1. Introduction: Trajectories of Images

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The Circulatory Turn

In today's society, digital images seem to circulate and move with ease. They are networked, streamed, presented on social media, and passed between small and portable screens such as smartphones, laptops, or tablets. Film and photography, formerly projection and print-based visual media, are consumed on digital displays and distributed via transmission and networking technologies on a regular basis—a characteristic that was associated with television and telegraphy in particular. On the networks, images are sent, received, and shared: whether recorded with a smartphone, extracted from a film or television show, appropriated or recycled, they are commented on, forwarded, linked, or liked on proprietary platforms. Images that were usually concealed in private, such as snapshots or home movies, are transformed from an intimate to a communal activity and appear in public, thereby undermining the traditional difference between the professional and the amateur (Rubinstein and Sluis 2008, 10). Becoming increasingly mobile, networked images are thus fed into circulation processes in which the medial positions of sending and receiving can change in unpredictable ways. They can not only move and animate what is represented by means of cinematic, televisual, or videographic techniques; they are themselves also on the move. Within seconds, they traverse great distances, geographic and political spaces, but also different symbolic contexts, media environments, and institutions.

Accordingly, the discourses of mobility, circulation, and networks have come to supersede the debates on production, indexicality, and manipulability that dominated early conceptions of post-photography and post-cinema (cf. Hagener, Hediger, and Strohmeier 2016; Gerling, Holschbach, and Löffler 2018; Henning 2018; Rubinstein and Sluis 2018). The crisis discourses of the digitally induced death of the photographic and cinematic, which primarily mourned the supposed loss of the material and semiotic media-specificity of the analog (see, among others, Doane 2008), have been replaced by diagnoses of "ubiquity" (cf. Fetveit 2013; Hand 2012). With them, the boundaries between moving and still images are regarded as becoming blurry within an incessant stream, update, and flow of mobilized net-

worked images (Lister 2013, 8; Gerling, Holschbach, and Löffler 2018, 126; Henning 2018, 131–133). After being concerned initially with the technological transformation from grain to pixel, from analog image carriers to image files, the caesura of the digital is now linked to connectedness, circulation, and the dissemination of photographs and films as well as their embedding in digital infrastructures (Gerling, Holschbach, and Löffler 2018, 8).

Especially since the early 2000s, circulation has enjoyed a theoretical boom in the discourses of digital media, promising to offer alternatives to prevalent methodologies that privileged either production or consumption, authors or audiences (Straw 2017, 427). In contrast, the shift to cultural circulation meant "to study the distances across which cultural forms travel, the rhythms of their movement, and the conditions which make possible various kinds of encounter" (Straw 2017, 428). Instead of being conceived as a supplementary, middle term between production and consumption, circulation aims to relate and encompass the processes involved in all three (Straw 2010, 25), emphasizing its active contribution to the production, meaning, and content of images as well as their redefinitions though time and space. In participatory online culture, this encompassing understanding becomes important for describing diverse media practices such as sharing, commenting, and disseminating content via social media platforms—with virality and memetics being their most visible manifestations. For Henry Jenkins, Sam Ford, and Joshua Green, circulation or "spreadability" even marks a re-organization of power hierarchies within media industries: while distribution designates top-down, centralized processes of dissemination typical of traditional mass media and the broadcasting of professional content, circulation "signals a movement toward a more participatory model of culture, one which sees the public not as simply consumers of preconstructed messages but as people who are shaping, sharing, reframing, and remixing media content in ways which might not have been previously imagined" (2018, 2). Therefore, circulation highlights social interaction, phatic communication, community building, and fan activities involved in the sharing and gift economy of the web. Moreover, these circulatory practices shift the focus from individual media content and its meaning to rhythms, speed, and patterns of transmission, because within a culture of overabundance they say more about the cultural role of media than isolated artifacts (Straw 2017, 429). Notably, social media and internet support a culture of bits, which can be combined and recombined, retweeted or reworked endlessly: "In a given culture of circulation, it is more important to track the proliferating copresence of varied textual/cultural forms in all their mobility and mutability than to attempt a delineation of their fragile autonomy and specificity" (Gaonkar and Povinelli 2003, 391).

In the discourses on the circulation and mobility of images, networked photography became a privileged medium of examination. Here, circulation addresses the new "public life" of snaps (Chéroux 2019, 7; see also Rubinstein and Sluis 2018) and

helps to grasp the transformations of the social uses and functions that were enabled by the media constellation of photography, internet, and mobile phone. Being an everyday apparatus intended for personal use and portability, the smartphone quickly replaced cameras as a recording device in amateur contexts. Being a networked device at the same time, the smartphone fostered connected photography and its mobilization as small digital files—easily to copy, manipulate, reproduce, transmit, upload, or download. For the French photo historian Clement Chéroux, this social mobilization and dissemination even constitutes a third revolution in the history of photography, characterized by an acceleration and increase in instantaneity (2019, 8). According to him, the evolution of photography has often been described as a great narrative of instantaneity. The early slow photography became accelerated, firstly, through the reduction of exposure times due to the development of light sensitive materials. Later, instant photography, exemplified by Polaroid, shortened the time of development and accelerated the consumption of images. Finally, Instagram contributed to the third revolution of instant sharing and publicity. This third shift retroactively changes the relevance of this photographic activity: whereas the third stage was slower and less visible in former times, networked photography revealed that dissemination and sharing were its mode of existence all along, preventing a reduction of photography to shooting and printing (Chéroux 2019, 8).

