

Zoom Obscura: Counterfunctional Design for Video-Conferencing

CHRIS ELSDEN, Institute for Design Informatics University of Edinburgh, UK

DAVID CHATTING, Department of Design Goldsmiths, University of London, UK

MIKE DUGGAN, Department of Digital Humanities King's College London, UK

ANDREW DWYER, Department of Geography Durham University, UK

PIP THORNTON, School of GeoSciences University of Edinburgh, UK

This paper reports on Zoom Obscura – an artist-based design research project, responding to the ubiquity of video-conferencing as a technical and cultural phenomenon throughout the Covid-19 pandemic. As enterprise software, such as Zoom, rapidly came to mediate even the most personal and intimate interactions, we supported and collaborated with seven independent artists to explore technical and creative interventions in video-conferencing. Our call for participation sought critical interventions that would help users counter, and regain agency in regard to the various ways in which personal data is captured, transmitted and processed in video-conferencing tools. In this design study, we analyse post-hoc how each of the seven projects employed aspects of counterfunctional design to achieve these aims. Each project reveals different avenues and strategies for counterfunctionality in video-conferencing software, as well as opportunities to design critically towards interactions and experiences that challenge existing norms and expectations around these platforms.

CCS Concepts: • **Human-centered computing** → **Interaction design process and methods**.

Additional Key Words and Phrases: Video Conferencing, Counterfunctional Design, Surveillance, Zoom, Covid-19, Design Research

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1 INTRODUCTION

Throughout 2020 and 2021, enterprise video-conferencing tools such as *Zoom* and *Microsoft Teams* became ubiquitous, and facilitated not only remote work and education, but were rapidly adopted for all manner of personal and social interactions, from pub quizzes and first dates, to religious gatherings and broadcasting funerals. The share price of Zoom Video Communications Inc. more than quadrupled in the 18 months from Jan 2020; the Zoom mobile app was reportedly downloaded more than 485 million times throughout 2020¹. Zoom suddenly had to manage not only remarkable user growth, but also found that a platform, designed primarily for use in the workplace, was being adopted universally. “*We did not design the product with the foresight that, in a matter of weeks, every person in the world would suddenly be working, studying, and socializing from home. We now have a much broader set of users who are utilizing our product in a myriad of*

¹<https://backlinko.com/zoom-users>

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unexpected ways, presenting us with challenges we did not anticipate when the platform was conceived.” – Eric. S. Yuan (Zoom CEO, 2020)²

Video-conferencing has entered a new era, rapidly becoming both essential and normalized, developing its own cultures, etiquettes and expectations. As a multi-disciplinary team of researchers based in the UK, working across design, geopolitics, digital humanities and cybersecurity, we wanted to develop an exploratory research project in response to the mass-adoption of these tools during the Covid-19 pandemic. Funded through a call for research projects related to agency, negotiability and legibility in relation to personal data, ‘Zoom Obscura’ set out to address two primary issues. Firstly, we were concerned with the remarkable volume of personal and biometric data – such as faces, voices, gestures, chat scripts, home backgrounds – which was suddenly accessible to video-conferencing platforms such as Zoom, and the opaque processes through which this data could be processed, analysed and ultimately monetised via the logics of contemporary surveillance capitalism [76, 83]. Secondly, we were interested in how the functionality, affordances, assumptions and design choices of such platforms, and Zoom specifically, could be countered or challenged to allow users to regain agency in how they were represented, and how their personal data could (or could not) be exploited by other users, or the platform itself. Building on the rich history of artistic interventions employed to counter and critique surveillance and agency in relation to cameras and video recording we set out to commission and study seven artistic and creative interventions in video-calling, with the following appeal:

