Video Conferencing: Infrastructures, Practices, Aesthetics

An Introduction

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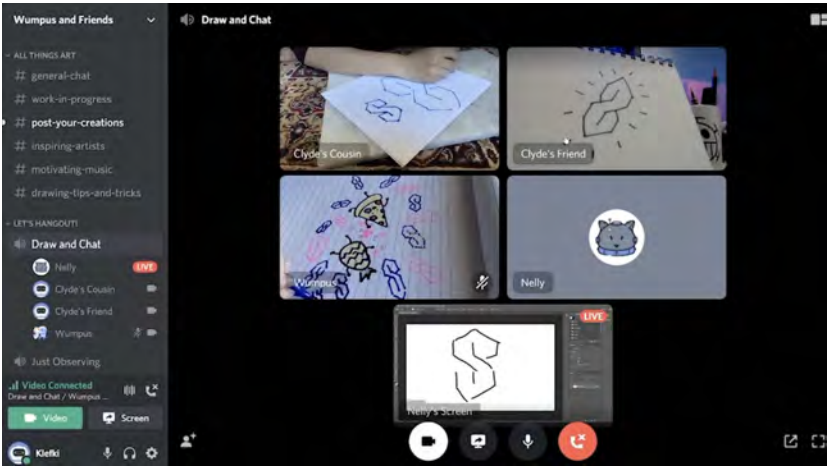
In preparation for a private meeting in late 2022, one of us was invited to install the Discord app, which they had no previous knowledge of. Being used to Zoom as a default mode of video conferencing, they recall, they found interacting with less common applications felt disorienting. Discord certainly confused our colleague and provoked them to search for familiar operations, functions, and aesthetics. After two years of pandemic Zooming, video conferencing meant for them joining a session by clicking on a link or typing a meeting ID; looking at the grid of symmetrical tiles; smoothly switching camera and mic on and off; sharing screens; observing a list of participants on the right side of the screen; and occasionally chatting in a small window. Therefore, our coeditor's first approach to Discord was a comparative one as they quickly started to look for the typical "Zoom experience" on a new platform, but the differences were too apparent. Whereas Zoom's opening interface mainly affords the planning and coordinating of meetings ahead of time and thereby connotes formal modes of interaction (for instance, in professional contexts), Discord's main user interface resembles a blend of an instant messenger, such as Skype, and a social media platform, such as YouTube or Twitch, thus foregrounding more informal social interaction as well as the consumption of content. After starting Discord, the user finds herself in the middle of a chat interface. It is divided into an area dedicated to a phone list of *friends*, an indifferent and all-encompassing term for contacts typical for social media such as Facebook; an oblong bar for managing contacts; and an area for the actual chatting, which invites the user to join "popular communities"—channels dwelling on music, gaming, education, science and technology, or general entertainment—that seem to emulate the recommendation logics and patterns of interaction and valorization prevalent on many social media platforms.[1]

1 Popular content or content to explore is recommended, for example, on the home pages or opening interfaces of YouTube, Twitch, or TikTok ("For You"). Streaming platforms, such as Netflix, also rely on popularity as a means to personalize content. On the tensions between personalization and popularity, see Unternährer (2021).

Figures 1–2: Discord inferface with fixed chat channels on the left and activated video chat feature (upper image); group video feature, added in response to the pandemic as a complement to voice channels (lower image)



Sources: Discord, https://www.engadget.com/2017-10-06-discord-video-chat-screen-share-rollout.html; Discord, https://discord.com/blog/wave-hello-to-server-video.

To start a video conversation, you do not join a preplanned "room," "meeting," or "session" but rather call a "friend"—spontaneously or after chatting with your contact.[2] After the connection is established, you can switch your camera on and start experimenting with screen sharing, chatting, or transferring documents via chat. Interestingly, the chat still occupies half of the screen; however, the caller can change the size of the video tiles, arranging them hierarchically (according to size) or symmetrically (according to size and spatial arrangement) or switching between full mode, pop-up, or image-in-image view. Unlike in Zoom, it is thus the chat area that is fixed, while the video stream comes on top of it and can be adopted individually, including actively blinding out the chat. The most confusing and defamiliarizing effect, however, certainly comes into play when trying to share the screen: instead of replacing the video tiles with the shared screen, Discord multiplies the video tiles, even resulting in a recursive and disorienting mise en abyme of tile-in-a-tile-in-a-tile, completely subverting the spatial clarity of Zoom.[3] This effect can be worsened when both callers start to share their screens simultaneously: each sharing adds a small video tile and then becomes repeated in the "shared tile."

An obvious cause of this defamiliarizing irritation is related to the equally global and incisive mainstreaming of video conferencing at the onset of the Covid-19 pandemic in early 2020. For sure, a majority of computer and smartphone users had been familiar with video chat applications—such as Skype, FaceTime, and Google Hangouts—for years. It was, however, the global pandemic and, more particularly, the various measures to fight the spread of the disease that significantly contributed to the dissemination of a set of video-based synchronous media practices that were hitherto far less common among the general population and that we subsume and address, in the following, under the term *video conferencing*. But what, then, constitutes video conferencing? In other words, what sets video *conferencing* software—such as Zoom, WebEx, Teams, Jitsi, and BigBlueButton—apart from video *chat* applications like Discord or Skype? While both types of applications share synchronous video link capability as a common mediatechnological denominator, they seem to diverge most strongly on the level of practice and, ultimately, in functionality, for they each cater to different use cases and are furthermore embedded in different practical contexts. Discord, for instance, emerged in 2015 as a messaging system for the global online gaming community and thus addresses

2 Discord also affords several other activities reminiscent of social media, such as exchanging emojis, GIFS, and stickers with friends or buying virtual "Nitros" (gifts, emojis, stickers, animation, etc.) for a month or a year—a form of monetarization reminiscent of virtual gifts used in live streaming on Twitch or TikTok.

3 Recursive image feedback can be prevented in Zoom by sharing the content of a particular application or window rather than transmitting the "screen" signal as such. Sharing the entire screen, however, may indeed result in the abovementioned "tile-in-a-tile-in-a-tile" effect.

people who want to get and stay in touch with other players or community members both during and between online sessions. Discord thus generally considers itself a chat or communications application that offers a range of different communicative channels, including video. This self-conception is underlined by their motto "Your place to talk," which clearly puts conversations at the center of the application. Conferencing software, in turn, generally serves to support goal-oriented group activities and hence formats, such as meetings, events, classes, and other scheduled encounters. The fact that conference applications mobilize the video feature for different purposes than instant messenging results in equally diverging configurations of basic functionalities.

First, in video conferencing applications, the video capability is usually embedded in interface arrangements that expect group settings rather than one-on-one (or one-on-some) conversations, which is why they aim to represent both individual speakers and the audience of participants (or some of them) on the screen, most commonly by means of the tile view. For this reason, video conference calls tend to feel more *public* than the comparatively *private* conversations. Second, video conference calls are initiated differently: rather than being spontaneous dial-up chats with "friends," conference calls are usually scheduled ahead of time and announced via invitation links attributed to an individual session or call. Therefore, video conferencing apps usually offer pre-meeting functionality that allow users to coordinate the planning of meetings, particularly the scheduling of the meeting and the invitation of participants by way of meeting links. Another notable difference here is that video chats are usually initiated by calling a person (or account), while video conference calls are tied to a specific (unique or recurring) time slot. Third, the video link between conference participants is usually not primarily used to facilitate communication as such (although communication is, of course, always a major part of video conference calls) but rather serves as a point of departure for subsequent collective activities, such as group coordination, decision making, and learning. Such goal-oriented group practices often involve the use of collaborative tools, both within the app (particularly screensharing, shared whiteboards, breakout rooms, or polls) and beyond (e.g., Google Docs or similar web-based office tools). On a general level, video conferencing can therefore be distinguished from video chat in the sense that it represents not a *communicative* but rather a *cooperative* technology (see also Volmar et al. 2023). The considerations drawn together in this book generally deal with such purposeful gatherings and the contexts in which they unfold.