Chéroux's observation is quite remarkable because it implies a re-evaluation of basic concepts of image theory. It suggests not so much that the circulation of images is technologically or conceptually limited to the realm of the digital, but rather that the rising traffic of digital photographs, films, and videos in our time invites us to re-examine the historical and theoretical relevance of images' mobility. As Thomas Nail notes, we are witnessing a mobilization of digital images on a new scale, resulting in a new perspective on images in general:

> The centrality of the movement and the mobility of the image have never been more dramatic. And just like the Copernican revolution, the aesthetic revolution of the image has consequences not only for the way we think about the contemporary image but for the way we think about all previous images as well. The contemporary mobility of the image lets us see something new about the nature of all hitherto existing images. Only now are we able to understand that movement and mobility have always been at the heart of the image. (Nail 2019, 1–2)

Of course, images' mobility was addressed theoretically and historically before digital networks made it overtly relevant. Particularly in art history, such questions were raised. Aby Warburg, for example, who is known for his interest in motivic and physical image migration through space and time, developed many terms and methodologies in order to map the cultural itineraries of images. In 1905, he coined the notion of "Bilderfahrzeuge," literally meaning "image vehicles." Initially, this

notion referred to carpets that were produced in Flanders and were transported to Florence (Heil and Ohrt 2016, 36). For Warburg, the carpets were the prototypical image vehicle. They became mobile by detaching themselves from the walls and through the reproducibility of their motifs (Beyer et al. 2018, 9). Later in the 1920s, he renamed them "automobile Bilderfahrzeuge," adding the idea of automobility, and extended the notion to different carriers such as graphic reproduction, canvas, books, or scripts that supported the geographical and historical migration of images (Heil and Ohrt 2016, 8, 36). 'Automobile image vehicles' enable the transport of pictorial formula, which Warburg tried to trace all his life, eventually leading to his famous project, the *Mnemosyne Atlas*. Whereas Warburg's interest in migratory processes is strongly related to his understanding of the history of arts and culture, with the "afterlife of antiquity" (Nachleben) being its primary model, his notion "Bilderfahrzeuge" seems to anticipate one of the basic differentiations of image theory, namely the difference between image carrier and image object (Beyer et al. 2018, 10). In their introduction to image theory, for example, Wolfram Pichler and Ralph Ubl explicitly refer to image carriers as "image vehicles," distinguishing them from image objects (2014, 20–25) and thus signaling the importance of detachment for the concept of the image.

According to the art historian Jennifer L. Roberts, the transportability and portability of images is the very precondition for our modern understanding of image and art autonomy. It is due to the detachment of an image from a specific place that basic pictorial differences can emerge:

> The portability of pictures was integral to their historical emergence: easel painting was developed in the early Renaissance as a way of detaching images from fixed social and spatial contexts. The advent of the canvas support allowed for a light surface, easy to move and independent of any particular architectural surround. And the strategies that led to the development of the object now called 'a picture' (the bounding frame, the internal relation of forms and narratives, and especially the deployment of linear perspective) worked similarly to virtualize the image and liberate its internal space of representation from external space through which it moved. Its space of illusionistic reference, in other words, was sealed off from its space of physical referral. The resulting geographical autonomy of picture format would come to exemplify the aesthetic autonomy that defined modern art theory from Kant to Clement Greenberg. (Roberts 2014, 2)

The autonomization and dislocation of the visual is closely linked to the differentiation between representational and real spaces, which is enacted, among other things, by the frame of the picture. Following André Malraux, Vinzenz Hediger also emphasizes that the circulation rather than the production of images is constitutive for the formation of an expressive aesthetic object that can be contemplated as an independent entity (Hediger 2016, 17–19). Consequently, he denies its supplemen-

tary, retroactive character and subordination to production or reception (Hediger 2016, 18).

Furthermore, it is a very telling coincidence that Nail's argument on the changing concept of the image in view of its digital circulation echoes the famous proposition made by Walter Benjamin (1969), namely that the mechanical reproduction of modern mass media has forever changed the notion of art, since it facilitates the spread, dissemination, and multiplication of images in space and time. Of course, the history of images as commodities within global capitalism aligns reproduction with processes of circulation and spatial and temporal mobility. Nevertheless, it seems that Benjamin's theses were explicitly revisited as processes of circulation and mobility only in recent times. Film and photography theory traditionally focused on "*referential reproducibility*," i.e. the reproduction of physical reality and issues of indexical trace; however, digitization made the second form of reproduction—"*circulatory reproducibility*," which addressed processes of multiplication primed for circulation—more visible (Balsom 2017, 4–5). Indeed, this new visibility in the digital realm prompts an increased theoretical and historical interest in images' mobility and circulation. Although not completely unprecedented in terms of scholarly study, this interest is reflected in new research in the fields of film, video, and photography that starts out from current digital image practices and notably coincides with a conceptual reevaluation of media formats.

In the photography discourses, this new visibility of images' mobility leads to theoretical and historical reassessment of photography as a mobile medium. For example, Michelle Henning argues that the mobility of images was merely accelerated by digital networks, while photographs were on the move from the moment of their invention: they were small in size, portable, and reproducible (2018, 7). Therefore, she invites us to question one of the fundamental assumptions of photography theory: instead of focusing on photography as a static medium aiming to freeze a moment, she conceives photography as an itinerant image—an image which is traveling, unfettered, migratory, journeying, displaced, wandering, and vagabond (Henning 2018, 7; see also her article in this volume). Its mobility and increasing acceleration is characteristic rather than incidental (Henning 2018,7). Analogously, for André Gunthert (2014), "connected photography" transforms the social functions of the medium due to the ability to share and show images instantly on social media and image platforms, stimulating a historical reevaluation. His notion of the "conversational image" captures the shifts in the social status of photography. According to him, images are acting more and more like speech. They are no longer simply an object of communication, but rather means of communicative, dialogical acts (Gunthert 2014, 4–5). Whereas wired photography is often regarded as crucial for the history of discrete image (see Dentler's chapter in this volume; Rothöhler 2018, 141–154; Chéroux 2019, 7), in Gunthert's account, the illustrated postcard becomes a precursor of the digital conversational image and a