”We seek artists, hackers and creative technologists who are interested in experimenting with creative methods to join us in a series of online workshops that will explore how to restore some control and agency in how we can be seen and heard in these newly ubiquitous online spaces. Through three half-day workshops held remotely, we will bring artists and technicians together to ideate, prototype, and exhibit various interventions into the rapidly normalising culture of video-calling in ways that do not compromise our privacy and limit the sharing of our data. We invite interventions that begin at any stage of the video-calling process – from analogue obfuscation, to software manipulation or camera trickery.” (Zoom Obscura – Call for Participation, October 2020)

This research paper reports on Zoom Obscura and the seven resulting artist works through the lens of counterfunctional design [63, 64]. Pierce and Paulos describes a counterfunctional thing as: *”a thing that exhibits features that counter some of its own ‘essential functionality’ while nonetheless retaining familiarity as ‘essentially that thing’”* (p. 375, [63]). For example, Pierce and Paulos experimented with cameras that produced extremely low-resolution pictures, made photographs inaccessible, or created other artificial limits on how photographs could be taken or viewed, thereby challenging and questioning functionality and qualities of digital cameras that are often taken for granted. As an approach, Pierce and Paulos relate their work to other critical and adversarial design approaches [24, 26], and view the imposition of limitations or ‘functional opposition’ as an opportunity to defamiliarize [8], critique, and generate alternative propositions for technology design. Pierce’s ‘Camera Obscura’ series [64] was already a key reference in the artists’ call for participation and, without directly employing Pierce’s approach, each of the artist interventions developed some form of counterfunctionality to challenge various aspects of the Zoom assemblage.

In this paper, we employ counterfunctional design post-hoc as a lens to reflect on each artist’s project and make three contributions to HCI and design research: **1)** We detail a series of exemplars of counterfunctional design for video-conferencing software; **2)** We describe how particular strategies for counterfunctionality can be used to resist surveillance and regain agency in the context of contemporary video-conferencing; **3)** We identify several directions for

²<https://blog.zoom.us/a-message-to-our-users/>

the design of more diverse, alternative and critically oriented video-conferencing tools in everyday life. We now turn to related work, before introducing the research context for Zoom Obscura, and our methodological approach to this particular study. We then introduce each of the artist projects in turn, and consider how aspects of counterfunctionality are developed in the work. Finally, we identify particular counterfunctional strategies to resist surveillance, and regain agency; and reflect on how these projects reveal important features and design considerations for living with ubiquitous video-conferencing.

2 RELATED WORK

In initial conversations with the artists, we shared a 'super-cut' video produced by design agency BERG [53], depicting examples of *videophones* in science fiction films as far back as the 1920s. From a design perspective the film clips illustrate a far broader imagination of what videophones could look like, in contrast to "*people talking to laptops – constrained by the world as seen from webcam and a laptop screen*" [42] – the primary experience of video-conferencing. There are now numerous well-established software companies offering 'video-conferencing' (including *Microsoft Teams*, *Skype* (also Microsoft), *Google Hangouts*, *emphBlueJeans*, *Jitsi*, however Zoom, launched in 2013, has leapfrogged rivals such as Skype [78] to become a dominant platform. BERG's film also highlights the extent to which Zoom's success, has built upon a century-long vision of personal and professional video-communication, and is dependent upon the mundane proliferation of high-quality cameras, screens, devices, and networks.

Video-mediated communication (VMC) and 'media space technologies' [38, 74] have of course been a fundamental area of HCI research – it would be considerably beyond the scope of this paper to attempt to chronologue all of this prior work. However, in this related work section we aim to situate our design study and the artists' work by: a) recalling some of the recurrent concerns of fundamental HCI research on video-mediated communication, contemporaneous studies of video-conferencing in HCI; b) discussing specific issues and challenges related to the experience of Zoom during the Covid-19 pandemic; and c) surfacing inspirational art and design projects that we shared with the artists.