Although video conferencing has only recently become a generally accepted form of gathering, it is important to note that the pandemic does not at all mark the beginning of video conferencing. As we will outline below, mediated social encounters based on audiovisual communication technologies have in fact been a possibility for decades. For the longest time, however, the use of video conferencing was largely limited to special use cases and remained fairly invisible and insignificant

to the larger public. While Skyping was by all means an established alternative to making phone calls since the mid-2000s, multipoint video conferencing with an increasing number of participants became a widespread phenomenon of private and professional interaction only as a result of the unprecedented political situation that put about one-third of the global population under lockdown. The restrictions on physical encounters proved indeed to be decisive for the rapid normalization of video conferencing across different sectors. Although video conferencing software had been widely available already before the pandemic, remote technologies were largely rejected as a valid alternative to physical, on-site meetings. One of the main reasons for this seems to be related to the gravitational force of infrastructural configurations—that is, the particular ways that social practices were linked to physical resources and habituated forms of interaction. Prior to the pandemic, the experience of collective practices had been strongly shaped by the "infrastructural base" (Star and Ruhleder 1996) of face-to-face encounters. This particularly involved physical spaces especially designed to support group activities (such as offices, meeting rooms, classrooms, and gyms) on the one hand and a plephora of auxiliary practices attached to those activities (such as tendencies of superiors toward habitualized practices of social surveillance or informal practices of socializing, like chatting by the water cooler) on the other. Therefore, it is probably not an exaggeration to say that it took a pandemic to render remote forms of meeting and other collaborative group activities a part of everyday life and a new normal for millions of people within just a few weeks; social distancing measures disentangled people from the infrastructural base that had previously shaped the experience of group activities (see Volmar et al. 2023).

In the course of this perceptual and infrastructural shift in early 2020, the previously little-known video conferencing service Zoom gained so much in popularity that the name became anchored in common usage both as a generic term for video conferencing (the verb "to Zoom") and as part of new labels and neologisms for new video conferencing-related phenomena and experiences ("Zoom bombing" and "Zoom fatigue," for instance). The general perception that Zoom almost seemed to have emerged out of nowhere might have contributed to the public misimpression that video conferencing did not exist before 2020 (see Li et al. 2022). Zoom, however, had been in business since 2012 and even become a global leader in cloud-based video conferencing software by 2019. Zoom had long marketed their software toward early adopters in startups, small and midsize businesses, and enterprises who would use video conferencing to organize meetings with remote workforces or among employees based in different locations or to conduct online courses and webinars in continuing education or open universities. Zoom's growing success throughout the 2010s eventually prompted other providers, such as Cisco and Microsoft, to develop their own cloud-based video conferencing solutions.

Caused by such external necessities, then, the rise of video conferencing represents a rather strange mediatechnological shift in that it unfolded quite differently to prior cases of technological change. To a vast majority of people, video conferencing came not as a choice but as a mere necessity, directive, or workaround—in short, as a technological base they had to adapt to in an extremely short amount of time. The pandemic thus turned the everyday lives of billions into a kind of global experiment in the evolution of digital tools for remote interaction. The endless circulation of Zoom "fails," online resources about remote work, and video conferencing guides on social media, all of which accompanied the appropriation of video conferencing in the early days of the pandemic, evidences the fact that the mainstreaming of digital tools for remote interaction and our familiarization to them took place as a collective learning experience on a massive scale (see Volmar et al. 2023). As such, the boom in remote tools in general and video confencing in particular might be emblematic of a larger shift in the self-conceptualization of contemporary societies, especially in the so-called Global North, from societies guided by the promise of progress and projection to societies of mere reaction and adaptation in light of numerous crises—a process that quietly started at the beginning of the twenty-first century with the war on terror; formed more visibly under the imprint of the financial crisis, which gave rise to the infamous political doctrine of TINA ("There is no alternative"); and further intensified over the past few years due to the growing implications of climate change and the imminent effects of the global pandemic. In a similar vein, the discourse on video conferencing during the onset of the pandemic differed markedly in tone from, for instance, the one on the internet in the 1990s, which, for the most part, was rather playful, experimental, and optimistic. While Twitter conversations about Zoom and similar apps—which oscillated between amazement and bewilderment, curiosity and desperation, cries for help and offers of assistance—revealed manifold experiences with the novel medial situation of remote life, most of them nevertheless remained linked to highly practical contexts and quotidian routines that people tried to keep up by means of digital technologies.

People who switched to video conferencing were nevertheless not simply at the mercy of circumstances; after all, the collective learning experience that unfolded produced new knowledge bases with best practices, workarounds, and troubleshooting advice. Moreover, due to the pandemic situation, people creatively (mis)appropriated video conferencing for use practices previously never associated with it, such as remote yoga classes and dinners. Thus, while the pandemic was a crucial factor in the spread of video conferencing as an everyday medium, the emerging media-cultural situation also had an effect on video conferencing technology itself, which changed in the course of this process toward universalization as developers integrated new features based on user innovation. Discord, for instance, which also became an increasingly popular platform during the pandemic, used this

spike in user numbers to emancipate itself from the thematic context it originated from by, among other things, changing its motto from "Chat for Gamers" to "Chat for Communities and Friends." Likewise, Zoom shifted its focus from corporate communication practices and the promise of offering "One consistent enterprise experience" (before March 2020) to a more general user base and slogan, claiming that we are all "In this together" (in March 2020).

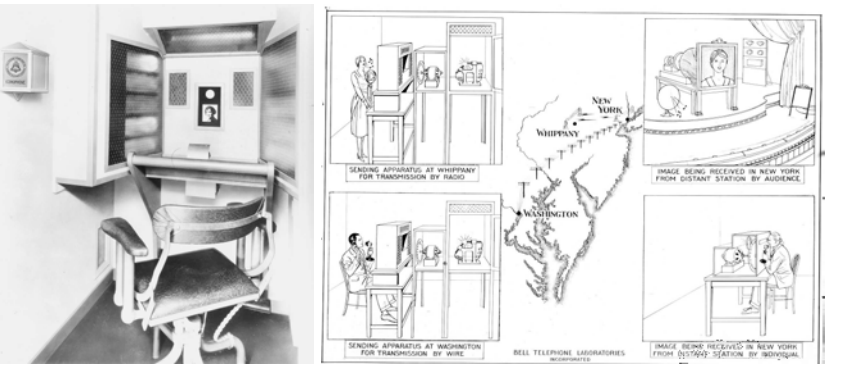
Taking stock of these developments, the authors in this book understand video conferencing as a media-cultural formation that has been largely shaped by the effects of the global pandemic. More particularly, what video conferencing constitutes today has been largely determined by a collective experience as well as processes of mutual adaptation: in the same way that video conferencing changed quotidian practices of meeting and collaborating, the mass appropriation and misappropriation of the technology—to fit numerous use cases it had not exactly been designed for—changed the functionality and appearance of the software and the providers' descriptions and understanding of their products. In this respect, video conferencing seems to be a particularly good example for the argument put forth by German media scholar Erhard Schüttpelz that all media are in fact "media of cooperation" (Schüttpelz 2017, 24) in that they are being used not merely to consume content but to organize everyday practices and support individual and collective goals. While the pandemic situation thus prompted what Volmar et al. (2023, 99–100) call "a general socio-technical process of *re-infrastructuring* disrupted ecologies of everyday practices" by way of video conferencing tools—a process that proved to be an exhausting experience for many—it nevertheless resulted in a number of fairly consolidated cultural forms and media practices that most people now deem to be video conferencing. This rapid normalization of expectations and usage habits was not least caused by the market dominance of a small number of individual providers, most prominently Zoom, Cisco WebEx, Microsoft Teams, and Google Hangouts. As users became particularly habituated to the functionality, workflows, and forms of interaction conceived for business communication and continuous learning, they quickly got acquainted to the aesthetics—shaped by, for instance, the presence of the notorious image tiles—as well. Put differently, the resulting habitualized media practices, which now form the nucleus of video conferencing culture, seem to have been shaped to no small degree by a particular confluence of video conferencing applications previously tailored to the business world and of everyday practices of joint action, a conjunction that produced its own formats, subversive practices, and cultural forms.