valuable example in the history of phatic communication. With it, mail art, which proliferated in the 1960–70s, also comes to the fore as an interesting step within the archaeology of visual networks and communities of sharing (Held 2005). And to give a last example: In his history of operative portraits ranging from Lavater to Facebook, Roland Meyer (2019) discusses photographic portraits explicitly from the vintage point of circulation, as evidenced by proliferating image flows on social media as well as by the *cartes de visites* popular in the 19th century. He argues that the quantitative overabundance and the implicit serialization of images in distributive contexts necessitate a logistical perspective that is able to explain how standards, protocols, and formats regulate and manage the circulation and dissemination of images (2019, 26; see also Nicole Wiedenmann's article in this volume). Being technical standards, formats affect basic material features of image carriers, such as their size, form and aspect ratio, and influence how images can be incorporated into larger technical ensembles, such as albums or archives (Meyer 2019, 27).

In studies on moving images, we can observe a comparable interest in circulation and an emphasis on the role that formats play for the mobilization of images in analog and digital realms. In her work on film and video art in circulation, Erika Balsom relates the mobility of moving images to the generation of aesthetic, cultural, and economic value implicated by the terms reproduction, original, and copy (2017, 11). Besides simply being a transportation of images in time and space, circulation significantly defines the boundaries of media. According to Balsom, experimental film or video art are distinguished less by media-specific materialities and aesthetics, and more by the economic and infrastructural logics of circulation (2017, 15), which is organized historically around different formats, such as 8 mm, 16 mm, VHS, DVD, mp4 or FLVs. Formats are closely connected to circulation and distribution because they imply different forms of compression and compactness. Smaller files are easy to transmit over networks, while smaller objects are easier to transport on the road. Although the term compression is usually applied to digital files, Jonathan Sterne (2015) indicates a much longer history, which can also include the size and material form of media containers such as films reels or DVD boxes. Importantly, formats have an infrastructural dimension: they are embedded in technical systems, whose parts have to be compatible and interoperable. For film historian Haidee Wasson (2007; 2013; 2015), formats are a crucial notion to study mobile cinematic infrastructures and the relocation of film and cinema to nontheatrical sites such as museum, home, and military or educational contexts (on relocation, see also Casetti 2015). Small film gauges call for smaller, lighter and portable cameras and projections screens. They facilitate nontheatrical circulation and invite reflection on the history of relocation before it became identified with watching films on mobile screening devices such as smartphones, laptops, and tablets (Wasson 2007, 77–79). On the move, relocated images traverse different devices, screens, interfaces, and corresponding technological networks, being subjected to

different screen sizes, proportions, and compression techniques. Hence, the content needs to be adapted to new sites of display, producing distortions or particular aesthetics of scale and formatting (Wasson 2007). In Lucas Hilderbrand's (2009) account of bootleg histories of videotape, VHS-format is addressed as a "middle-aged" medium, often neglected within the transition from analog to digital, and thus contextualized as an important precursor of digital circulatory practices. In several case studies, he shows how VHS enables cultures of access, structures legal and illegal practices of circulation and filmic relocation, and shapes affective attachments and communities of exchange. Being a low-res, small format, VHS is easily mobilized in personal networks and sent by mail.

Although this brief recapitulation is by no means exhaustive, it is exemplary of the new methodological, analytical, and historical significance of circulation in visual media studies drawn upon by this edited collection. Expanding the scope beyond digital images, this volume is also concerned with the many ways that images are and were on the move before digitization: Images travel as engravings, postcards, banknotes, postage stamps, carpets, advertisements, flyers, or passport portraits. They are transported by mail, ship, or plane and disseminated in telecommunication networks, magazines, or newspapers. Images are carried in envelopes, intimate jewelry, boxes, albums, frames, or reels. Taking the contemporary mobilization of images in digital networks as a starting point, the goal of this volume, therefore, is to re-examine the historical, aesthetical, and theoretical relevance of image mobility more generally. It is especially interested in considering the materiality of circulation. Instead of limiting its questions to social practices revolving around viral and phatic communication today, or focusing primarily on the motivic image migration of iconography, the volume suggests taking a more integrative approach and interrogating the conditions that make the transmission and circulation of images possible or conversely, stand in its way. More specifically, it addresses the trajectories, spacing, deferrals, and intervals between production and exhibition which lend weight to the materiality of mobile images.

Trajectories: The Materiality of Circulation

Today's strong association of circulation with digital culture, as expressed by the notion of "spreadability" (Jenkins, Ford, and Green 2018, 4–9) and different views on virality, can be misleading because of its "fantasies of total and immediate circulation" (Brunet 2017, 13). On the one hand, the term is reduced to the activity of human beings, ignoring the networks and infrastructures that need to be established and sustained over time. Circulation has to be enabled. It is an aim rather than a reality or a starting point: technical artifacts and structures, and organizational and socio-economic relationships have to be implemented in order for

signals to move (Parks/Starosielski 2015). It includes different circulation systems such as infrastructures of transport, postal services, or communication networks, which may even rely on each other. On the other hand, virality suggest that images and other media texts propagate by themselves, in isolation from human and non-human agents as well as from technological, cultural, and semiotic relationships. This idea of a self-regulatory process underestimates the fact that images—in order to circulate—have to be set into motion first.