2.1 Video-Mediated Communication, and Media Spaces in HCI Research

We first wish to briefly identify some directions in prior HCI research that resonated with the aims of Zoom Obscura. Dourish and Bly's seminal 1992 'Portholes' paper [25] described a novel system to share snapshots from a network of cameras distributed across Xerox PARC offices that offered subtle awareness of colleagues activities. The grid arrangement of these snapshots is starkly resonant of a Zoom call. The breadth of meaning and use derived from these snapshots illustrates how rich even low-resolution video-communication can be. This is quite distinct to the continuous drive and demand to optimize, manipulate and maximise the efficient transfer of high-resolution image and audio. Indeed, HCI is replete with studies and prototypes of systems that sought to produce more naturalistic representations, create a greater sense of 'presence' and 'being there' [1, 19, 39], or offering tools to creatively manage one's 'portrayal' [19]. By contrast, Rintel [66] articulately describes how the 'trouble' and distortions of video-calling which are normally viewed as problematic, can be appropriated and treated as opportunities by long-distance couples to perform relational work. Noll [61] argues that AT&T's picturephone [57] launched in the 1960s failed and was withdrawn from the market primarily because consumers at that time saw "*little incremental value compared to a telephone call – and perhaps even negative value for some users.*" In short, less (bandwidth, resolution, presence) can sometimes be more [46]. Our project was concerned with the value of obfuscation and countering core functionality of video communication to protect privacy and regain agency; we see here how communication, presence, and meaning can be managed and produced in media spaces of varying, and often highly limited, resolution, bandwidth and visibility.

Work in HCI on media spaces and VMC also attends to individuals' privacy, and their means to manage 'ways of being seen' [59] in more subtle and nuanced ways [12, 28]. Early accounts of media space technologies recount the fraught trade-offs between availability, and awareness, and concerns around pervasive video-sharing [9, 25, 31]. Describing deployments of another Portholes system in 1997, Lee et al. [50] describe the following user concerns "*Five user reactions to Portholes consistently arise when we demo or recruit user groups. They include: 1) camera shyness; 2) threat of surveillance; 3) loss of control over privacy; 4) lack of feedback and control of video images, and; 5) lack of support for awareness of audience.*" (Lee et al, pp. 388). These concerns are all entirely resonant with contemporary wariness of a Zoom call in 2021. Similarly, Boyle et al. [12] offer a comprehensive theoretical description of privacy factors related to VMC based on prior work, highlighting in particular how individuals' desires for autonomy (control over one's appearance, impression and identity), solitude (control over one's interpersonal interactions) and confidentiality (control over other's access to information about oneself) are played out as enduring privacy concerns in VMC (p.107).

In recent years, as video-conference technologies have become steadily more pervasive, stable and accessible much work has considered the implications and peculiarity of VMC in domestic settings (e.g. [3, 43, 44, 60]) intimate relationships (e.g. [48, 55, 56]), or in particular working environments and communities of practice (e.g. [4, 16, 49, 67]). The CHI 2021 proceedings included several papers concerning the nature of remote communication, and a panel the use of video-conferencing tools [68]. These papers variously explored: novel and challenging contexts for use of video-conferencing tools [45]; learning environments [10, 81]; experiences of particular user groups [71]; and new interaction techniques [35]. However, looking beyond any one particular use case, the fundamental motivation and context for our work has been to respond to the shift from video-conferencing as a particular situated event, to being the primary, and in some cases the only place to socially interact, connect and collaborate with others on a daily basis. Heshmat and Neustaedter's detailed study of video-conferencing between friends and family during the pandemic identified that while participants enthusiastically experimented with these technologies, many were ultimately abandoned or withdrawn from [40]. Furthermore, control and agency in how one participates and is portrayed remotely remains paramount. Hence, this contemporary context brings concerns about personal privacy, portrayal and autonomy to the fore.

2.2 Issues and Challenges of Contemporary Video-Conferencing

Several contemporary critiques of video-conferencing software have emerged in light of the pandemic. We will briefly unpack three of the most relevant concerns here: the fatigue and lack of agency within Zoom; how one is seen and presented through Zoom; and the potential for data collection and privacy violations.

