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# Fold, Format, Fault: On Reformatting and Loss

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After the dissolution of the Intelligence Directorate of the Buenos Aires Provincial Police in 1997, a safe with 15 rolls of microfilm was found half-accidentally in its former headquarters in a room disguised as a supply closet (Vales 1999). The roughly 20,000 personal files recorded on these microfilms contained information about many *desaparecidos*—an estimated 20,000 to 30,000 "disappeared" who were secretly arrested, kidnapped, tortured, or murdered by the Argentine military dictatorship during the 1970s and '80s as alleged political enemies, criminals, dissidents, or suspected socialists.

The early history of microfilming in Argentina is closely tied to the military and public administration (Gionco 2016). The use of this medium, such as for microfilming cadaster records and patents or archiving the resolutions of dissolved state organs, was encouraged and in some cases mandated legislatively or by presidential decree in the 1970s. The transfer of the *desaparecidos'* paper records from one carrier medium to another was a reformatting, a compression. It was a schismatic gesture that, on the one hand, physically and symbolically diminished the significance of the past in shaping the present, and, on the other hand, preserved the traces of this past for a future yet to come.

It is in the nature of microfilm—its affordance or medium specificity, as we might say somewhat archaically—to easily hide large amounts of information. Over the years, its compressive property permitted the police and

secret agencies of Argentina and other previous South American dictatorships to conceal and deny the existence of hundreds of thousands of documents and, by extension, the people that "disappeared" with them.[1] The act of reformatting became the subject of an international political scandal when, in 1997, *El Mundo* revealed that many thousands of further files had been brought to Spain, microfilmed there and transported secretly to Switzerland (La Nación 1997a). There, it was reported, in a lockbox in an unidentified bank in Lugano, they anticipate their own discovery. The reasons for this are a matter of speculation and although the existence of still unseen *desaparecidos* records has been confirmed by several military officials (Clarín 1997a, 1997b; La Nación 1997b; Ares 1999), to my knowledge, they have never been found. "[T]hey remain in waiting, *about* to be *of history*," as Charles Wolfe wrote about the limbo in which knowledge lingers on its journey from the past before it becomes history (2009, 98, emphasis in original).

The past stored on microfilms can, of course, still be "lost"—that is to say, incinerated in secret, as indeed happened with many of them (Bonnefoy 2017). Yet being the archival medium that it is, under the right conditions, microfilm also accommodates the possibility to be found. When a fraction of the films were recovered after 23 years, the painful but in many cases intangible trauma of the Dirty War was finally formatted into evidence that could be mourned—it became an archive of repression, as they are called. The archives of repression, some of which remain undiscovered and some already destroyed, symbolically link the memory of Latin American state terror and genocide to others across the globe. The existence and subsistence of the microfilms gradually discovered throughout the 1990s has been and continues to be vitally important in the judicial and cultural recuperation from Argentina's dark past, or what Thomas Keenan (2014) calls "counter-forensics": an unearthing of buried bodies and hidden archives in the service of political struggle, in the search for justice for the victims and their families, and in remembrance of their personal narratives.

The microfilms later underwent another reformatting. Around the year 2000, they were digitized and stored in *Tagged Image File Format* (TIFF) by the Argentine Forensic Anthropology Team, the nongovernmental organization tasked with the search for information about *desaparecidos* (Hanson 2000).[2] This format migration, too, enabled (though not without its

1 Kahan (2007) gives a good historical overview (in Spanish) of the functioning of the Intelligence Directorate archive and its opening.

2 For a contemporary account of preservation challenges at the turn of the millennium in Argentina, Chile, and Uruguay, see also Bickford (1999). For a more recent social

own losses and difficulties) a rereading of the past. Digitizing the films into a lossless format meant not only preserving them as testimony, but also made possible the computer-assisted analysis of conserved fingerprints, thanks to which the remains of some missing people could be identified and located.

Let us thus, at least provisionally, assume that the Argentine case is not an aberration and that format changes are *always* an expression of a political will. This is not only because "format-making activities" often play out as political machinations in the arena of cartel-like consortia (Sebok 2009; see also Decherney 2013). Even after formats have formed and their wars have been won, the reformatting of old documents does not become a neutral procedure. The choice to store information in any particular format for a given purpose, even when this choice appears to be a disinterested effect of convention, always precludes some manipulations of the past while permitting others, whether the information is concealed in a closet, stored in a deposit box, or submitted to computer analysis. This supposition—that media formats are political characteristics of history—demands that we enter and interrogate a place where reformatting is performed on a grand scale: the audiovisual archive.

In this chapter, I wish to consider reformatting as a recurrent cultural practice and explore the ways it transforms our relationship with the past—that is, both curtails and multiplies the ways in which we can interact with it. What objects get reformatted, how, and why? What relationship exists between reformatting, loss, and history? In order to offer some possible answers to these questions, I will look at mechanisms of format standardization, identification, and migration. In the interest of capturing some of formats' overarching logics and simultaneously taking advantage of the many meanings of "format," I will do so across a number of different media and industries, but pay close attention to film archives in particular. My analysis will be conceptually informed by bibliography, as my starting point will be to develop a format theory—and a theory of reformatting—grounded in the study of paper and bookmaking.