Similarly, the logistics researcher Chua notes that circulation is often reduced to an abstract and immaterial idea of the movement of things, people, and ideas (Chua 2020, 106). In these cases, it is just a metaphor for mobility, deprived of material embeddedness and any sensibility for conflicts, politics, and inequalities (Chua 2020, 106). Yet the "logistics of images" (Rothöhler 2018, 6–10) are dependent on material, infrastructural, technical, political, economic, and social resources and preconditions. In order to traverse space and time, images rely on a multiplicity of human and non-human actors and actor-networks (Callon 1986; Latour 1993; Law 1992). Human and non-human actors transport and safeguard images, ensure technical compatibility in transit, or introduce interference and noise. Thomas Bachler's photograph (Fig. 1.1), which serves as the cover image of this book, impressively demonstrates the logistics of images and their implications by engaging with the materiality of transport and the heterogeneity of actors involved.

The filigree black-and-white photo is named after its own journey: "From Düsseldorf to Kassel." The image is part of Thomas Bachler's photo series *Souvenirs* (original title *Reiseerinnerungen/Travel Memories*). In this series, the German photographer delegated his artistic agency to the postal service and transportation networks. After converting a suitcase into a camera obscura and equipping it with photosensitive paper, Bachler sent it as a postal package. In this way, the photo paper could record its own travel. The black-and-white, mostly abstract images are entitled "From Stuttgart to Kassel," "From Cologne to Kassel" or "From Hamburg to Kassel," etc. The *Souvernirs*-series alludes to the touristic snapshot photography that is meant to document a journey and authenticate an experience (Potts 2018, 94), but also to one of the central topoi of photographic theory: the mnemotechnical function of photography. In this case, however, the human recollecting subject is absent. On the contrary, Bachler's project is about relinquishing all control to the pinhole camera. As the photographer remarks, "not being responsible for the motifs in your own photography is very refreshing. It's a task the German Post Office actually took over for me. Once posted at the counter, the pinhole camera parcels of my own design literally exposed the entire delivery process, right through to their arrival at my apartment." (Bachler 2019, n.p.) Unusual recording techniques and devices characterize many of Thomas Bachler's photographic experiments and pertain to his conceptual artistic strategy. Each series employs a specific self-constructed apparatus. In the series *Bon Voyage*, for example, Bachler turned a small

truck into a camera obscura and placed 1.5 x 1 m photo material inside the vehicle, which recorded a 100 km-long drive along the freeway. While the images from *Souvenirs* mostly show abstract patterns of traces, the recordings from *Bon Voyage* depict black vanishing points.

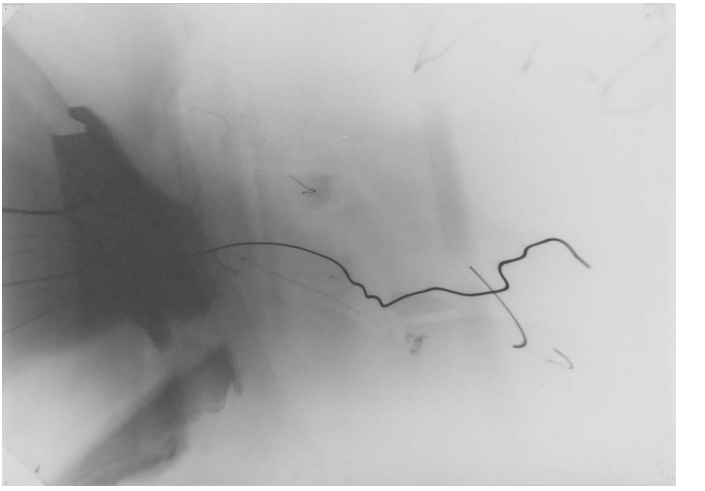

Figure 1.1: Thomas Bachler, *From Düsseldorf to Kassel*, from the series *Reiseerinnerungen (Souvenirs)*, 1985.

Bachler's photographs subvert the photographic dispositif, especially its industrially standardized form of the snapshot. Simultaneously, they reveal how images can register their very mobilization and use materially. During transportation, images are subject to the materiality of routes and infrastructures and submitted to the standards and protocols of transmission technologies. They are exposed to ecological milieus and territorial politics or introduced to economic considerations. As several authors observe in this volume, images accumulate material traces, marks, and inscriptions of their trajectories. As Jonathan Dentlers argues in his chapter, wire photography's low-resolution images indicate the technical processes and procedures during which the images are transformed into data and back. The dots and pixels, blurred edges, dropping out of middle tones or the manual retouching uncover the usually hidden and invisible infrastructures of transmission, complicating the traditional understanding of the objectivity and indexicality of photographic images. As explored in Ellen Handy's study, stamps, labeling, or greeting texts can attest to the circulatory routes of postcards. Lucas Hilderbrand conceives the material traces of wear and tear that videotapes endure in circulation as bootleg aesthetics. This bears witness not only to a spatio-temporal trajectory of

videotapes, but also to the affective attachment of repeated consumption and the processes of auratization that videotapes undergo. Whereas Griet Bonne shows how the circulatory reproducibility of Rubens' artworks involves continual changes of media and media specific (re-)materializations, Maria Schulze and Sarine Waltenspül trace how the complex histories of use and reuse of scientific films can imply reformatting, resignifications, and material transformations of footage. Importantly, these different case studies elucidate the way that the "logistics of images" are a complex process of negotiation between the stability of forms, "translation without corruption" (Latour 1990, 28; see also 1997, 179), and the undesirable transformation that leaves visible material traces of damage, wear, compression, or pixilation, producing "poor images" (Steyerl 2009) or encrusting images with historicity. In other words, the material traces of circulation speak of both aesthetic pleasures and technical failures, increased value and noise, a desire for transformation, and the necessities of stability or conservation.