'*Zoom Fatigue*' is a term that gained currency throughout 2020 to describe the exhaustion experienced when video-calling [69]. Geert Lovink unpacks both the experiential and political nature of this phenomenon [52] which derives from a combination of: too much screen time; requiring greater focus in the absence of other non-verbal cues; lacking natural breaks between meetings that occur as one moves from one space to another; overcoming any issues of lag or connectivity; and a hyper-awareness of one's own and others appearance [41, 65]. Lovink's article also highlights the weariness of engaging in personal and work life within the bounds of the same, limited interface. Choi and Diehm further identifies this compression of all manner of human experiences into a single space as '*aesthetic flattening*' [20]. Describing the difficulty of breaking the universal grids and frames imposed by Zoom, they rail against "*human expression compressed and flattened into a 2D grid on a flat screen and squeezed into frictionless design paradigms.*" These concerns reflect the consequences of spending excessive time in these environments, and the lack of agency many people feel they have in avoiding, limiting or reframing their use and expectations of these tools [6].

Beyond the experiential challenges of Zoom, a deeper critique concerns the ‘Zoom gaze’ – the way Zoom constructs particular views of their users, and shapes the way these users see themselves [17]. Caines is partially concerned with the way attendees in a meeting are confronted, incessantly, with their own self-image, encouraged to surveil, and correct one’s appearance for an optimal self-presentation. However, more deeply, they identify the illusion of control, and the extent to which meeting hosts and the platform itself hierarchically hold power over how meeting attendees appear. Hosts can for example spotlight attendees, unmute their microphones and even employ attention tracking metrics. The attendee themselves often has limited understanding how a meeting will be configured. Furthermore, the ability to trivially record an entire meeting, has rapidly broadened the possibility and expectations to document and retain all manner of otherwise personal conversations. While meeting participants are now notified when the host records a meeting via Zoom, there is no way to know that other users are not unilaterally recording their own screen and audio. This makes one’s very appearance in a Zoom meeting, a tacit acceptance of the possibility of unconsented recording.

This attention to ‘gaze’ [11] speaks to the risks and concerns of surveillance – by both the platform, and other attendees on a call. While the specific business model of Zoom is unclear, the platform has gained potential access to an astonishing amount of biometric and personal data, usually associated with specific identities, which can be processed and rendered available for economic exchange. This data includes faces, voices, background surroundings, chat logs and metadata about who users call and when. We ultimately do not yet know the full extent of how such vast data could be exploited and monetized. However, the logics of surveillance capitalism make clear the potential value of this ‘behavioural surplus’ [82] produced through our daily dependence on video-conferencing tools. End-to-end encryption is sometimes presumed as one antidote to such data extraction; however, Zoom has already conceded a class-action lawsuit that acknowledges that promises of ‘end-to-end’ encryption were false [34], and users’ data was sold on to Google, Facebook and LinkedIn [13]. Taking this into account, along with the scale and reach of Zoom as a platform, it is therefore critical that we consider interventions and design that allow users to recognize and regain their agency as they engage with these technologies.

2.3 Critical Art and Design for Video-Conferencing

There is a rich history of artistic interventions employed to counter and critique surveillance and agency in relation to cameras and video recording. Monahan [59] offers a compelling review of how such work helps people reflect on ways of being seen and support rethinking of individuals relations to wider systems of control and surveillance. In addition to examples of adversarial design [24], such as Mark Shepard’s *CCD Not-Me Umbrella*³, or forms of camouflage art [58] (e.g. Harvey’s *CV Dazzle*⁴) we were especially interested in tactical and pragmatic interventions that could be widely appropriated (for example, Brunton and Nissenbaum’s ‘user guide for privacy and protest’ [15], ‘tactical media’ [29] and ‘culture jamming’ [18]). Hito Steyerl’s work *How Not to be Seen*⁵ exemplifies this, presenting a critical and playful didactic film based around lessons to make oneself invisible [73]. A number of artist projects specific to video-conferencing also emerged during the pandemic. Sam Levigne produced the *Zoom Deleter*⁶ – a tool to immediately remove Zoom from your computer if it detected it; and *Zoom Escaper*⁷ – a series of disruptive audio samples to be played into a Zoom call, and provide an excuse to leave the call. Design agency Tellart introduced a series of ‘Panacea