## An Epistemology of Loss

Many heritage institutions worldwide—but among them especially those influential European and North American archives whose preservation

science perspective on the forensic-anthropological work in South America, see Mazzucelli and Heyden (2015).

policies will significantly shape the future of audiovisual heritage for generations to come—are currently participating in international format standardization initiatives. These projects aim to reduce the diversity of analog and digital media formats, which is perceived to be chaotic and prone to error. Central in this undertaking are lossless digital formats. Audio and photographic archives have been making use of lossless formats for a long time, but for moving images, the lossless compression or uncompressed storage of large quantities of video material only recently became computationally viable and financially tolerable.

It is noteworthy that Jonathan Sterne (2012) fleshed out the outlines of what a format theory could be on the example of a *lossy* file format. Lossy compression has been called "the very foundation of computer culture" in some of the canonical works on new media (Manovich 2001, 55), and more recently also "imperative today for theories of media and mediation" (Galloway and LaRivière 2017, 143). Contrarily, lossless compression and uncompressed formats have received rather scant media-theoretical treatment. At first glance, this may seem like an issue of proximity. We experience the lossy, epoch-defining triumvirate of the post-television age (JPEG, MPEG, MP3) in interactions with devices we keep at intimate distance from our bodies and touch daily. Lossy compression's sensory qualities are familiar to us in form of manifold errors, glitches, and artifacts. Such faults make the materiality of formats and compression schemes media-historically palpable.

Lossless file formats, on the other hand, at first seem to fall into two categories. Those like FFV1 and LTO are niche instruments with specialist applications, or, like PNG, omnipresent but rarely noticeable in situ. Yet as I have argued elsewhere (Jancovic 2017), lossless compression, as part of the algorithmic infrastructure of the world and precisely because it operates in hiding and on glacial and mostly dormant strata of culture and knowledge (archived films, criminological records, genomic data), may be capable of exerting cultural forces much more insidious and unpredictable.

On closer inspection, though, there are actually plenty of quotidian file formats that utilize lossless compression: GIF, ZIP, and FLAC (familiar to music aficionados), to name a few. Additionally, even lossy formats like JPEG use multiple iterative levels of compression to reduce file size, only some of which are lossy. Other formats like camera raw (familiar to photography aficionados) exist in uncompressed, lossy, and lossless "flavors." And as might be objected at the mention of GIF, the contours of lossiness itself are unsharp: though GIF uses lossless encoding to compress data, its limited

color palette still firmly places it on the spectrum of what we consider lossy formats (see also Strauven in this volume). These ambiguities show how imprecise our terminology is in naming "loss" and in discriminating between filtering, subsampling, quantizing, reduction (see Schneider in this volume), and other technocultural procedures for manipulating signals in order to condense them. But what, then, is the relationship between formats and loss?

## On the Folding and Unfolding of Paper

The semantic reservoir of the word "format" is seemingly inexhaustible (see Volmar, Jancovic, and Schneider in this volume). I would like to offer an additional inflection, the oldest one. Bibliographer Thomas Tanselle (1971) explains that the science of books needs a word to describe the relationship between the physical structure of a book and the routines of a print shop that occasioned it.[3] Historically, the printing trade used "format" for this. Unlike its vernacular use, "format" refers not to size but to the folding of a book: a single folding of the paper sheet creates a folio, a double a quarto—the ancestor of today's A4—a triple an octavo, and so on. Writes Tanselle: "format is not one of the properties of paper but represents something done to the paper" (1971, 32). To format is to fold.

I return to this orthodox bibliographic definition not out of etymological puritanism. Rather, I am convinced that bibliography has much to offer to the study of many media besides books, both methodologically and conceptually, and that a look toward historical bookmaking practices can shed light on persistent and important media-technological notions such as compression and, indeed, format. Bibliography directs our attention to formats as practices, as actions done. A narrow interpretation of format as folding may seem limiting, but it already contains all of its later permutations and sets the stage for the subterranean links between media recognized by Sterne. Formatting has always been a compression in the contemporary sense: the folding of the paper sheet shrinks its dimensions and simplifies its transport and storage, while the imposition—the spatial arrangement of individual pages on the forme before printing—is fundamentally an encoding problem; it ensures that the compressed data is collated correctly and decodable in the right temporal order during reading (see also Seppi 2016, 38–42). We may think of the fold of a book as an early example of a compression artifact.