Size and weight—or more broadly the formats—also affect the mobility of analog as well as digital images and materially condition their circulation. Large and heavy pictures slow down circulation and require more human and non-human agents for their mobilization than small and light ones. As art historian Jennifer L. Roberts notes with regard to paintings, transit and transport foreground the materiality, ponderousness and thingness of images in the first place: "Everything is heavier when it has to be picked up and moved . . . . The thingness of a picture is somehow not definitively established, in other words, until it has to be moved" (Roberts 2014, 8–9). Chéroux also emphasizes the relevance of material features for the mobility of images, while being surprised by the discovery that "not a single line in any history of photography addresses the weight of images" (2019, 10). Although digital images are often regarded as dematerialized, which is supposed to increase the speed and effortlessness of their circulation, we are not dealing with weightlessness, but rather with a transformation of measurement: instead of being scaled in kilograms or pounds, digital images are measured in file sizes that indicate a virtual kind of weight. Moreover, they are distributed materially and processually: As data packages, they traverse different technical and material infrastructures, channels, milieus, nodes, and surfaces, repeatedly "acquiring shifting materialities underway" (Fetveit 2013, 96). In doing so, their virtual weight renders the images adequate to the infrastructures and material realities of potential associated actors.

More often, however, it is the low-resolution of pixelated images that draws attention to "*the specific, layered materialities of digital technologies*" (Casetti and Somaini 2018, 88). Pixelated aesthetics and low-resolution are visible traces of compression, and importantly of circulation and the accompanying process of transformation. In her much-quoted paper "In the Defense of the Poor Image," Hito Steyerl declares the low-res, compressed, reedited, ripped, repeatedly copy-pasted and decontextualized images "the lumpen proletarian in the class society of appearances" (Steyerl

2009, 1). The "poor image" demonstrates the aesthetics of circulation and testifies to the digital visual culture that valorizes velocity, spread, and participation: "It transforms quality into accessibility, exhibition value into cult value, films into clips, contemplation into distraction" (Steyerl 2009, 1). "Poor images are poor because they are heavily compressed and travel quickly" (Steyerl 2009, 7). Images lose quality, even to the extent of abstraction, by being reformatted and compressed several times and thus becoming multiple-generation copies. Hence, the aesthetics of circulation is interrelated with certain image formats operating on lossy compression codecs, such as JPEG,[1] AVI, or the notorious mp4, but also with small formats such as VHS or Super 8, to name a few analog equivalents of easy mobilizability and lo-fi aesthetics.

As mentioned above, issues of compression and compression formats go well beyond digital media. More generally, compression speaks of infrastructures and their material conditions:

> For media scholars, this means that media are not like suitcases; and images, sounds, and moving pictures are not like clothes. They have no existence apart from their containers and from their movements—or the possibility of thereof. Compression makes infrastructures more valuable, capable of carrying or holding materials they otherwise would or could not, even as compression also transforms those materials to make them available to the infrastructure. (Sterne 2015, 36)

Given that storage and bandwidth resources are limited and expensive, an efficient dissemination of (audio-)visual material becomes important. Compression is based on the elimination of data that are considered redundant. It reduces the amount of information, while increasing its spreadability. According to Jonathan Sterne, the traffic of compressed material even highlights "the distributed character of culture in our age" (2012, 1). By diminishing data to be transported, compression negotiates the capacities of a 'channel': the utilization of transmission technology; the speed of transmission; the scarcity of bandwidths and frequencies; the material, energetic, and monetary costs of transport; the number of necessary actors, and the aesthetically and perceptually significant transformations paid for transportation (Latour 1997, 177). This requires the accommodation of signals to infrastructures as well as the modification of infrastructures in order to enable them to carry different kind of signals (Sterne 2015, 34). Compression standards and formats can also embody old infrastructural conditions even if they have already been changed, and direct the focus on the materiality of circulation: "on the stuff beneath, beyond, and behind the boxes our media come in, whether we are talking about portable mp3 players, film projectors, television sets, parcels, mobile phones, or computers" (Sterne 2012, 11). Although circulation and infrastructures are often regarded as complementary terms—one addressing movement and the other connoting stability (Sarkar 2020, 117)—, it is more productive to think of them in terms of plasticity

and co-determination (Sarkar 2020, 121–122), or in terms of "trajectories," to use a notion of actor-network theory that designates the circulatory activity of networking.

Networking: The A-Modernity of Circulation

Today, the notion of circulation has become ubiquitous in many discourses. It is applied to everything that is on the move and is able to span distances or change positions: viruses, containers, films, books, money, toxins, affects, short messages, electricity, water, or means of transport (Hagener, Opitz, and Tellmann 2020, 10). According to Straw (2017), the notion is used mostly in three contexts: economy, urban movement, and culture (although he ignores ecology). In economy, it addresses the relation between money and goods, raising the question whether goods have value in themselves or only acquire it in their market circulation (Straw 2017, 424). In present-day capitalism, circulation goes along with asymmetries in the process of globalization, which mobilizes money and goods while immobilizing people and limiting migration (Straw 2017, 425–426). In the context of urbanity, circulation deals with the governance of mobile people, goods, and ideas (Straw 2017, 424). It touches on issues of transportation systems as well as the biopolitical regulation of desirable and undesirable flows, as addressed by Foucault (2007, 34). In culture, circulation focuses on the dissemination of information, news, and artistic expressions and the ways cultural artifacts find their audiences (Straw 2017, 424).