³<https://vimeo.com/38001493>

⁴<https://cvdazzle.com/>

⁵<https://www.tate.org.uk/art/artworks/steyerl-how-not-to-be-seen-a-fucking-didactic-educational-mov-file-t14506>

⁶<https://antiboredom.github.io/zoom-deleter>

⁷<https://lav.io/projects/zoom-escaper/>

experiments⁸ prototyped interventions to produce unconventional means of collaborative communication through video-conferencing.

HCI researchers too have increasingly drawn from and participated in design as an approach to critical inquiry around surveillance, privacy and obfuscation. For example, Browne et al. developed the 'Camera Adversaria' – a tool to perturb the automatic surveillance of personal photography [14], which is presented as critical design, as well as being a fully-functioning application. 'Eyecam' [75] is an “ anthropomorphic webcam” which resembles and mimics a human eye to draw attention to the potential relations between humans and sensing devices. Gatehouse and Chatting [30] illustrate the particular challenges of undertaking research through design with networked devices, which as a material, can become 'inarticulate', resistant to the objectives of the designer. Nonetheless, this in itself, often reveals much about the nature and power of networks themselves. In the realm of voice assistants, Desjardins et al. [23] exemplify how performative experiments and transdisciplinary collaborations can reveal particular qualities and features of domestic technologies. Through funding, supporting, and studying the work of a diverse group of independent artists we sought to both produce usable creative interventions, probe the boundaries of Zoom as a networked technology, and engage in performative experiments that reveal certain qualities of the Zoom assemblage in relation to surveillance and agency.

3 RESEARCH CONTEXT: ZOOM OBSCURA

Zoom Obscura was born in the summer of 2020, in response to a research funding call for projects related to agency, legibility and negotiability in human interactions with data. We chose to focus in particular on the Zoom platform given its rapid, international dominance as the leading video-conferencing software, and the diversity of its use in both professional and personal contexts. We sought to work with artists to both produce impactful creative interventions, and also to cultivate a critical and diverse community to reflect on issues of surveillance and agency.

In September 2020, we widely circulated a Call for Participation and received 33 expressions of interest from artists across the UK, North America and Europe. These expressions of interest (500 words) included artists' CVs, described their motivations and gave an outline of an intervention they would attempt. Four of the authors scored proposals for novelty, significance, relevance and clarity. On this basis, we commissioned seven artists to take part, each paid £1000. We chose artists who we hoped could work together, as well as independently, and chose projects that intervened across different aspects of the Zoom assemblage, not only the camera. We aimed to include a mix of both accomplished technologists, and performance artists. Finally, we ensured a diverse group of artists of varying career stages, backgrounds and interests. Artists retained all of the rights to their work, however committed to a public exhibition of their project at the end of the project, as well as providing a series of written and visual resources that the project team could use to promote, analyse and reflect upon for research. The artists were very clearly briefed about the nature of the project as research driven, and academically funded and consented to their work being used and identified through this research. Pragmatically, Zoom Obscura took place over three collective workshops, all taking place as Zoom meetings, in November 2020, January 2021, and March 2021. The first workshop facilitated introductions, the second workshop invited artists to share progress and initial demos, the third workshop required a 'final' presentation of a working version of their project.