3 See also Needham (1994).

Thus, if format is not a description of what an object is but rather a trace of the material procedures that have called forth its outward form,[4] then identifying formats is not a matter of the Galilean techniques of measurement and categorization. Rather, it belongs to the domain of interpretation and inference, the domain of all those disciplines—history, archaeology, criminology, medicine—that, as Carlo Ginzburg (1989) has argued, share a distant lineage in divination and the reading of venatic clues. A format is not simply "there" but has to be deduced and teased out from traces in the paper. The placement of watermarks and the direction of chain lines (fig. 1) left behind by the mold are, fundamentally, just residue of the papermaking and therefore irrelevant to the philological essence of a book, the text. Bibliography reverses this semiotic hierarchy. To attain a bibliographically and bibliogenetically useful description of the format of a book, the preserved wave patterns have to be unfolded and made legible as inscriptions, and therefore as always already more than just a side-effect of a technological process.


[Figure 1] Detail of the title page of *Gothofredi Guillelmi Leibnitii Opera Omnia*, a collection of Gottfried Wilhelm Leibniz's writings edited by Louis Dutens (1768), second volume, as scanned by and available from the Library of the Max Planck Institute for the History of Science (document ID MPIWG:U68MHQT3). Edge damage and faint vertical chain lines are visible.

4 On this point cf. also Niehaus (2018) who contrasts the philosophical category of "form," which can arise from inside, with "format," which only materializes as a consequence of being acted upon from outside. Also see Wiedemeyer's discussion of the German *Falte* vs. *Falz*, fold vs. hinge, in relation to Deleuze.

The mechanization of the printing industry in the first quarter of the 19th century enabled the production of much larger paper than was previously possible. As Tanselle (1971) notes, besides the tenfold increase in papermaking speed, this also led to a great multiplicity of book formats, much in the same way audiovisual archives have been experiencing it with video and digital files. With the introduction of wove paper in the mid-18th century and later automation of papermaking, chain lines disappear or become purely ornamental, ceasing to give an indication about the format—as a matter of fact, it is entirely possible to encounter books that do not have an identifiable format at all. But already prior to that, such markings were always only incomplete traces, a kind of circumstantial evidence that needs to be deciphered in order to be explained. As incunabulists know well, in the history of bookmaking, many ambiguous formats exist for which provisional terms like "octavo-form sextodecimo" have to be improvised (see Tanselle 2000, 1971).

## Unruly Formats

Such unruly formats refuse to be contained by economies of *scale*. Things that are oddly formatted do not fit into standard envelopes, mass-manufactured picture frames or the time slots of broadcast programming. They stick out of folders, are awkward to carry, stubbornly resist being embedded in slideshows or opened with incompatible software. Few objects are as puzzling and productive to think about media-theoretically and epistemologically as an electronic file whose format is unidentifiable and whose contents are therefore illegible even though they can be read.

The identification of formats is of major concern for not only bibliography but also archives and the entertainment industry. Formats, whether book or broadcast, are more than the immediate appearance of the formatted thing. This is why the trade association FRAPA, Format Recognition and Protection Association, can offer services like the analysis and comparison of television formats to assist TV producers in copyright litigation. Archives, too, often need help identifying the format of electronic files. A number of format registries exist to aid with this, such as the UK National Archives' PRONOM, a database of technical information regarding the structure of file formats and software products that support them.

Format matters have thus been troubling heritage institutions for a while, film archives in particular due to cinema's international nature. Already in the late 1970s and early 1980s, when film archivists began using computers to assist their work, format standardization became an urgent

goal of the archiving community. The format in question was not only the merry congeries of film gauges, magnetic tapes, and file types that cause preservation headaches today, but the format of catalog data. The development of a common computerized cataloging format—a WorldCat for film—would, so it was hoped, greatly facilitate international exchange, consistency, and discoverability, and was among the International Federation of Film Archives' major priorities. Despite widespread support throughout the 1980s, such initiatives often encountered difficulties at the level of technology as well as in administration, logistics, and politics (see, e.g., Smither 1987). We may compare this with the medieval standardization of paper sheet and mold sizes, or similar attempts in Republican France around 1800, or the thirty-odd years it took to somewhat standardize film camera and projector apertures, or the early 20th century efforts to create "world formats" for all everyday objects—all of which produced mixed or, to put it more mildly, very gradual and approximate results (Needham 1988; Schubin 1996; Kinross 2009; Niehaus 2018). Notably, however, Wilhelm Ostwald's international format standardization ambitions, which ultimately inspired the ISO 216 paper sizes in use today, were already fundamentally driven by a notion of losslessness: he advocated for the $1:\sqrt{2}$ aspect ratio for paper because it allowed reformatting without loss—that is, without waste (Krajewski 2006). Today's baroque cornucopia of formats and the associated question of lossless reformatting is therefore by no means a new set of problems, although each time it reappears in a different industrial, institutional, cultural, and technological climate.

During the 1990s, libraries and, later, photographic archives began to experiment with digitization (as opposed to microfilming) for preservation reformatting. Halfway into the decade, archivists for the first time carefully considered the prospect of using digital images as preservation master copies. Even before that, the notion emerged that for electronic records, "preservation means copying, not physical preservation" (Lesk 1992, 13). The issues then were nearly identical to those faced by film archives today, namely, the obsolescence of hardware and software, proprietary and therefore opaque technologies, incompatibilities between vendors, and lack of comprehensive and inter-institutional integrity verification methods (Graham 1994; Walters 1995).