However, the separation of the economic from the cultural, the aesthetic from the phatic, the media cultural from the urban notions of circulation, as Straw's account suggests, might emerge as reductive. Often, circulatory systems overlap. Postal networks, for example, rely on urban transportation as well as on maritime and air traffic, while the circulation of media objects can rely on postal networks in turn. Historically, a circulatory system may even co-evolve. As David Henkin has shown, in the USA, the postal service contributed to the proliferation of the then new medium photography, whose uses and potentials were still not clearly defined (2018, 48). Especially cheap postage rates facilitated interpersonal communication and communion by means of photographic portraits, which were a predominant application and a primary social use in the United States by the 1850s (Henkin 2018, 48–49, 52–53). At the same time, photography popularized mail for personal reasons. Therefore, Henkin stresses the close historical correspondence between photography and mail and the economic aspects affecting the conduction of (familial) relationships at a distance (Henkin 2018, 44). Comparably, Simone Natale notes that in the mid-nineteenth century, photography and the railroad were strategically aligned in the service of nation-building, governance, spatial conquest, and touristic travel, turning photography into a circulatory medium "with wings" (Na-

tale 2018, 38–39) and one of space annihilation usually connected to telegraphy, the railroad, or steam in the 19th century (Natale 2018, 44–45). Today, aesthetic and cultural artifacts are frequently consumed in buses, trains, or airplanes—either by using portable media such as magazines, newspapers, smartphones, IPods, or tablets carried by a person, or by watching stationary installed screens displaying news, navigational information, advertisements, or films in the means of travel, as Dominik Maeder elaborates in this volume. Here, media artifacts and people, information and matter are simultaneously on the move, and virtual and physical travel even seem to coincide.

Such examples of entanglement point towards the idea of the 'a-modernity of circulation'—to draw on Bruno Latour's famous criticism of modern processes of purification (Latour 1993, 10–12). If circulation is addressed in a-modern terms, we need to consider not only processes of separation and differentiation, but also processes of hybridization and translation between the technical and the social, the economic and the cultural, the human and the non-human, etc. (Latour 1993, 10–12). In the ANT, heterogenous networks of agency distributed between human and nonhuman actors are substituted for the isolated domains of economy, law, science, or culture, as they are conceived in the episteme of Western modernity (Latour 2013, 29–30; Law 1992, 381–383). Networks are first and foremost processes of relating, or more precisely: of associating. The notion "circulation" is crucial for the a-modern episteme of the ANT, insofar as the processes of network association are enabled by the circulation, mobilization, and trajectories of actors: "A network is not a thing, but the recorded movement of a thing. . . . It is no longer whether a net is a representation or a thing, a part of society or a part of discourse or a part of nature, but what moves and how this movement is recorded" (Latour 1996, 378). Following Michel Serres' theory of "quasi-objects" (Serres 1982, 224–234), actors, too, are conceived as unfixed "circulating objects" that undergo trials on their way and have to negotiate with others (Latour 1996, 374). In circulation, the actors transform and co-determine each other, acquiring stability, continuity, or power in the process (Latour 1996, 379). An actor thus circulates in a network *and* is simultaneously a network, i.e. "a network-*tracing* activity" or "a trajectory that is called a network" (Latour 1996, 378).

From this perspective, images do not simply circulate in given techno-social or techno-ecological actor-networks and adapt to them; instead, they actively contribute to the making and remaking of networks and logistical relationships by functioning both as "quasi-objects" (Serres 1982, 224–234) and as hybrid, distributed networks. Or to put it differently, images circulate as actors in agentially distributed networks and function themselves as hybrid networks. Importantly, as ANT often emphasizes in order to prevent misunderstandings, a network is a process full of negotiations and installments of relational ties that cannot be reduced to a ready-made infrastructure or an established technical arrangement

such as postal, telecommunication, or rail networks (Callon 1986, 28–33; Latour 2013, 31–32). In terms of ANT, a networked image is not automatically an image circulating online. More precisely, internet images and other kinds of images can be described as distributed image actor-networks. After being recruited, technical infrastructures and computer networks can become part of distributed image networks. The actor-network of an image is therefore both smaller and bigger than technical infrastructures.[2]

However, when tracing network building and trajectories of circulation, it is also important to think of limitations and restrictions. Circulation often connotes continuous flows and contiguity, thereby neglecting interruptions, blockages, disruptions, and breakdowns (Hagener, Opitz, and Tellmann 2020, 15). Image actor-networks of circulation may entail resistances to easy mobilization and even imply total interruptions of image flows. "For every image object or archive that circulates, . . . there are others that do not" (Phelan 2017, par. 8). The opportunities to circulate or to participate in circulatory networks are not equal and can cause exclusion and discrimination, both of human and non-human actors. Circulation networks follow particular rules. For example, as the histories of the early American Post Office indicate, people of color were not allowed to carry mail because the access to information and the opportunities to form a black informational community were regarded as dangerous for the existing power structures (Pottroff 2018, 624–627). Circulation was structured and disrupted by racial inequality (625). The postal network worked as a "classification system" that delivered only certain texts to certain groups of people by certain groups of people (626). Such classificatory and exclusive systems, of course, can stimulate informal or illegal circulation. Furthermore, as Lucas Hilderbrand shows in his study on Ted Haynes' film *The Carpenters* in this volume, circulation can be impeded legally due to copyright and economic interests. Furthermore, copies can be (temporarily) withdrawn from circulation by entering an archive or private collection, which is accompanied by special valuation and reevaluation of artifacts. As Sarine Waltenspül and Mario Schulz elaborate in their paper on the historical trajectory of Ludwig Prandl's flow film *Entstehung von Wirbeln bei Wasserströmungen* (*Production of Vortices by Bodies Travelling in Water*), changes in political regimes and power structures also affect the visibility and invisibility of images and audiovisual material, implying censorship, resignification, or even a material restructuring of content. Finally, art institutions and their economic models can limit circulation and rarify an object for selling and uniqueness purposes. Media of reproducibility such as photography and film can be authenticated and rarified by subjecting them to the logics of the limited edition and producing conflicts with their reproducibility. In recent times, avant-garde and experimental films, which historically struggled for visibility and a broader publicity in the realm of theatrical exhibition, suddenly face such limitations after entering into art spaces (Balsom 2017, 129, 136). Today, on social media platforms, content