This contingent and rather surprising formation of video conferencing as a set of widely used media practices calls for scholary investigations that take stock of its specificities in greater detail and interrogate its particular media-historical moment. *Video Conferencing: Infrastructures, Practices, Aesthetics* thus takes the current situation as a starting point for assessing the complex mediality of this new form of

distributed social interaction. Linking theoretical reflection to material case studies, the contributors to this volume question video conferencing and the specific meanings it acquires in different social, cultural, and historical contexts. Together, the volume's contributions, most of which stem from media studies and neighboring disciplines, expand the scope of examination beyond the contexts and experiences of the global pandemic—for instance, by connecting them to prior forms and deeper histories of audiovisual communication and remote interaction. Before we discuss the structure of the volume, we would therefore like to provide some historical context regarding the media history of video conferencing and its history as an object of scholarly research to situate the positions presented in this volume within a longer media history of *visual (tele)communications* technologies.

A Brief History of Video Conferencing

Figure 3 a–b: Two-way television booth at AT&T 195 Broadway, 1930 (left); scematic of an early television demonstration over radio and telephone circuits, 1927 (right)



Sources: Courtesy of AT&T Archives and History Center.

As stated above, the Covid-19 pandemic by no means represented the beginning of video conferencing but rather marked the starting point for the formation of what could be termed a global video conferencing culture. The history of video conferencing—as a technology, a practice, and a discourse—is, however, much older than even the memory of Skype conversations from the mid-2000s might suggest. The technological foundation used for video conferencing—the creation and transmission of electronic audio and video signals as a means of telecommunication—is basically as old as television. During its experimental phase in the 1920s and 1930s, the direction in which the technology of television would develop as a public medium

remained largely undecided: contemporaries saw both potential for television as a programmed broadcast medium in the form of radio with added moving imagery or as a telecommunication medium modeled after the telephone but enhanced by a televisual channel (the term *tele-vision* not coincidentally reminiscent of the term *telephone*). Unsurprisingly, research on television at Bell Telephone Laboratories also involved experiments in what was termed "two-way television," which consisted of two interconnected camera (recording) and display (reproduction) systems located in different places.

Figure 4 a–b: Camera setup behind the booth (left) and booth of the German Fernsehsprechdienst in the late 1930s (right)

Sources: German Federal Archives.

Between 1936 and 1940, the German Reichspost even developed a national public visual telephone network called *Fernsehsprechdienst* (literally meaning "television-phone"). The service consisted of connection points (*Fernsehsprechstellen*) that were similar in technology and design to the two-way television booths devised at Bell Labs and that were located at central postoffices and public places in a number of larger cities all over Germany (among others, Berlin, Leipzig, Nuremberg, Frankfurt, Munich, and Hamburg) and connected via newly designed and laid broadband cables (see Goebel 1953). While serving as an attraction during the 1936 Olympic

Games and other large-scale events, such as fairs, to boast the German Reich's know-how in electrical and communications engineering, the regular service was rarely used and never proved commercially successful. The further expansion of the network was abandoned in 1940 after the system was considered not essential for the war, and it was never taken up again.

Figure 5 a–b: Images of the AT&T Picturephone Mod-II with accessory pieces, 1970 (left); and as a display device for computer output, 1970 (right)

Sources: Courtesy of AT&T Archives and History Center.

In the 1950s, however, communications engineers all over the world picked up the thread again and conceived videophones on the basis of the newly invented transistor technology, which made it possible to squeeze the recording and display systems into single devices. AT&T, for instance, aimed at establishing visual telephony under the trademark Picturephone service as the next big step in the history of telecommunications and invested about half a billion US dollars into research and development of visual communications. After presenting Picturephone to the public in 1964 at the world's fair in New York and in Disneyland as yet another booth-based service, AT&T launched a Picturephone subscriber service using desktop devices in 1970—first in the local network of Pittsburgh and later in Chicago (see Lipartito 2003; Mills 2012; Dietrich 2020). Among other things, the Picturephone "Mod-II" offered to hold video conference calls with more than two participants through automatic image switching by means of voice detection. It also featured

"graphics capability" for sharing documents and slides by means of an extractable mirror, which pointed the camera downward by 90 degrees to capture the tabletop. It even offered the possibility to use the device as a computer terminal and display system (see figure; note that the push-button telephone, introduced by AT&T in 1963, served as an input or terminal device to enter commands and alphanumerical information/data).

While the AT&T Picturephone probably represents the most iconic example of analog video telephones, similar services were conceived, tested, or marketed in many countries around the globe, including Great Britain, France, Germany, Sweden, Switzerland, the Soviet Union, Japan, and the Philippines. Technologically feasible yet not publicly available or accepted, audiovisual forms of telecommunication also became part of a broader vision of and discourse on the technological future and the cultural imaginary of the space age—for instance, through the representation of videophones in popular culture, such as in the animated series *The Jetsons*, and not least thanks to AT&T's marketing department, which prominently product-placed their Picturephone in Hollywood motion pictures, such as *2001: A Space Odyssey* (1968) and *Blade Runner* (1982). Despite the hype, however, none of the videophone services proved successful in terms of either revenue or substantial user figures. Judged solely by numbers, Picturephone turned out to be a huge economic failure and did not even come close to becoming the envisioned future of telecommunications (Noll 1992; Lipartito 2003; Schnaars and Wymbs 2004).

In the mid-1970s, due to a lack of interest from the general subscriber (mostly because of the exorbitant cost of the service), AT&T geared their efforts from televised phone conversations toward group-based meeting solutions in business contexts. After several years of testing, the Picturephone Meeting Service, with the rather unfortunate initialism PMS, was first launched in 1982 (*New York Times* 1982; Wright 1983; Menist and Wright 1984). It consisted of a network of specially equipped and interconnected conference rooms in 12 major US cities. Even earlier in the 1970s, the Japanese Electronic Corporation (NEC) and, shortly after, British Telecom (BT) had already introduced group-oriented video conferencing systems based on analog television technology (Wilcox 2000, 4). Several other telecommunications companies, particularly in Europe, would also start to build video conference rooms and experiment with transnational video calls in the 1980s. Due to the equipment costs and high bandwidth requirements, however, video conferencing rooms remained a niche application, the users of which were enterprise customers and, significantly, the telecommunications companies themselves.