The TIFF format into which the *desaparecidos* microfilms were digitized is notably the same format that many European film archives now use to store large portions of their born-digital (and in less common cases, digitized) collections. This is not a coincidence. TIFF is used commonly as a preservation or migration target format because it allows the lossless

storage of image data, a trait both criminologists and archivists consider desirable. Archival format migrations are one specific manifestation of what Wolfgang Ernst has diagnosed as the "shift from an ancient European culture that privileged storage to a media-culture of permanent transfer" (2002, 14, my translation). Reformatting is what contemporary archives *do*: 35mm films are scanned into DPX images, DPX images compressed into MXF mezzanine files, mezzanine files transcoded into H.264 access files, QuickTime containers rewrapped into Matroska containers, JPEG2000 sequences converted into TIFF sequences, LTO-5 tapes migrated to LTO-7. The archive of the 21st century is like a book bindery where objects are endlessly folded, unfolded, and refolded. Behind all these formats is some technological promise, some standardizing authority, some hardware marketing department, some implicit or explicit policy on closed or open source, some formal and informal knowledge circulated between archivists, some weighing of preservation ideals against financial realities. Each format reveals a chain of aesthetic, political, and financial balancing acts that have led to its being chosen over others in a particular cohort of archival material.

## Formatting as Cultural Technique

For Gilles Deleuze, the fold was a pluripotent instrument with which to think about and irritate, among other things, the distinction between interiority and exteriority (Deleuze 2006; O'Sullivan 2012). The fold is a fault line, a division that connects. In the fold, inside and outside, container and cargo, sea and ship, discrete and continuous touch. Deleuze's interest in folding (and its prehistory in Foucault, Merleau-Ponty, and so on) did not arise in a vacuum. In the year following the publication of his book on the fold and Leibniz, the first International Meeting of Origami Science and Technology was held in Italy. Folding has had a long but latent existence on the periphery of mathematics. As Michael Friedman (2018) observes, paper, usually a passive storage medium for mathematical inscriptions, exhibits the peculiar behavior of producing mathematical objects when folded: straight lines. Yet folding never, until recently, occupied the same position of prominence that other mathematizable cultural practices like knotting and weaving do. Folding was axiomatized only late in the 20th century (Friedman 2018), around the time of Deleuze's engagement with it, marking its inauguration into the mathematical sciences' arsenal of epistemically productive machines.

We may also notice how the gesture of folding was taken up shortly afterwards elsewhere; for example, by Bruno Latour (1999), who identified the folding of time and space, of human and nonhuman, as a property of all technical mediation; or recall that Donna Haraway (2007, 249) proposed *infolding* as an alternative to *interface*. In the years since, much like format theory, folding has taken off considerably, recently even warranting an edited volume (Friedman and Schäffner 2016) with the subtitle "Towards a New Field of Interdisciplinary Research." Like formats, folding is in vogue. These two distinct concepts, formats and folding, both of which have recently become major research paradigms, can thus be drawn together through a long, shared material history in the medium of paper.

Although the idea of a media history of folding has been broached previously by Nina Wiedemeyer (2014), folding, surprisingly, has rarely been counted among cultural techniques and considered as such.[5] Cultural techniques are a unit of analysis born in the interstice between German-speaking cultural science and historical media anthropology.[6] Harun Maye, Sybille Krämer, and Horst Bredekamp conceive of them in similar terms as "inconspicuous knowledge-techniques," "cyclical translation chains between signs, people and things" (Maye 2010, 121, 124) or bodily and habituated "operative procedures concerning the handling of things and symbols" (Krämer and Bredekamp 2008, 18; all translations mine). Often-given examples are enliteration processes (reading, writing, counting) or more primeval agricultural procedures like the demarcation of plots, boundaries, and enclosures in soil (Siegert 2010, 2013; Winthrop-Young 2014). Key to these operations is that they produce those primordial distinctions governing anthropic culture that are undone in Deleuze's fold: inside and outside, culture and nature, private and public, subject and object (see also Young 2015).

The formatting and reformatting of things—and I mean, in the first instance, the literal folding of paper—is a prime example of a cultural technique, not only since, as media scholar Susanne Müller (2014) argues, computers became ubiquitous. Children the world over learn how to fold paper, that is to say, they cultivate a habitual empirical understanding

5 Except perhaps for marginal mentions, e.g., in Siegert (1993, 2010) and for a treatment by Friedman (2018) and Wiedemeyer (2014) herself, both of whom deal primarily with highly specialized—i.e., mathematical or artistic—cases of folding.