moderation by human and algorithmic actors regulates the flow of images, limiting visibility for supposedly controversial content such as nudity, pornography, terror images, and other violence (Gillespie 2018; Müller-Helle 2020). Therefore, circulation needs to be complemented by the histories of "*uncirculation*" (Mancini 2017, 45).

Contributions

In this volume, the term circulation is used in a broad sense in order to encompass different kinds of movements that images undergo in space and time. It includes travel, transport, transmission, sending, dissemination, reproduction, streaming, and relocation. All these different forms of movements have in common that they involve material agents, infrastructures, and networks for their realization. Circulation is neither an abstract movement of ideas or objects nor an activity by human beings only. It is a collaborative process deeply rooted in the materiality of the world, its resistances and affordances. This understanding of circulation is indebted to actor-network theory because it allows us to take into account the technical, social, economic, aesthetic, and other dimensions. In each case, the authors specify their particular understanding of circulation and trajectories and clarify whether they are using the related notion of distribution synonymously or giving priority to one of the terms.

The first section entitled "Image Networks and Networked Images" addresses the historical and conceptual relationship between networked, connected images, which proliferate in the digital realm, and other image technologies strongly reliant on vast, even overlapping infrastructures and agential networks, as they are conceived by the ANT. Of particular interest is the oscillation and slippage between images being entities circulating in networks, images being operational actors co-constituting networks, and images being distributed as networks themselves. The section is opened by Ellen Handy's article on postcards, inviting us to consider the parallels between today's image circulation in digital and social networks and the boom in the production and circulation of postcards in the early 20th century. Many millions of these photo-based postcards were circulated all over the world, their production dependent on heavy machinery and their transportation tied to rail, road, and postal networks. However, instead of simply offering a prehistory of the "conversational image" (Gunthert 2014) and its phatic circulation, Ellen Handy focuses on the material, ideological, economic, infrastructural, and logistical preconditions that have enabled postcards to become a mass medium in the USA, taking one of the largest American postcard producers, Curt Teich Company of Chicago, as a case study. In terms of ANT, the article shifts the focus from images as punctualized, stabilized, and blackboxed objects circulating autonomously to the actor-

network of postcard production and circulation. In the second article, Jonathan Dentler discusses the under-studied role of wire photography in global news media and gives insights into the long history and genealogy of digital images. By focusing on the visual traces that the process of telegraphic transmissions inscribed into the visual material, Dentler offers an infrastructural and logistical view on photography, emphasizing how the medium was tied to circulation and communication long before the advent of connected social photography. While telegraphic images travelled as electrical information and not as physical objects, it is only after World War One that the infrastructural and organizational conditions were in place to mobilize them on a regular basis. Moreover, his examination of human and non-human interventions that images are subjected to in business and telecommunication networks reveals the media hybridity of wire photos and complicates our contemporary understanding of digital visual culture. According to Simon Rothöhler, digital images proliferating online as memes, GIFs, viral videos, or selfies should be conceived as fundamentally distributed. To address images on the move, Rothöhler prefers the complex notion of distribution, which draws on several understandings simultaneously: on the concept of distributed agency as offered by the ANT; on the distributed structure of the internet network (in contrast to centralized or decentralized, as differentiated by Paul Baran, for example); and on images as being materially, spatially, and temporality distributed within logistical networks. In his chapter, he focuses on the de-aestheticized forms of distributed images that are mobilized mainly as data and optical information, thus constituting an "invisible visual culture" addressed to non-human technical agents in particular. The section is completed by Dominik Maeder, who focuses on moving images relocated onto the airplane, where they travel together with people and other goods. However, he argues that in-flight entertainment images cannot be properly grasped as mere objects of transportation. In fact, they exhibit infrastructural power and even take on the quality of infrastructural images by being an indispensable part of the operational logic of aerial passenger transport. Images in airplanes significantly contribute to immobilizing human bodies and managing fears, ensuring the unimpaired operativity of flying and its infrastructures. In this way, Dominik Maeder convincingly shows that the study of mobility or mobilization, increasingly gaining importance in media studies, needs to consider accompanying processes of immobilization and blockages of movement.

The section "Formats and Mobility of Images" examines the formatting of circulation. It draws on media studies approaches that closely link formats to the circulation, distribution, and dissemination of images. Formats can contribute to both easy mobilization and to the immobilization of images. Ensuring compatibility and interoperativity within infrastructures, they also help to question how images on the move can touch down at specific places and material sites of presentation. In her article, Nicole Wiedemann discusses the logistics of analog pho-