From the 1970s onwards, large corporations, among them Procter & Gamble, IBM, and Boeing, also began to establish private video conferencing systems (Johansen and Bullen 1984, 164), thereby giving rise to a new industry dedicated to both analog and, increasingly, digital video conferencing technology. Compression Labs, Incorporated, for instance, introduced the first commercial digital group

video conferencing system in 1982. The CLI T1 was designed to enable video communications over leased-line T1 circuits at 1.544 Mbps. Despite the high costs (ca. $250,000 for the codec device alone plus about $1,000 per hour line costs), the prospects of digital video conferencing created incentives for new development in digital image and video compression. PictureTel Corporation, for instance, was founded on data compression research that combined transform coding of digital images with interframe motion compensation.[4] The technology would later become a substantial element of the MPEG video compression standards, which shows that video conferencing represented a major driver of research into digital video coding.

Figure 6: A promotional image for AT&T's Picturephone Meeting Service

Source: Courtesy of AT&T Archives and History Center.

PictureTel's digital codecs did not only result in a lower price range for video conferencing ($80,000 for the codec hardware and $100 per hour line costs) but also led to a generally better compatibility of video communications with dial-up data networks, such as the Integrated Services Digital Network (ISDN). By the end of the

4 Motion compensation means that rather than analyzing and coding each image frame separately, PictureTel's advanced video codecs, such as the C-2000 algorithm from 1986, considered only the alterations—that is, the motion—of successing frames relative to reference frames, a method that proved to be significantly more efficient than existing compression techniques.

1980s, more than 70 percent of the digital video conference systems in use throughout the world were PictureTel systems. In the 1990s and 2000s, companies such as Polycom, Hewlett-Packard, Tandberg, and Cisco would follow. The growing choice of competing systems moved the question of interoperability into focus, ultimately leading to a number of industry-wide standards developed by the ITU-T,[5] first and foremost the H.320 standard (1990), an umbrella recommendation for transmitting multimedia content (i.e., audio, video, and data) over ISDN networks, and the H.261 (1988) and H.263 (1996) video compression standards devised for video coding at low bit rates (see also Wilcox 2000, 119–147). These standards also laid the foundations for the subsequent family of MPEG standards, whose video compression codecs were most prominently used to store video content on DVDs. As the common standards allowed owners of systems from different vendors to dial one another, they were particularly important to increase the chances for a wider adoption of video conferencing (although this never really happened). With increasing computing power and broadband internet connections in the mid-2000s, video conferencing studio systems were gradually supplemented by mobile units—so-called rollabouts—that could be moved between regular meeting rooms, as well as by native video chat applications, such as Skype and later FaceTime, that were based entirely on general purpose technologies, which means that no further hardware was necessary.

To grasp the meaning of video conferencing not only with respect to its technological base (of digital image transmission) but also on the level of user practice, it is, however, necessary to consider a different genealogy of technologically mediated conferencing. It seems noteworthy that for the longest time, this parallel and at times overlapping historical strand of video conferencing did not involve the transmission of moving images at all. Rather, it was centered on the evolution of audio conference calls and the question of how to share documents and other visual content, such as slides and graphs, between conference participants. First attempts to share documents on different computers or display systems connected via local digital networks in real time date back well into the 1960s. Most notably, the intranet-based system PLATO (short for Programmed Logic for Automated Teaching Operations) developed primarily at the University of Illinois's Computer-Based Education Research Laboratory is regarded as an early experiment in distributed instruction and thus a predecessor of what are now known as *webinars*. With the dissemination of internet access and personal computers equipped with operating systems featuring a graphical user interface, the 1990s saw a boom in extended forms of document sharing, first within networked desktop applications, such as Lotus Notes

5 The ITU-T is the Telecommunication Standardization Sector within the International Telecommunication Union.

(first released in 1989), and second, through so-called net conferencing or "audiographic conferencing" applications (Wilcox 2000, 149–164), such as Microsoft's NetMeeting, Intel's ProShare, PictureTel's LiveShare Plus, and PlaceWare's Auditorium (which came out of Xerox PARC), all of which combined the possibility of hosting audio calls via the software rather than via telephone with application and document sharing capability and other collaborative and communicative tools, such as whiteboard, note pad, and chat functionality. Some of these applications, such as ProShare, later featured video capability too.

Figure 7: Astronaut Marsha Ivins holding a teleconference with student participants in the KIDSAT program using Intel ProShare, the computer screen shows an image of the participants on Earth as well as Ivins's camera image and data of the KIDSAT experiment (photo taken February 27, 1997)

Source: National Aeronautics and Space Administration. Lyndon B. Johnson Space Center.

With the growing popularity of the World Wide Web and graphical browsers in the late 1990s, companies like WebEx moved net conferencing functionality to browser-based conference tools, which were soon termed *web conferencing*. In the early 2000s, WebEx Meeting Center (WebEx), GoToMeeting (Citrix Systems), and Adobe Connect (Adobe) became widely used products for web-based conferencing and webinars. As mentioned above, video support was usually not part of web conferencing before the advent of broadband internet access, when video capabilities were successively added to the existing products. But while video-based conferences

and webinars became a technological possibility, the quality of the video transmission turned out to be notoriously unreliable. With its high requirements in terms of transmission bandwidth, connection stability, and signal latency, multipoint video conferencing with high numbers of participants was clearly at odds with the logics of packet-switched networks and the numerous contingencies in terms of hardware, software, and network configurations at the different endpoints. In the early 2010s, Eric Yuan, the founder of Zoom Video Communications, turned to the then-new capabilities of cloud computing to overcome the persistent technical difficulties and thereby gave web conferencing a substantial makeover—with considerable success. Although version 1.0 of the Zoom client, which was released in January 2013, allowed users to host video calls with up to only 25 participants, it was yet able to attract more than a million users within just a few months. As both software and user base grew in the consecutive years, competitors, such as Cisco WebEx, followed suit and developed their own cloud-based video conferencing solutions. By 2019, the year of its initial public offering, Zoom Communications—although largely unnoticed by the general public—had become a global leader of video conferencing software within the business and distance education sectors, which is one of the main reasons, next to its technological edge, that it ended up becoming the go-to application for remote meetings during the global Covid-19 pandemic.

Video Conferencing as a Research Object

In the five decades preceding the pandemic, the diverse manifestations of visual communications and mediated conferencing solutions prompted scientific investigations into video communication as well. It is interesting that, during those years, researchers looked into many of the questions that came up in light of the unfolding pandemic. In the early 1970s, in large part due to the oil crisis and an emerging environmentalist movement, telecommunications research aimed, for instance, to assess the potential impacts of a future adoption of video communication on business travel, commuting, and more generally energy consumption and environmental pollution, such as by contrasting the cost of video conferencing with the cost of travel (Nilles, Carlson, and Gray 1976; Gold 1979). Other studies attempted to estimate the potential range of application of video conferencing, primarily by comparing, differentiating, and rating mediated and nonmediated forms of communication. This line of research actually became the dominant vector of early video conferencing research, as, for instance, a review article from 1984 stated: "Most researchers concentrated their efforts on empirical investigations of the effect of channel type (audio, audio-video or face-to-face) upon meeting outcomes and user attitudes" (Albertson 1984, 394) to determine which types of conferences and tasks might be most effectively shifted to video in the future (see also Williams 1977, 964).