6 This term, too, has been enjoying dramatic popularity in recent anglophone media research, due in no small part to the translation efforts of John Durham Peters, Geoffrey Winthrop-Young, and others. For its genealogy, see Geoghegan (2013) and Winthrop-Young (2014).

of the manipulation of planar surfaces in space without recourse to symbolical knowledge of topology. Ignoring for a moment Deleuze's metaphysical insights about the fold, the folding of paper as cultural technique operationalizes the boundary between a featureless plane of virtual possibility and actualized space and function: a "transition from nondistinction to distinction" (Siegert 2015, 14).

In its focus on process, cultural techniques research thus resonates with format theory. Format, after all, as bibliography teaches us, is always a doing. Bernard Dionysius Geoghegan (2013, 69) argues that cultural techniques encompass both the moment of emergence of new symbolical systems as well as their formalization, and can emerge prior to the media that form around them. The same could be said for many formats: the great multitude of early Kinetoscopes, Bioscopes, Biographs, and so forth anteceded the notion of cinema. In a description closely resembling the definitions of cultural techniques just mentioned, Liam Cole Young interprets format theory as a field interested in "how humans and their devices converge to establish ways of doing, hearing, seeing, and thinking that are the ground upon which concepts, desires, and institutions are built" (2015, n.p.). It is its genesis in the habituated gestures of paperfolding that explains why format studies finds so much agreement with the anti-ontological stance of cultural techniques research posited by Young.

The bibliographical identification of book formats requires a diachronic understanding of papermaking, printing, binding and trimming methods and tools, of the sequence of imposition, of the shape and weight and durability of the molds and deckles and wire facings, of the pressure and weight applied to various parts of the machines, and of the specific, precise directions, rules, and ways of grasping and handling them that papermakers, typesetters, and binders traditionally used. It is this type of haptic, material knowledge that we might seek when researching other kinds of formats, too.

To summarize, folding and formatting need to be thought concurrently as cultural techniques. I argue that folding must be studied by format theory as much as it is by philosophy and mathematics. In fact, there may be an entire genealogy waiting to be uncovered that connects the seemingly unrelated sciences that study folding: from mathematics, philosophy, stratigraphy, and bibliography to the physics and engineering of metamaterials or the biochemistry of peptides and DNA.

## Fault Lines

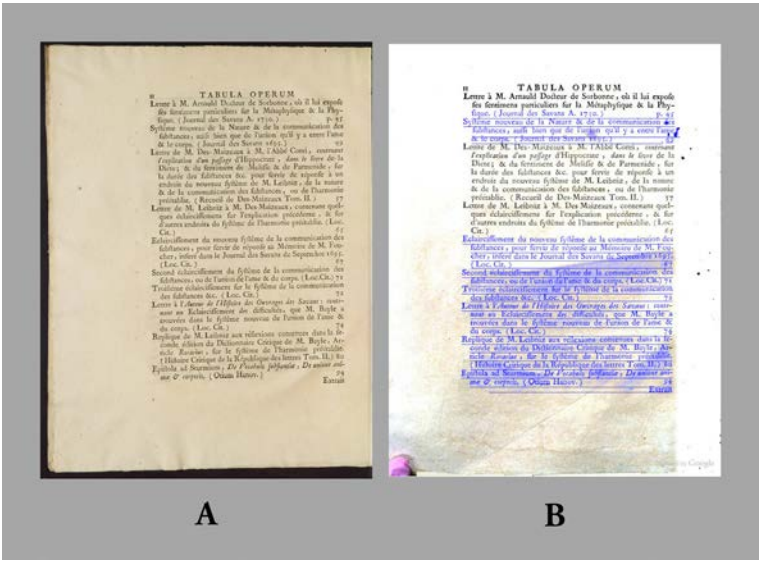
Here, I return to the question posed at the beginning: what is the relationship between formats and loss? One consequence of the mechanization of papermaking was a change in the bibliographical value of faults and losses. The format of books from the 19th century onward can often only be revealed through incomplete copies and damages. For example, the leading edge of a printing forme receives the most stress, so examining damage on the type can disclose clues about the imposition, and therefore also about the format (Tanselle 2000). In newer books, the format/folding can at times be determined if an untrimmed or even unopened copy has been preserved. Such an object, though it resembles a book, is, paradoxically, not one yet because it cannot be opened and therefore also cannot be read. It is only by irreversibly cutting open the folds, by creating an interface—*Schnittstelle*—that the bookness of a gathering of paper begins.[7]

If Leibniz provided Deleuze with the folds that hold the universe together, he also provided the history of mathematics with cuts in search of an interface. At the Gottfried Wilhelm Leibniz Library in Hannover, Germany, a reconstruction of Leibniz's notes has been underway since 2015. Leibniz had the habit of filling sheets of paper with notes on different subjects, from metaphysics to calculus, and then cutting the paper with scissors and ordering the snippets by topic. In an effort to piece the preserved fragments together, librarians and historians turned to forensic software developed for the purpose of reassembling files of the East German State Security Service that had been torn up by hand (Wehry 2017). The hope is that by reforming the scraps into a whole—undoing the "losses" that Leibniz intentionally introduced by severing the temporal relationships within his writing and replacing them with thematic relationships—a well-formatted chronological narrative might emerge.