tography by using *cartes de visite* as a case study. In Europe and the USA, the 19th century was an important period of analog images' mobility. In addition to the increased circulation of goods, the expansion of free markets, and the annihilation of space by new means of transportation, there was also an almost revolutionary proliferation of portrait photography at that time. This was enabled, among other things, by the standardizations of the photographic format implemented by Adolphe-Eugène Disdéri. His *carte de visite*-format triggered an increase in the circulation and dissemination of photographic portraits, and with it a veritable "cartomania." As Nicole Wiedemann shows, this mobilization in turn relied on diverse organizational networks. At the same time, the small size and light weight of the format fostered its easy insertion within these structures and helped to mold them. In the second chapter, Lucas Hilderbrand traces the screening and legal trajectories of the cult film *Superstar: The Karen Carpenter Story* (Todd Haynes, 1987). Although the film was withdrawn from official distribution after Haynes received cease-and-desist letters threatening copyright litigation over the film's unauthorized inclusion of the Carpenters' music, it continued to circulate via bootleg videotapes, semi-secret screenings, and eventually DVDs and downloadable MPEGs. *Superstar* was a film phenomenon of the home video age, as the video format aided the duplicating and circulating of the film for a wide viewing public. Because the film has circulated historically through direct, interpersonal copying and loaning, the cassettes themselves have become mementos of specific people or time periods in their owner's lives by materially registering the histories of repeated viewing and multiple-generation dubbing. *Superstar* bootlegs' material traces bear witness to the aesthetics and affects of circulation. In the final chapter of this section, Frank Bauer and Philipp Kurth focus on the formatting of networked streaming and pay attention to the often-neglected difference between container formats and codecs. In particular, the authors discuss the relationship between container formats and compression algorithms and their impact on the transmission of large amounts of video data in production and distribution. While compression undoubtedly negotiates the channel capacities and facilitates the mobilization of content, Frank Bauer and Philipp Kurth argue that the characteristics of container formats and codecs also define what makes a download a stream, challenging the traditional difference between storable files and transient transmission, i.e. between temporarily immobilized and mobilized distributed image data.

The final section "Trajectories and Traces" is dedicated to tracing the paths images take on the move or—to modify a catchphrase of ANT—to following their movements. Although the mobility of images is often associated with movement in space and bridging geographical distances, this section also considers how images circulate, spread, and travel across times. Crucial for this task of tracing are the material and symbolic transformations and accumulated traces of use. Travel-

ling through space and time, images become reformatted and noisy; they change their material support and cultural meaning; become accelerated or slowed down; degrade or increase their value. In the first chapter, Michelle Henning questions the simplified opposition between pre-digital and digital photographic images. Specifically, the characterization of the digital image as mobile, transitory, virtual, and immediate depends on a characterization of chemical photography as relatively static, fixed, and solidly material. Contrary to this, she emphasizes analog photography's mobility, recognizing its role in unleashing images from their fixed place by situating photography within broader theories of modern capitalist acceleration. She argues that digital and pre-digital photographs' mobility and temporality depend on their ability to be assembled and reassembled and to change material supports. While this speeding-up is framed mainly as a process of dematerialization, Michelle Henning focuses on the dirt and noise that images accrue on the move, thus revealing material infrastructures and channels that produce it. Griet Bonne traces the circulatory reproducibility, i.e. dissemination and multiplication, of Peter Paul Rubens' work across Europe and historical periods. Rubens was one of the first Flemish artists to be aware of the commercial and legal conditions of mechanical reproduction, who was also consciously engaged with the reproducibility of his oeuvre, via both multiple painted versions of a single composition and via prints. By comparing Rubens' 300th and 400th birthday celebrations, in 1877 and 1977 respectively, Griet Bonne examines the mobilization of Rubens' images by means of different technical media, ranging from engravings to photography, postcards, film, and television. She unravels the impact of these material transitions and changed mediations on Rubens' images, focusing on the close interrelation between dispersive and concentrating logics, i.e. between the spatial, temporal, and material spread on the one hand and the symbolical construction of an original oeuvre, which in turn stimulates tourism as a prototype of modern travel, on the other. Whereas Griet Bonne implicitly sketches an object-biographical approach, Mario Schulze and Sarine Waltenspül explicitly tie together the concepts "trajectories" and "object biographies" and critically discuss both in terms of their productivity for tracing the circulation of scientific films. Following the historical and geographical paths, reformatting, and (re)uses of the flow film *Entstehung von Wirbeln bei Wasserstömungen* (Ludwig Prandtl), the authors aim to understand the multiple, subtle ways of intertwining science, politics, and the public sphere, and to disclose the cultural, intermedial, and aesthetic transformations accompanying the film's trajectory. To do so, they analyze how films circulate through space and time—in their changing materiality (from 35 mm nitrate film to 16 mm safety film to different file formats) and visuality (from a rough cut to re-edited found footage to digitally color-graded and noise-reduced) as well as their shifting epistemic functions (between measurement, research, teaching, and popularization). In the final chapter of this section, Tomáš Dvořák traces a rather extreme form of image trajec-

tories: images sent to outer space. These include the Pioneer plaques from 1972 and 1973 (diagrams engraved into gold-anodized aluminium plaques that provide information about the origin of the spacecraft), the Golden Records carried by Voyagers 1 and 2 (both launched in 1977 and including, among other things, a collection of 115 images encoded into a video signal), and Trevor Paglen's art project *The Last Pictures* (2012). These images are designed to last for billions of years and to move not only in space but, more importantly, in time. Their materiality is therefore destined to resist transformations in transport, to avoid traces of travel. Tomáš Dvořák conceives these images as time capsules, whose trajectories call for a reconsideration of our anthropocentric media and image theories.

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Notes

1 Strictly speaking, JPEG is a compression codec, while the actual container format is named Jpeg Image File Format (JIFF). Often, JPEG is mistakenly regarded as a format and used as a synonym for JIFF. On the difference between container format and codec, as well as on their significance, see Frank Bauer's and Philipp Kurth's chapter in this volume.

2 In the ANT, "small" and "big," "micro" and "macro" are relative categories (see Callon and Latour 1981).