One argument commonly voiced was that the efficacy of a communications technology increased with the amount of "bandwidth"—that is, "communicative channels," such as text, audio, and video—offered to users (Ryan and Craig 1975, 2). Others emphasized the significance of nonverbal communication and concluded that the relative lack thereof in mediated forms of communication would render establishing relationships, treating sensitive topics, and even communication in general more difficult than in face-to-face situations (Kendon 1967; Sacks, Schegloff, and Jefferson 1974; Argyle, Lalljee, and Cook 1968). While not entirely false, these rather general views nevertheless displayed considerable shortcomings as they failed, for instance, to account for task-specific efficiency within a given technology. Moreover, they were unable to explain the high acceptance and efficiency scores of "low-bandwidth," phone-based conference calls. Social psychologists John Short, Ederyn Williams, and Bruce Christie from the University of London therefore sought to find a better explanation. In their 1976 study, *The Social Psychology of Telecommunications*, the researchers proposed the concept of "social presence" to examine and understand technologically mediated communication. According to their theory, the social presence of a given medium is determined first by the *objective* features of that medium—"[qualities] of the communications medium"—and second by *subjective* features resulting from users' perceptions and opinions or attributions regarding that medium—the "perceptual or attitudinal dimension of the user, a 'mental set' towards the medium" (Short, Williams, and Christie 1976, 65). The researchers explained that they thus conceived of social presence "not as an objective quality of the medium, though it must surely be dependent upon the medium's objective qualities, but as a subjective quality of the medium" (66).[6] A follow-up study by Rutter et al. (1981) regarded social presence to be determined by "cuelessness"—that is, the lack of social cues, within a certain conversational setting: "The smaller the aggregate number of available social cues from whatever source—visual communication, physical presence or, indeed, any other—the more task oriented and depersonalized the content, and the less spontaneous the style" (48). According to this understanding, then, "social presence is underpinned by cuelessness. The more cueless a medium, the less its social presence" (49). Another comparative approach, which ventured in a similar direction, proposed the concept of "information richness," or "media richness," as a way to rate different forms of communication and, more concretely, to identify potential fields of application for video conferencing: "Richness is defined as the potential information-carrying capacity of data" (Daft and Lengel 1984, 196). Subsequent research modified and updated the model of media richness (see, for instance, Dennis and Valacich 1999).

6 The subjective assessments of media technologies and hence the social presence of different means of interpersonal communication were usually determined by means of questionnaires based on the method of the "semantic differential."

Though offering new terminologies and the consideration of subjective attitudes toward technological settings, the findings of the comparative approaches largely reproduced the results of the earlier 1970s studies focused on communicative bandwidth, which favorably positioned video conferencing closely to face-to-face communication. This proved to be problematic given the fact that none of the developed theoretical concepts—whether social presence, cuelessness, or information richness—provided explanations for the then-notorious rejection of visual communications technologies by users. As an immediate effect of this lack of uptake, research on video conferencing generally declined in the 1980s. A growing number of studies, however, also started to directly address this general disinterest in "teleconferencing" (as it came to be called at the time) and thus took the paradox of teleconferencing as a starting point for conceptualizing mediated conferencing along new lines. Johansen and Bullen (1984), for instance, expressed doubts that video conferencing could in fact replace face-to-face-meetings. Birell and Young (1984) even called into question "the desire to replicate the face-to-face meeting. We should be considering more deeply whether the face-to-face model is really so very valid" (286). The puzzlement over the facts that "teleconferencing expectations in general have failed to realize themselves fully despite consistently brilliant market forecasts" (Egido 1990, 351) and that video conferencing continued to remain a "technology on the fringe" (Mayes and Foubister 1996a, 163; see also 1996b) were echoed in the literature well into the 1990s and 2000s.

As a response to this situation, new approaches came to the fore, which suggested discarding comparative methodologies of assessing different technologies in general in favor of more detailed microanalyses of actual teleconferencing situations. As one researcher put it, "In order to understand the impact of mediated communication on this intersubjective process more fully, research is needed which focuses on the interaction itself rather than on task effectiveness, user attitudes, or simple objective measures of communicative differences" (Hiemstra 1982, 883). Psychologists, for instance, approached this question by measuring the influence of individual parameters—such as image resolution, size, and refresh rate—on speech comprehension and the ability to decode emotional cues (see, for instance, Wallbott 1992; Blokland and Anderson 1998; Barber and Laws 1994). Sociologists, linguists, and computer scientists appropriated conversational analysis (see Sacks, Schegloff, and Jefferson 1974), an approach to studying pragmatic language rooted in Harold Garfinkel's concept of ethnomethdology, to examine conversations via teleconferencing technologies.

On a methological level, researchers made use of new technological possibilities of creating and storing video-based research data. Périn (1983), for instance, proposed using video recordings in conjunction with detailed transcriptions of teleconferencing meetings to study the basic rules and pragmatic strategies of video-based communication, including turn-taking sequences between speakers, the use

of the gaze, and other verbal and nonverbal cues. In a similar vein, Cohen (1984) pursued questions regarding how video conferencing results in altered perceptual conditions, which in turn influence the fundamental organization of interpersonal communication (e.g., with respect to turn-taking patterns, turn length, or disruptions of the temporal coordination of communicative activities). By focusing on the specifics of teleconferencing interactions, Cohen and others were able to pinpoint some of the major issues with video-mediated communication. Interestingly, a lot of these issues are still very much part of our video conferencing experience today, most notably transmission delay, which "disrupts the pace of normal conversations, makes the appropriate timing of interruptions more difficult, and impedes the smooth resolution of simultaneous speech events" (Cohen 1984, 292). These approaches were further advanced in the 1990s by, for instance, Abigail Sellen in her work on speech patterns in video-mediated conversations (see Gaver 1992; Sellen 1992; Heath and Luff 1993; O'Conaill, Whittaker, and Wilbur 1993). At the same time, researchers also refined their methodological toolkit, not least by conceiving elaborate transcription methods (see O'Conaill and Whittaker 1995; O'Malley et al. 1996; Ruhleder and Jordan 2001). Apart from this, video conferencing research also branched into studying various fields of application, such as business communication (see Köhler 1993; Schulte 1993; Kydd 1994), education (see Storck and Sproull 1995; Kawalek 1997; Schütze 2000), and medicine (see Guckelberger 1995; Armoni 2000). This line of video conferencing research based on ethnomethodology and conversational analysis is still very much alive today (see Due and Licoppe 2020).

With the gradual advancements of personal computing and digital video compression in the 1980s and early 1990s, video conferencing research too went digital. This technological shift was most notably accompanied by a change of perception, which now associated video conferencing more closely with the domain of computing than with the telecommunication sector but equally with an extension of disciplinary perspectives. For instance, scholars who had worked on computer-mediated communication (CMC), a field that included the study of such new communicative forms as newsgroups, bulletin boards, and email, increasingly became interested in video-based forms of communication and interaction. A lot of computer science research was carried out within the Association for Computing Machinery (ACM) in research fields like computer-human interaction (HCI) and computer-supported cooperative work (CSCW) (see Furuta and Neuwirth 1994). In this line of research, computer scientists not only studied existing video conferencing solutions but aimed to overcome some of the identified deficits of "talking heads" video conferencing (Nardi et al. 1993) by experimenting with new digital interfaces (see, for instance, the contributions in Finn, Sellen, and Wilbur 1997).