Paper is an excellent storage medium for creases, it remembers every fold. A fold is also a fault, a wrinkle, a pleat, *un pli*. To figuratively *apply* something (like a framework or a concept, such as the concept of "fold" to a theory of media formats) means to put it to work but also to ply it, to bend, fold, and distort it. Reformatting—the applying of a new format—is therefore never just a repackaging but always a refolding. As we know since Matthew Kirschenbaum (2012), who applied methods of both bibliography and forensics to the study of electronic documents, every

7 Here, again, we hear a remote echo of agri-cultural techniques at work: the folded leaves are slit open with a tool called a plow.

migration is a mutation.[8] There are no lossless formats because formats are not transparent vessels but imprint the content they frame with scars, tears, and folds. When something is formatted and reformatted, it yields to the politics of the format. Cinema offers a most striking example: the awareness that their films might be reformatted for television and home video led cinematographers to develop techniques like "shoot and protect." This frame composition principle anticipates aspect-ratio alterations that have not yet taken place and subtly affects not only what appears in the picture and how but also the set design, lighting, sound recording, and, as Mark Schubin (1996) has demonstrated, also the plot, timing and dramaturgy. Formats can thus also shape and reformat cultural expressions preemptively and across different media.




[Figure 2] Page II from the table of contents of *Gothofredi Guillelmi Leibnitii Opera Omnia* in two different online-accessible versions.

A: A copy held and scanned by the Library of the Max Planck Institute for the History of Science; digitization provenance unknown.

B: A copy held by the National Central Library of Rome, scanned on March 19, 2013 by Google (Archive.org identifier: bub_gb_zeDzFGJjWLIC).

Bibliography teaches us that loss and faults in their many forms are epistemically fertile: they can be read. Indeed, for certain modes of addressing the past, they are *desirable*. This is a critical realization for

8 See also Chun 2008.

any process of reformatting, especially for the institutional realities of preservation and digitization. Historical books, for example, are often—most prominently in Google's book digitizations—scanned and retouched in a way that prunes away the fuzzy and damaged edges of leaves. The examples in figure 2 demonstrate two very different approaches to book digitization on the same passage of text. Image A includes the fold and edges as well as faintly visible chain lines. In image B, contrast is increased, rendering all of them invisible. The former much better preserves historical information pertaining to the format as a material and sensory property of the book. But image B, too, is not without its own folds, faults, and marginalia that document the technical processes and labor of its own reformatting: some text is automatically turned into blue hyperlinks and underlined, and the scanner operator's presence is marked by the inclusion of a finger covered with a protective pink glove in the lower left corner.[9] These reformattings encode very different relationships to the past, and make very different forms of historical inquiry possible or impossible.

As far as knowledge practices go, the online accessibility and searchability of library and archive collections is one of the great achievements of the 21st century. But trimming off the edges and other traces of formatting means, in essence, presupposing that people accessing the digitized records will have an interest only in a select (although undoubtedly very important) aspect of the book, namely the text. Even when scanned in high resolution and saved in a lossless format, the—quite literally—marginal knowledge contained in the shape and structure of the book's folded leaves can thus be lost.[10] One could argue that for the vast majority of readers, such digitizations are good enough, since only the minuscule audience of the bibliographically inclined would be interested in examining the paper, and those should likely prefer to do so on the physical original. While that is hard to dispute, my point here is that all acts of reformatting express some limited and limiting ideology of use and utility, some opinion on what constitutes content or "essence" and what is secondary to it, and, as the hidden *desaparecidos* microfilms show most urgently, some politics of access and exclusion, visibility and secrecy, history and memory.[11]

9 On the relationship between Google's book scanning process and outsourced labor, see Bergermann 2016.

10 Wiedemeyer (2014, 145–48) makes a similar criticism of digitizations.

11 Siegert (1993) compellingly delineates the separation between public and secret in the late medieval period as a difference of medium, of (rigid) parchment against (foldable and sealable) paper. One could rephrase this as the difference between a capacity to be reformatted and resistance to it.

Even lossless formats are "lossless" only in a narrow and transitory sense bound by historical contingencies. TIFF, for instance, carries the affordances and constraints of 32-bit computing: it can only reference addresses 4 gigabytes away from beginning of file. For image sequences in digital film preservation, this is not yet a problem because a single frame is orders of magnitude smaller. But if we venture to the periphery of what might still be considered visual culture—astronomical and medical imaging, for example—it quickly proves to be an insurmountable limitation. In response, these fields develop image formats of their own (like DICOM or BigTIFF), and they often do so fully aware of the need to standardize them. But as imaging practices and hardware change and the needs of particular communities (clinical vs. research imaging, for instance) diverge, the formats tend to mutate and multiply (see, e.g., Larobina and Murino 2014; Kitaeff et al. 2015).