During the first workshop, our technical consultant (David Chatting) sought to unpack the 'Zoom assemblage' to reveal potential points of intervention the artists might pursue to obscure and counteract Zoom's functionality. They offered a 'Map of Zoom', resonant of other approaches to map networked technologies [21]. The map exhibits the

⁸<https://www.tellart.com/projects/panacea>

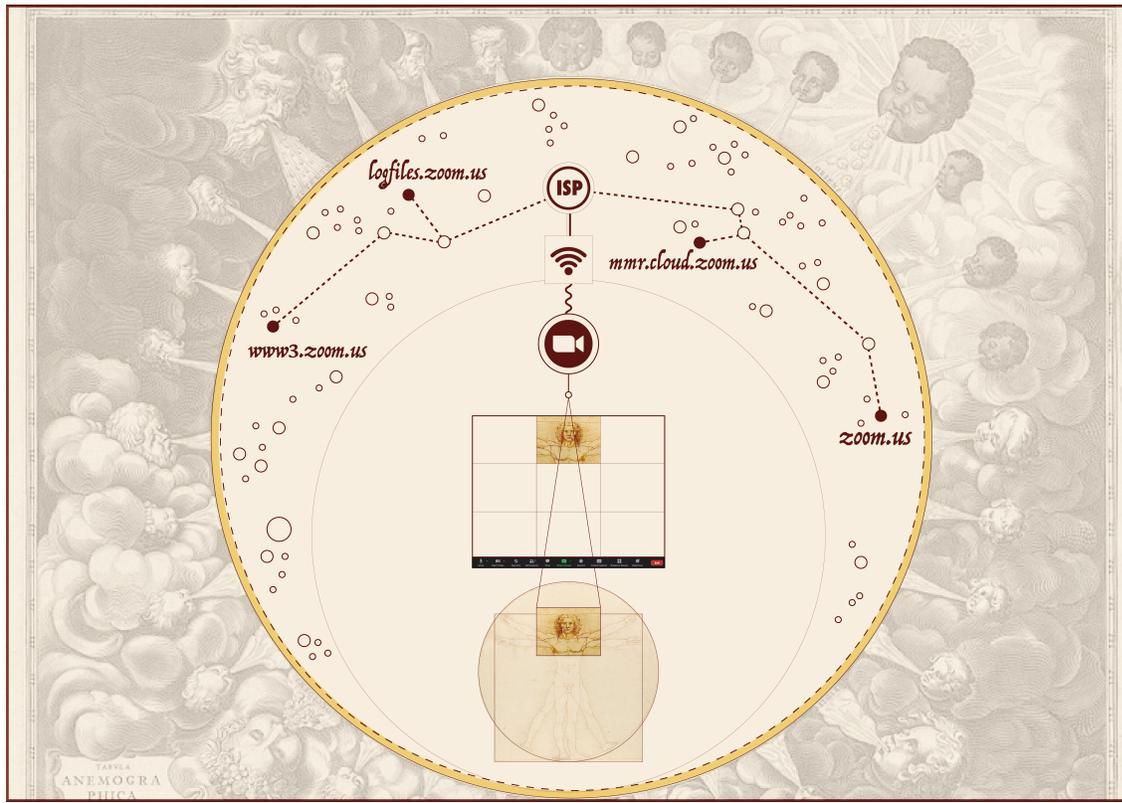


Fig. 1. A Map of Zoom, presented to artists to inspire interventions in various layers of the Zoom assemblage.

nature of a Zoom meeting in a series of layers, from the framing of da Vinci's Vitruvian Man, situated in a particular arrangement in front of a fixed camera and screen, through a domestic Wi-Fi network, via an Internet Service Provider, and beyond to a broader international network of servers (e.g. `logfiles.zoom.us`), through which it becomes unknowable how personal data flows. The final layer suggests the (largely unknown) external forces at the periphery of this network – the motivations and business models that enable and underwrite these platforms. Through these layers, the map critiques how the Zoom assemblage partitions and interprets a human body in particular ways, and then renders this visible, or not, to a wider network. In addition, technical resources presented to artists included how to use `p5.js`⁹ to quickly prototype computer vision, the use of 'virtual cameras' through *Open Broadcast Software*¹⁰, and network inspection tools such as *Little Snitch*¹¹.