Drawing on their extensive experience with digital technologies, Paul Dourish et al. (1996) argued that while conversational analysis had deepened the understanding of how technological mediation influenced conversations and interactions between

individual speakers, it proved not to be very suitable for understanding (or getting into view) what people actually did within "media spaces" (see Stults 1986; Gaver 1992; Heath and Luff 1992; Bly, Harrison, and Irwin 1993)—that is, "flexible, networked, multimedia computer environments" designed to support cooperative work (Dourish et al. 1996, 33). In addition to studying face-to-face conversations in mediated environments, Dourish et al. suggested focusing on the "emerging communicative practices" (33) that coevolve over time when people and their specific work practices get in contact with networked media environments and studying these practices "in real, long-term use" (34). In other words, Dourish et al. stressed that rather than center the transfer or mediatization of "face-to-face behaviours," it seemed necessary to consider the specific circumstances, goals, and purposeful, group-centered activities that inform particular conversations and bring the people involved together in the first place (33). Rather than seeing mediated interaction as potentially inferior or less real than immediate face-to-face interaction, they insist that "the media space world *is* the real world; it is a place where real people, in real working relationships, engage in real interactions" (59)—and that taking the peculiarities of these media worlds more seriously is thus merited.

Dourish and his collaborators' insistence on considering the formation of media-specific behaviors and practices through habituation and as part of a "community of practice" (Lave and Wenger 1991) and on developing a praxeological perspective corresponds well with our own endeavor to study what we have termed *video conferencing culture* above. But it also reveals yet another gap in previous video conferencing research—namely, the fact that much work from the past five decades has focused on the here and now of video conferencing, with regard to either mechanisms of video-mediated conversations or cooperative work practices. Most studies treat users of video conferencing technologies as subjects without histories and contexts and do not consider the cultural aspects of video conferencing, such as discursive formations, sedimented practices, social norms, and political underpinnings.

Until the pandemic, and apart from a few notable exceptions (see, for instance, Otto 2013; Longhurst 2016), little work was done on cultural forms and meaning in conjunction with video telephony and video conferencing as media practices. This book represents a first step toward providing such contextualizations. To do so, zooming in on video conferencing demands us to zoom out to open the view on the background of video conferencing and its "infrastructural extensions" (Tasman 2015). Therefore, *Video Conferencing: Infrastructures, Practices, Aesthetics* asks, from a media studies perspective, what constitutes video conferencing as a media-cultural phenomenon and a constellation of particular technologies and online practices. How can we allow for the pluralization of uses and users of video conferencing due to the global Covid-19 pandemic? How can we contextualize video conferencing with respect to infrastructural conditions, use practices, and peculiar aesthetics, and what are the politics involved in video-mediated forms of remote interaction

and cooperation? To put it differently, how can we take into account what lies in the background of our common experiences and everyday practice with video conferencing applications?

The Mediality of Video Conferencing

Given the rich research history outlined above, it is surprising that video conferencing is not a very well-established research object within media studies. Certainly, one reason for this is that video conferencing remained a comparatively marginal medium until the global pandemic. Our collection thus aims to fill this gap by bringing together contributions that examine the phenomenon of video conferencing from the perspective of media studies. More particularly, the volume seeks to assess video conferencing through the lens of three interrelated foci—infrastructures, practices, and aesthetics—that we take as the main aspects for delineating video conferencing's mediality. Since the 1990s, the concept of mediality has been used in media studies to stimulate the debate on the specific qualities of manifold forms, processes, conditions, and consequences of mediation. Less focused on fixed entities that then defined a *medium*, the concept of mediality aims at broader and specifically processual questions of mediation as something that is occurring, not easily grasped, and undergoing change; it is rather concerned with the processes of "becoming-media" (Vogl 2007). To that effect, it can refer to specific media forms, phenomena, and practices as well as to media in general. The "'mediality' of media," as Ulrike Bergermann puts it, "refers doubly to respective concrete individual media (formats, contents), and also to 'the media' and what they might have in common" (2016, 435). In each case, mediality is used as a concept "to call attention to what media do, to the ways in which they function as agents" (Grusin 2010, 72), so that processuality and productivity come to the fore.

The question of mediality thus responds to an inescapable conditionality: what is mediated cannot be detached from the processes of mediation, just as in speech the voice as medium always already leaves its trace (see Krämer 2015, 27–37). Against this backdrop that "there can be no neutral instance of mediation, as the medium in question will itself always shape the procedures and results of the mediation process" (Distelmeyer 2022, 51), research on mediality traces constitutive characteristics. Mediality, Sybille Krämer (2021, 88) sums up, "is to be understood as a form of generating relationality." This does not, however, determine which form of relationality is taken into consideration. Jonathan Sterne, for instance, uses "the term *mediality* (and *mediatic* in adjectival form) to evoke a quality of or pertaining to media and the complex ways in which communication technologies refer to one another in form or content" (2012, 9). But even this in other words *intermedial* understanding and focus on communication aims at a complex processuality for which different

aspects and their interactions have to be taken into account—or, more concretely, "its [the medium's] articulation with particular practices, ways of doing things, institutions, and even in some cases belief systems" (10). Materiality and technologies belong to it just as much as practices and concepts as well as elementary, social, political, economic, and ecological conditions and effects.

Researching the mediality of video conferencing therefore poses a particular challenge: How can the complexity of conditions, processes, and effects be addressed and questioned? Given that the relations and interactions of human and more-than-human agencies at issue here depend on platform structures whose conditions and processes are anything but readily visible, such an undertaking poses some challenges. To examine the phenomenon of video conferencing from the perspective of media studies therefore means asking which conditions and infrastructures are at work, what kind of processes and practices appear in respect to certain technologies, and which aesthetics show up and yet allow only a part of what is effective in the process to become apparent. Therefore, we deem these questions—about infrastructures, practices, and aesthetics—essential to discussing not only the current phenomenon of video conferencing but also its history, its fundamental characteristics, and its further implications.

The concept of infrastructures specifies, especially in relation to materials and technologies, the question of conditions. Infrastructures enable and condition practices and aesthetics and are at the same time interrelated—as illustrated, for example, by the success story of Zoom in the early months of the pandemic, when increasing user numbers could be handled only by responding with infrastructural changes, as Amazon Web Services (AWS) added the performance of thousands of servers daily. Thus, especially for the phenomenon of video conferencing, the concept of infrastructure, as Lisa Parks and Nicole Starosielski have pointed out, must be understood as a dynamic category that provokes questions about "processes of distribution" and its "unique materialities" as well as "the relation between technological literacies and public involvement in infrastructure development, regulation, and use" (2015, 5). Infrastructures are not simply givens; they are in operation, are maintained and serviced, consume resources, require human and more-than-human agencies, include some and exclude others, and are usually in a state of constant flux. As Parks and Starosielski show, the interest in infrastructures challenges us "to recognize a more extensive field of actants and relations in media and communication studies" (10). In terms of video conferencing, this includes not only the software architectures of the respective services, their workers, and their servers as well as those of the third parties that provide additional support and computing power, like AWS and Oracle; it also includes the infrastructures of the internet and cloud computing—from the running protocols to the submarine cables that need to be maintained, from servers, cell towers, and air interfaces to the computers with

which we ultimately carry out our video conferencing practices in those disparate spaces hidden behind the unifying term *home office*.