Deleuze's reading of the Baroque was closely tied to an uproar of formats, a Great Reformatting:

> the painting exceeds its frame and is realized in polychrome marble sculpture; and sculpture goes beyond itself by being achieved in architecture; and in turn, architecture discovers a frame in the façade, but the frame itself becomes detached from the inside, and establishes relations with the surroundings so as to realize architecture in city planning. (2006, 141)[12]

Our age industrialized Deleuze's Baroque into the bedrock of cultural production. Not just in the archive, reformatted audiovisual objects surround us everywhere; in fact, most images, texts, and recorded sounds we encounter undergo dozens of format changes throughout their existence. Documents born as InDesign files are reformatted for e-readers and exported as PDFs, printed and then scanned as DjVu files; online videos are downscaled for mobile devices and upscaled for 8K television sets; films metamorphose from raw video to intermediate editing formats to DCPs or XDCAM or VP9 files. Our messaging apps convert all the animated GIFs we send into MP4 videos, since we would otherwise be inundating their servers with an inefficiently lossless format from 1989. Content delivery networks reformat JPEG images into WebP files. Our handheld devices continuously monitor their own orientation in space and diligently turn images from portrait to landscape for us. It is a very contemporary brand of vexation and anger to be fighting with a phone over the format of a photograph whose "orientation," stored in EXIF format, contradicts what human observers

12 See also Jacob Burckhardt on Baroque formats quoted in Niehaus 2018, 30.

might consider natural. Unruly—we might even say queer—formats, indeed. Many of us have by now surely also encountered television sets that refuse to play video files because of a particular format: the file system format of a storage medium, an unlicensed audio stream format or even a nominally supported video format in the wrong container or with a quirk like an incompatible bit depth. Such irritations of modern life, in turn, sustain the online cottage industry of format converter software and services.


[Figure 3] Screenshot from a trailer for *The Hitchhiker's Guide to the Galaxy* (2005) circulated on YouTube, showing traces of multiple reformattings. The image originated with an anamorphic widescreen aspect ratio of 1:2.39. My brief examination suggests that this trailer may have been digitized into DV NTSC format, erroneously captured without correcting for DV's narrow pixel aspect ratio of 0.91 (thus stretching in width) and letterboxed into a 3:2 frame, subsequently letterboxed again into a 4:3 frame and finally pillarboxed for YouTube into a 16:9 frame.

[Figure 4] The same frame from the 2007 Touchstone Home Entertainment Blu-ray release of the film.

All of these reformattings leave their own folds. Trimming the edges of a scanned book's pages is a subtractive reformatting, like the lossy amputation of paintings that art historian Jacob Burckhardt pleaded against in 1886 (Müller 2014; Niehaus 2018). At times, reformatting can even induce a complete effacement of media objects: Paolo Cherchi Usai (2000, 61) once recalled a fulminant anecdote in which a print of Hans-Jürgen Syberberg's *Parsifal* (1982) was hacked to pieces by a furious projectionist who was unable to correctly adjust its aspect ratio. But format changes are also generative. The black slabs of letterboxed films on television or the blurry aureoles that "correct" vertical videos to make them suitable for YouTube—these prostheses we graft onto things in order to make them "have" a certain format (figs. 3–4) are not simply empty or redundant spaces. They are evidence of procedural frictions across aesthetic, technological, and economic registers that sometimes, dramatically, escalate into format wars.

Importantly, this is not only a matter of "poor images" (Steyerl 2009) or "small formats" (Niehaus 2018) that want to circulate quickly and therefore shift and shed their shape recklessly and often. It can also happen to films during their transition from the formalized film industry into the film archive. As one of the examples known to me, the EYE Film Institute in the Netherlands, as is common in countries with state-subsidized film industries, asks digital film productions to bestow copies as Digital Cinema Distribution Masters (DCDMs) to the archive. This master copy contains the picture, sound, subtitles, and metadata of a film in lossless formats. Filming in HDTV resolution (with a width of 1920 pixels) is still not uncommon, for example, in non-fiction filmmaking, and for such material, EYE Film Institute asks that the image be padded to a width of 1998 pixels to ensure full compliance with standard DCDM resolutions.[13] Given a height of 1080 pixels, this translates to 1:1.85—a historical aspect ratio from the analog film era commonly called flat widescreen.

