up cultivated fields, forests and water sources. The goal is a long to critically erode life-sustaining water sources over a long period of time. When working in Palestine, researchers state that they sometimes feel like coroners - investigators of a spatial murder – the "spatiocide" (Hanafi 2004). The effects of environmental degradation can linger for years after the fighting ends, leading to all-encompassing devastation.

> Our investigation shows that each spray leaves behind a unique destructive signature. No two aerial sprays will have the same effect, nor can their damage be reasonably predicted by the army, since the location where the toxic chemicals land, and their respective concentrations, depend heavily on the direction and speed of the wind relative to the flight path of the aircraft. This practice weaponizes herbicide spraying as a belligerent act, designed to 'enable optimal and continuous security operations' (Forensic Architecture).

The images of seemingly nonviolent events – an airplane flying over plots of land – that follow one another in the video are cases in point of how Forensic Architecture's analysis demonstrates how vital a thorough reading of the visual material and a frame-by-frame analysis is in the context of denouncing anthropocentrism. They provide a broadening of the perspective of the representation of violence, and consequently also of what constitutes evidence of it: first and foremost, the data-images from the studies conducted by the agency's visual architects on the repertoire of images produced from below. These consequently trigger a search for data in order to produce device-images from datasets that, though disconnected from the amateur datasets, are made to engage in a dialogue with them. In this, as in previous works, it is the timeline (repeatedly staged as in *Destruction and Return in Al-Araqib* in 2017) which drives this dialogue.

Everything starts with amateur videos denouncing and documenting the facts: a form of surveillance from below conducted by the inhabitants of Gaza towards the oppressor; a form of "counter-surveillance". Methodologically, this material seeks to demonstrate a shift between two distinct architectural approaches: on the one hand, the source material for the study is remote sensing in the field and culture monitoring through satellite imagery. This is followed by the second approach: data images generated with reconstructions in fluid dynamics which are fundamental to the understanding. The latter practice is used for issues involving fluid action: the space occupied by the gas becomes a grid for calculating the most severely damaged areas. On satellite photographs, environmental degradation on an extended time scale is highlighted. The effects of environmental degradation can linger for years after the fighting stops, leading to totalising devastation.

As much as actions of environmental degradation such as this are not considered violence, Forensic Architecture's initiative demonstrates how there needs to be a broadening of the concept of what can constitute violence, and consequently also what amounts to evidence.

The use of environmental data as evidence of armed conflict raises not only scientific, but also legal, political and, above all, representational questions. The representation of the causes of environmental violence requires the creation of complex structures useful for dissemination, with the specific intent of highlighting the issue but also reclamation of a world which no longer exists. In this sense, the narrative technique used by Forensic Architecture is temporal reconstruction: forensic analysis allows the creation of visual timelines through which it is possible, in the immediate future, to have a complete picture of change over an extended period of time.

Two years after *Herbicidal Warfare in Gaza*, the same geographical area, the same motivation: Forensic Architecture documents yet another violent environmental attack. But the technique has changed. If the only possible reading in the previous case was temporal and the only source was visual processing (we said fluid dynamics, but thermodynamics is also often used), from 2020 onwards the *forensic turn* seems to remodel the vehicle of the message. It relies solely on a visual apparatus in which a strong ontological realism and the perception of what happened (epistemic realism) coexist. There is no longer an assemblage but a superimposition of data: the study of time is superimposed on the study of space. Forensic Architecture calls this distinctive line 'field causality', referring to indirect, multidirectional forms of causality distributed over extended space and time. The in-

creasingly pervasive presence of camera devices has allowed the agency to expand artistic experimentation in this way.

This is evident in *The Bombing of the Khudair Warehouse: Chemical Warfare by Indirect Means,* where the aesthetics of data presentation become more refined and complex. On the evening of 15 May 2021, Israeli occupation forces bombed the Khudair Pharmaceuticals and Agricultural Tools Company, Gaza's largest agricultural chemical warehouse, in Beit Lahiya, where around 50 per cent of all the vital agricultural chemicals used in the besieged Strip were stored. The warehouse consisted of six rooms totalling 2,700 square meters and was surrounded by Palestinian houses and agricultural fields. Incendiary shells detonated tonnes of toxic pesticides, fertilizers and agricultural chemicals, triggering a toxic cloud that enveloped the northern Gaza area.

Among the innumerable video and audio documentary material assembled, it is no coincidence that, with regard to crimes against the environment, the analysis always begins with an image, be it a photo or a frame from amateur videos. The investigation begins with the subject-eye; next, the laboratory considers and reworks only video material capable of making evident the need to simultaneously communicate material, media and testimonial content. Forensic Architecture calls it "Architectural Image Complex":

> What we refer to as the architectural image complex is a method of assembling image evidence in a spatial environment. The architectural image complex can function as an optical device that allows the viewer to see the scene of the crime as a set of relations between images in time and space. It can also be used as a navigational device to help move between images, exploring a space that is at once virtual and photographic (Weizman 2019: 100).