Although infrastructures foreground material and technological conditions, they are also closely related to practices and uses. Practices take place and become stabilized in infrastructured situations through repetition and routine. Infrastructural materialities not only enable and restrict specific forms of practice but are also transformed within and by those practices. And—as the example of video conferencing in particular shows—the infrastructures themselves also imply and rely on practices of both human (e.g., maintenance) and more-than-human (e.g., processing) agencies. The focus on practices thus emphasizes the relations users have with technologies and media. According to Nick Couldry, to ask about media practices is to ask about "what people … are doing with media"—that is, how individual media users process and circulate meaning in everyday media practices (Couldry 2012, 6–9). Moreover, focusing on practices invites us to study "how diverse forms of *work* and *cooperation*—between different actors both human and non-human—are being constituted, stabilized, governed, and changed by and with media technologies" (Volmar 2017, 11) or, more generally, what people do with media and what media do for, to, and with people in a specific socio-historical context (see Dang-Anh et al. 2017, 7). Madeleine Akrich and Bruno Latour (1992, 259–262) have suggested the term *script* and its processual variations to describe this mutual conditionality of media and uses: technologies are conceived and implemented with an idea of specific uses and thus are designed with a script in mind. Scripts have a *prescriptive* dimension inasmuch as they delimit the potential range of actions, whereas users have to *subscribe* to these allowances and affordances or reject them—that is, develop a *de-inscriptive* stance toward designed uses (261). Moreover, scripts come along with *pre-inscriptions* (i.e., expectations on the abilities and competencies users must have to handle a specific technology) and *ascriptions* (i.e., ideas about the source of agencies, specific activity, and decision while using technologies) (261–262). Thus, the focus on different ways of dealing with scripts underlines the relationality of media and practices.

The attention to practices of different types and actors is also reflected in the gerund *video conferencing*, which gives this volume its title. The aim of this anthology is therefore not a definitional but an analytical one: it is a matter not of classifying "the video conference" as "a medium" but of exploring the mediality of that multifaceted and profoundly processual phenomenon of video conferencing. Thus, to focus on practices can mean to analyze the processes of conferencing and collaborating across spatial distances; processes of social and temporal synchronization, such as chatting and sharing screens; and practices of social and aesthetic (self-)regulation and (self-)expression, such as talking and muting. Practices of video conferencing not only have a spatial and temporal dimension but also imply forms of embodiment and ways of being located in front of a screen in domestic or profes-

sional spaces, ways of interacting with interfaces and hardware, and the diversity of embodiments supported or prevented by the respective media settings and infrastructural conditions.

Similarly, aesthetics is an important part of the relationship between media and uses. Understood as being rooted in *aisthesis*, the ancient Greek term for perception and sensation, aesthetics can even be considered as fundamental for interrelating infrastructural configurations and material conditions to the sensitivity and agency of human bodies, enabling access to media affordances and transformations of scripts. It is due to sensual perceptions that users can or cannot do something with media, whereas media also condition perceptional processes. The aesthetics of video conferencing can also be related to practices, dispositifs, and aesthetics established in older media: for example, the aesthetics of talking heads clearly connects the setting to the history and formats of television, such as talk shows and news. The experience of seeing oneself in a mirror-like way refers back to video technology, which enabled an instantaneous monitor image and a visual surveillant loop unprecedented in prior media, leading to diagnosis of the narcissistic structure of video technology (see Krauss 1976). When the video transmission is switched off, the aesthetics may resemble the telephonic setting, phenomenologically emphasizing sound. Although the term *video conferencing* emphasizes video, and thus visuality, it incorporates different media and aesthetic as well as practical regimes. Video conferencing applications combine image, speech, text, and—by way of manual interaction with interfaces—touch. The practices mentioned above (sharing screens, chatting, muting, etc.) usually rely on multiple perceptual and media modalities and registers at once. But to address the aesthetics of video conferencing implies a focus on not only appearing and making perceptible but also processes of concealment, invisibilities, and inaccessibility. This includes *anaesthetic* practices of muting and switching off the camera and the media-aesthetic conditions of the frame and offspace, as well as the basic characteristics of infrastructures and their different layers (see Schabacher 2013), which are not easily accessible for regular users.

In the attention to the interdependencies between aesthetics, practices, and infrastructures, the question of whether the visual connotations of the term *video conferencing* are misleading may even arise with regard to the mediality of video conferencing in general. The diffusion of digital (computing) devices in various forms, the proliferation of the internet, and the immensely influential sociotechnical (organizational) structure of platforms are undoubtedly among the most powerful factors that the focus on visuality cannot grasp. The video in video conferencing thus "conceals" the computer-technical as well as internet- and platform-based conditionality at play.

The Structure of the Book

The plurality of users and uses prompts us to approach the mediality of video conferencing not from the interaction between a user, a piece of software, and the resulting situation alone but by considering their extensions beyond the situation: infrastructural conditions, the embeddedness of video conferencing into the fabric of everyday practices, and how aesthetic phenomena enrich video conferencing and our understanding of it. Therefore, we address infrastructures, practices, and aesthetics as being interrelated, entangled, and even interdependent. They must be seen and discussed in relation to each other, which also has consequences for the structure of this volume. Four sections—"Teaching | Learning," "Infrastructuring | Interfacing," "Performing | Appearing," and "Working | Cooperating"—cluster texts whose perspectives on the interaction between infrastructures, practices, and aesthetics form their own focal points: perspectives on experiences and observations in the field of online education; on attention to processes of diverse levels of interfaces, ranging from user interfaces to application programming interfaces (APIs) and platform structures; on specific manifestations and strategies with which gazes are directed and corrected and artistic contexts expanded; and on different work contexts currently changing due to video conferencing and in which further historical traces of screen work can be found. The numerous cross-references throughout this volume indicate the strong interactions forged between the contributions, highlighting the mediality of video conferencing. Hence, the aim of this first anthology on the newly emerging phenomenon of video conferencing is to precisely stimulate that: debates and research that set out to explain what kind of phenomenon we are dealing with.

Teaching | Learning

It was probably in educational settings that the precarious infrastructural conditions of internet-based video conferencing and the unequal distribution of infrastructural resources in terms of, for instance, bandwidth, hardware, and domestic space became the most apparent. More than in other contexts, individual practices of "tile management"—out of personal preference or as a way to foster connection stability—caused frustration and public debate. For almost two years, the pandemic restructured our everyday lives and working routines as most parts of professional and private life moved online. Education was one of the fields massively affected by the lockdown and social distancing routines and in which a large part of the population—including teachers, children, parents, and university students, faculty and staff — had a stake. The switch to video conferencing as a technological base for instruction and learning enabled the continuation of educational work despite widespread shutdowns of schools and university campuses, although this work very often took place under less-than-ideal circumstances. The substitution of

shared physical space (gathering places) for virtual "rooms" consisting of rectangles and tiles transformed the aesthetic, epistemic, and social conditions of education and stimulated the reflection on different forms of mediation. The chapters in this section shed light on the different medialities, power structures, and processes of implementation, slow habituation, and resistance involved in video conferencing.

In "A Study Abroad during Covid-19," *Kalani Michell* explores the aesthetic and epistemic affordances of the video conferencing applications Zoom and Gather.town through the prism of "virtual voyages." By taking students to Jamaica and Malaysia virtually in class, the course paralleled the experience of mediated distance, estrangement, and experimentation that accompanied the first weeks and months of online teaching in this new media environment. In her essay "Teaching into the Void: Reflections on 'Blended Learning' and Other Digital Amenities," *Donatella Della Ratta* explores the exhausting effects of video conferencing and consequential resistance techniques in order to critically engage with techno-determinist narratives and efforts of normalization and naturalization of education during the crisis. Whereas Michell and Della Ratta address the aesthetic-political dynamics of habituation and experimentation, *Andreas Weich*, *Irina Kaldrack*, and *Philipp Deny* focus on processes of subjectivation implied in video conferencing. Analyzing the media constellations of on-site teaching and teaching via video conferencing allows the authors to identify what kind of presence is being produced in them. It turns out that presence, despite its different configurations, serves primarily as a concept that masks practices of control used to generate specific subject positions. *Geert Lovink* also deals with specific subject effects of video conferencing and its interfaces. By addressing the experience of Zoom fatigue, he unpacks the digital restructuring of life during the pandemic, which intensifies the already existing neoliberal pressures and the mentality of "always-on," producing chronically exhausted subjects and the symptomology of media "fatigue." In the last chapter of the section, *Maha Bali* shifts the focus from fatigue and frustration to "intentionally equitable hospitality"—practices that aim to create welcoming, equitable, and pleasant experiences by starting with reflection on design choices, adaptation during facilitation, and awareness of the power within and beyond a platform.