Replicating an analog format by adding 39 empty pixels on both sides of the image might seem insignificant (and in the grand scheme of things it very well is) but it also shows that formats have a mind of their own and a way of asserting themselves. They sometimes mutate vigorously within the same carrier, and at other times remain tenaciously persistent across generations of media. Formats tend to remain the same because of standardization, but they also change in nontransparent ways, folding into each

13 Mention of this resolution has been removed in the new Digital Cinema Initiatives 1.3 DCDM specification published in 2018.

other and stratifying internal difference as versioning: U-matic becomes U-matic SP, 8mm becomes Super 8, HDCAM becomes HDCAM SR. Nitrate film shrinks and thus changes its format, becoming incompatible with projection hardware. Incompatible video formats turn into clumsy compromises like the 14:9 aspect ratio sometimes used in television production. Besides the public document that describes it, TIFF has private, non-standard, undisclosed, or unreliably circulated implementations that can impinge upon archival efforts. The discrepancy between format as a virtual, ideal standard and format as actualized form is why newer standardization initiatives like PREFORMA not only develop format *specifications* but also provide their *implementations* for reference. These paradoxical tendencies explain why some theories of formats commit to their mutability (Bucher, Gloning, and Lehnen 2010), while others insist precisely on their fundamental permanence (Niehaus 2018). I take this as an indication that format theory has yet to find a model of temporality that can account for formats' apparently contradictory propensities in a satisfactory way.

## Conclusion: A Geology of Culture

At the risk of overindulging in semantics, let us remember that a fold is also a geological event, a bend in the sedimented strata of the soil. As the installation and video artist Annett Zinsmeister (2004) notes, the fold is a phase transition, a sudden change of orientation. One of the greatest folds in the history of Europe has been not only a format transition around 1480, when portable book formats began replacing the large folios (Füssel 2005). It was also an ideological reorientation—a reset, a formatting of the religious operating system, a *reformation*. The Reformation could take place because of a change of direction in the technological substrate of culture in the form of movable type but also, as Johannes Burkhardt and others have pointed out, the invention and rapid circulation of formats like the mass-printed pamphlet and daily report (Burkhardt in Schulze et al. 2005).

Formats thus engrave not only "old infrastructural context" (Sterne 2012, 15) but also the cultural, epistemic, political and even religious torsions of an age into concrete objects. They can be placeholders for class differences and social hierarchies (see Genette 1997, 17–22; Bucher, Gloning, and Lehnen 2010, 20). Entire value systems and cultures of taste are encapsulated in the way one unfolds a "tabloid" differently from a "broadsheet." Some formats are ascribed truth value, others are made out to be inherently untrustworthy—recall Reuters' 2015 ban on the use of the RAW format by photojournalists. The New York Public Library's massive

collection of comic books is a testament to the cultural mechanisms of appraisal that delimit the set of archivable and archive-worthy formats: the "books" are, as a matter of fact, microfilms. In 2017, the Gerrit Rietveld Art Academy in Amsterdam inaugurated a new master's program in "film, design and propaganda." Its catchy slogan announced: "HD is the new A4." Here, HD, the parvenu format, metonymically serves as a proxy for a power transfer between media whose intricate gradations cannot be fully articulated with the totalizing term *medium* alone. This power transfer is also a reversal of direction: a retrograde motion from Hippasus back to Pythagoras, from the irrational beauty of $\sqrt{2}$ that governs ISO 216 paper sizes to the integer beauty of $2^n$ that digital screens like so much.

Formats and media are thus interlinked in nonlinear ways that we do not yet fully understand. They each follow idiosyncratic and multidirectional temporalities that slip against and attrit each other but, confoundingly, also undulate in tandem. Formats have far-reaching consequences for the experience of media, for the accessibility and reproducibility of scientific data, and for private and collective memory. The format of archival records has a significant impact on not only who is able and willing to access them (Capell 2010) but also their perceived authenticity and veracity (e.g., Hedstrom et al. 2006). That is why the "losslessness" of the TIFF format used in the forensic analysis of the *desaparecidos* files is so instrumental: it helps to discursively anchor the horrific losses of a volatile past in a technological promise of immutability.

In the archive—whether the dispersed archives of repression, the established institutional repositories of objects and knowledge like EYE, or their messy present-day online counterparts like YouTube—history can be traced as an unfolding of formats. Reformatting has become one of the chief activities that archives perform on the objects in their custody, alongside or as part of preservation. What format theory can contribute to historical research is an awareness that such reformatting actively inscribes histories in the margins and in the folds. To the historiographical question "what does this object say?" format theory adds: "why is it in this format?"

Even without looking inside the vessel at the content of an archival object, a close look at its format can reveal a great deal about the circumstances of its existence, and about the archive that contains it. Understanding format as a process draws attention to not only "the catacombs under the conceptual, practical, and institutional edifices of media" (Sterne 2012, 16) but also the politics suffusing those catacombs, and in some cases the bodies buried within. Format changes might perhaps be the preliminary tremors

of large tectonic shifts in cultural and political systems. The reformatting of the *desaparecidos* paper files was an inflection point: the microfilming was a signal that mechanisms of institutional forgetting were being set into motion. The same mechanisms would later also make possible the past's coming into language. The transition from silver halide microfilm to TIFF file also marks an event that has been slowly taking place since the 1990s: the subduction of a tectonic formation known as analog media under the large stratum of digital data. To study media formats is therefore not just a good way to understand *media* history (Müller 2014; Sterne 2012), it might be a good way to understand the history of the world.

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