The 'complex', to which Weizman convincingly refers, belonging to the architectural image, thus replaces both the thematic classification system of the archives and the linear transition between the images in the before-and-after montages, as was the case in previous works.

The main consequence is that this type of image confronts us with reality and the testimonial power of the source image as much as with the depiction of the data. This is possible, as anticipated, thanks to the layering of data present in the device-image; the technique most widely adopted in this regard, and seen widely in use for example in pandemic reports, is photogrammetry:

> Photogrammetry is a process by which large numbers of still photographs, of an object or environment, can be combined to create a precise and navigable 3D model. Photogrammetry software computes distances within a 2D image by a process of triangulation, taking into consideration metadata such as the focal length of the lens of the camera that captured the image Specific technical software then arranges every pixel from multiple overlapping images in 3D space, creating a 'point cloud' made of often hundreds of millions of individual pixels, or 'points'. This point cloud can be anchored to its location in the real world (Forensic Architecture).

Let us examine the details of *The Shelling of Khudair Warehouse*. Original photos and drone footage and dozens of images and videos of the site available online, as well as CCTV footage, are used in order to construct a 3D model of the warehouse. To authenticate this 3D model, fragments of photos are superimposed. The study related to the Architectural Image Complex also refers to the process the agency undertakes in order for the images to 'speak for themselves' and to assign realistic value to them as well as to contextualise them.

For example, none of the CCTV videos found contained an exact date. Looking for time indicators, the investigators conducted a shadow analysis to determine the approximate time of the attack. They then synchronised the videos to determine the timing of events, establishing the time when the first canister hit the warehouse at around 17:46, geolocating the camera and identifying the projectiles as coming from the southeast. In addition, the study of the trajectory and smoke tail allowed the architects to recognise the M150 Smoke HC 155mm ammunition developed by Israeli arms manufacturer Elbit Systems: an 'advanced smoke projectile' and a new type of projectile designed to split into five separate containers, all of which emit high-density smoke.

A second example is a video by Abdelsalam Abu Halime. On the 15th of May at 5:52 pm Abu Halime filmed a thick column of black smoke rising from the Judea warehouse. The agency geolocated two frames of this footage and measured the size of the plume. To

estimate the extent of the plume they used meteorological data such as wind direction from the day of the attack. Within the first hour the toxic plume had affected an area of approximately five point seven square kilometres, spanning Bethlehem and its agricultural zones as well as a densely populated Jabaliya refugee camp. The air concentration of some of the chemicals exceeded acute exposure guideline levels or Acute Emergency Levels (AEGL). Mapping extracted from a satellite image showed the data from the soil acidity study of the surrounding areas.

> We shared our findings with experts at the UK-based conflict and environment observatory, which stated that the nature of the chemicals stored suggested a risk of significant environmental harm. The observatory also pointed out that chemicals discharged into the underlying soils with water from the fire, potentially contaminating groundwater beneath the site (Forensic Architecture).

Areas hundreds of metres away from the warehouse have concentrations of sulfur dioxide and phosphorous pentoxide exceeding AEGL 2, causing irreversible damage to land and human health. This attack was the first in a series of punitive strikes – near Jabaliya, an area east of Shejaiyyeh, in Gaza – by the Israeli occupation forces, which deliberately targeted civilian economic infrastructure and the agricultural sector.

Geological resources were once mapped through surveys and field observations, and today are mapped with advanced remote sensing technologies. As Eyal Weizmann suggests, this reckoning of the earth is now more closely linked to the 'increasingly complex bureaucracy of calculations that include sensors in the subsurface, ground, air and sea, all processed by algorithms and related models'.

Similarly, the practices of meteorology become media techniques that make sense of the dynamics of the sky; geology is an excavation into the earth and its secrets that allows us to see not only the present moment unfolding into a potential future of exploitation, but also the past buried beneath our feet. Depth becomes time.

This brings to mind a link with what Georg Simmel (Simmel 1998) pointed out in a short essay on ruin, also highlighted by sociologist Sonia Paone, who states how

> architecture is a victory of the spirit over nature, a balance between mechanical matter and the formative spirituality that transforms it. But this marvelous equilibrium is broken the moment the building falls into ruin, revealing a cosmic tragic nature. This cosmic tragic nature, which in the cases considered by Forensic Architecture is not due to decay and neglect but to violence, thus becomes the starting point to return to a state of equilibrium in which the reconstruction of form, albeit virtually, is not so much and only a victory. It is the affirmation of truth and justice (Paone 2022, my trans.).

Forensic Architecture does so by analysing the causes and the repercussions – in the short and long term – of environmental disasters that affect populations all over the world, choosing to communicate through, as Guattari suggests, a universal language: the art of producing images.

Notes

[1] Video activism arises from the need to reconstruct news from the bottom up to prevent commercial and institutional media from giving only one interpretation of the facts.

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