Infrastructuring | Interfacing

The shift to the online environment also meant installing new medial infrastructures for maintaining social and professional life as well as cultivating new forms of cooperation and collaboration—a process that was accompanied by diverse challenges and disruptions. The access to resources, technologies, and know-how was unequally distributed: unstable or absent internet connections, lack of cameras or microphones, and noisy backgrounds were common experiences. Thus, a meeting

usually started with phatic communication checking whether the "channel" was successfully established ("Do you hear me?" "Can you see me?" "I cannot hear you"). The infrastructures on which each of these meetings depends involve interface processes that go far beyond what becomes perceptible and available as user interfaces. Some of these even show up quite directly. For example, when a user opens BigBlueButton, a dialog box asks whether BigBlueButton is allowed to access the camera and microphone, indicating that video conferencing also relies on software-hardware interfaces that enable the video conferencing software to make use of a device's hardware. To experience, benefit from, and maybe struggle with user interfaces of, for instance, Discord, BigBlueButton, or Zoom, other forms of interfacing are always needed—like software-hardware interfaces (to allow the general purpose machine to behave as a specialized Discord or Zoom machine); software-software interfaces (to, as application programming interfaces, allow programs to interact and, as internet protocols, allow for internet traffic); or hardware-hardware interfaces (to allow the internet's submarine cables to actually make a connection). Among other things, the focus on infrastructures thus demonstrates how the interface concept, proposed by software studies in the early 2000s and continued by media studies, is fruitfully refined. Especially for the mediality of video conferencing, as the contributions in this section show, to widen the attention for interfaces toward an interface complex that encompasses different materialities and processualities, facilities and practices, resources and ideologies in equal measure becomes productive.

Jan Distelmeyer explores the traces left by the interactions between the different levels of this interface complex in the debates about and experiences of video conferencing. How these various interface processes manifest as effects, aesthetics, and practices (dealing with tiles, spaces, sounds, chats, and buttons), he argues, form new power relations and bring fundamental questions of digitality and platformization before the "user's" eyes and ears. By focusing on artistic experimentations with video conferencing interfaces, *Christian Ulrik Anderson* and *Søren Bro Pold* discuss the facial performance that becomes essential with the proliferation of video conferencing and reflect on the much larger politics of the face. They explore how the interfaces turn the face into a technical object. In his contribution, "Laws of Zoom," *Kim Albrecht* investigates the application programming interface of Zoom and the infrastructure of the hardware and software of internal and external code structures that are expressed by it. By developing an artistic method of "infrastructure imaging," he visualizes the organizing principles and structures of the Zoom API.

Performing | Appearing

This section examines how video conferencing technologies and its historical predecessors structure and produce new forms of *(in)visibilities*: of faces, bodies and private spaces, and therefore the realm of interpersonal relationships. The new vis-

ibility of the domestic, the dispositif of mirror-like self-observation, and the focus on tiled faces might be considered as three crucial aesthetic characteristics of video conferencing during the pandemic. The shifts to home office and distant learning resulted in the overlap of not only private and professional but also online and offline spaces—an aesthetics and socio-spatiality that touch upon basic questions of mediality. Being streamed in close-up, in medium shot, or without image, the tiled faces and talking heads are a basic mode of aesthetic audiovisual arrangement in video conferencing that enhances visibility and produces forms of aesthetic withdrawal. The visibility and invisibility of faces and bodies thus negotiate the social distances and proximities already implied by the entanglement of spaces. Being visible in a mirror-like structure also establishes a situation of being constantly watched by others and oneself, accompanied by modes of constant aesthetic self-evaluation and control.

The contributions in this section relate this kind of observation to the socio-aesthetic power of the gaze and its entanglement with the logics of late capitalism. The section opens with a chapter by *Laura Katharina Mücke*, which analyzes video conferencing interfaces as politicized spaces where visibility and invisibility condition social relations. By drawing on film-theoretical concepts, Mücke examines the fixed frontal view of video conferencing applications as a form of social mise-en-scène. In the next chapter, *Robert Rapoport* and *Vera Tollmann* critically interrogate the use of computer vision and generative adversarial networks for gaze correction in video conferencing applications. They argue that while gaze correction tries to collapse the difference between looking at the screen and looking into the camera, it simultaneously fails to encode and automate the social dynamics and cultural specificity of the eye contact, leading the aesthetics of optimization to prioritize user retention on platforms over the social accuracy of looking. *Martina Leeker* focuses on the use of video conferencing and virtual technology in performing arts and theater during the pandemic. By analyzing historical and contemporary artworks that engage with telepresence and the form of "distant socializing," she proposes to call this sociopolitical regime of the visible "the real virtual," thus undermining the longstanding opposition of reality and virtuality. In the final contribution to the section, *Till Baumgärtel* uses the form of the interview with the international artist Bill Bartlett, who in the late 1970s and 1980s experimented with telecommunication technologies such as satellites, slow-scan television, fax, and email in collaborative art projects. Using the technologies for making contact, collaboration, and tele-interaction, these art projects can be considered precursors of today's teleconferences and forms of communication that have since become commonplace in our use of Skype, Zoom, FaceTime, and other platforms.

Working | Cooperating

In the final section, the chapters address the usages of video conferencing in different work-related contexts. It deepens the questions and issues authors raised in the section on the educational context. The section focuses on the collaborative and cooperative dimension of practices, but it also touches upon socioeconomic consequences and sociopolitical issues of social participation and accesses enabled and prevented by video conferencing applications. Thus, the section emphasizes practices to delineate their entanglement with aesthetics, interfaces, and infrastructures. In this section, it is mainly the domestic room that constitutes the infrastructural settings of cooperative practices and conditions specific aesthetic affordances and exclusions. Access to cooperation, as several contributors show, is neither economically nor aesthetically equal.

In her chapter, *Alexandra Anikina* deals with the relation of public appearance and domestic space in video conferencing and the manifold tactics of revealing and concealing private backgrounds in mediated home office contexts. By tracing the aestheticization and professionalization of the *background*, she examines the interfaced architectures of the gaze and the economic structure of being seen, turning the act of looking and showing into a form of labor. *Winfried Gerling* traces and analyzes dispositifs of people working in front of screens as a genealogy of video conferencing in domestic environments. By revisiting historical photographs, his contribution explores how communicative relationships, working conditions, and visibilities are shaped in these screen arrangements. *Will Houstoun* and *Katharina Rein* examine the transformations that performance magic underwent by migrating to video conferencing platforms during the Covid-19 pandemic. Reflecting also on televised magic performances as precursors to those taking place online, the authors outline the mediality and the general characteristics of video conferencing. The collaborative contribution by *Tom Bieling*, *Beate Ochsner*, *Siegfried Saerberg*, *Robert Stock*, and *Frithjof Esch* problematizes how media participation of people with varying (dis)abilities is produced in professional settings by including the perspectives of (dis)abled people in their analysis. Writing with multiple voices, the authors discuss accessibility to video conferencing as a collaborative effort involving knowledge and access work.

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