Zoom Obscura formally concluded with a 'Launchpad' event in May 2021, to reveal and profile the artists' work publicly, alongside a series of commentaries. Each project produced a 5-minute video to introduce their work, as well as

⁹<https://p5js.org/>

¹⁰<https://obsproject.com/>

¹¹<https://www.obdev.at/products/littlesnitch/index.html>

images, relevant links and an artist statement for their work. We also produced a ‘How to’ brochure ¹² that anyone could use to employ the artist’s work in their own Zoom call.

4 ANALYSING ZOOM OBSCURA THROUGH COUNTERFUNCTIONAL DESIGN

This paper reflects on the Zoom Obscura as a whole, and specifically the seven creative interventions produced. The corpus of data that we draw upon for this analysis is diverse, and includes: original artist applications; recordings and notes from three artist workshops; discussions and links shared in social channels (*Slack*); final artist pieces and statements; 5-minute videos produced by artists for the launch event; exhibition content; follow-up interviews with three of the artists and a community partner who hosted a preview of the work; and two recorded ‘crit’ sessions between project team, taking place at the end of the project in July 2021. Facilitated as a structured conversation through a shared interactive whiteboard, these crit sessions were based around a close reading of each project (resonant with other approaches to design critique in HCI [5]). Specifically, four of the authors identified and discussed their view of the key themes of each project, the most novel and interesting aspects of the work, how the work could or should be used in other contexts beyond Zoom Obscura, as well as our views on how the project could have been improved or taken further. This critique helped us develop the core qualities of each intervention as well as the similarities and differences between them. From this initial broad ranging critique, we sought to identify the role of counterfunctional design [62] in these projects. Taken together, we treat these as a series of design studies of counterfunctionality in video-conferencing. While counterfunctionality was referenced in the initial call, and briefings to artists, it was not explicitly instructed or requested – we wanted artists to follow their own instincts. However, we are using counterfunctionality in this paper post-hoc as a lens to unpack what the various artist interventions are doing, and how they achieve their ends.

4.1 Analysing Counterfunctionality

We understand counterfunctionality directly through the formulation offered by Pierce and Paulos [63, 64]. Counterfunctional design is deeply rooted in other traditions of experimental and avant-garde design, based on “general strategies of opposing familiar functional features of technology”. It therefore shares many of the attributes of approaches such as ludic [32], slow [36], adversarial [24] and critical [25] design, where familiar technologies and practices are ‘defamiliarized’, [8] and seen in a new light. Crucially, the approach aims to explore how opposing “essential functionality” can reveal new potential experiences of a technology, without necessarily committing to a particular a priori critique or approach. In this respect, the authors also propose “*counterfunctionality as a way of both interpreting existing artifacts and approaching the design of new things*” (p.377, [63]) – in this paper we use counterfunctionality as a way to interpret the artists’ projects, and to suggest new directions for the design of video-conferencing. Furthermore, counterfunctional design is not simply critical and adversarial, but crucially seeks new functionality and design opportunities through countering existing affordances of a technology. Counterfunctionality hence embraces the value technological limitations; in contrast to the emphasis Zoom places on high-resolution, multi-participant, and long-form, video-calling, facilitating the unlimited possibility of working with anyone, from anywhere, at any time.

We sought to identify any counterfunctional aspects of the project, in particular, the ‘positive functions’ and normal expectations of Zoom that were being addressed, how exactly these were countered, and the consequences of that counterfunctionality. This directly follows the schema offered by Pierce and Paulos used to generate counterfunctional designs for digital cameras:

¹²https://zoomobscura.files.wordpress.com/2021/04/how_to_zoom_obscura-3.pdf

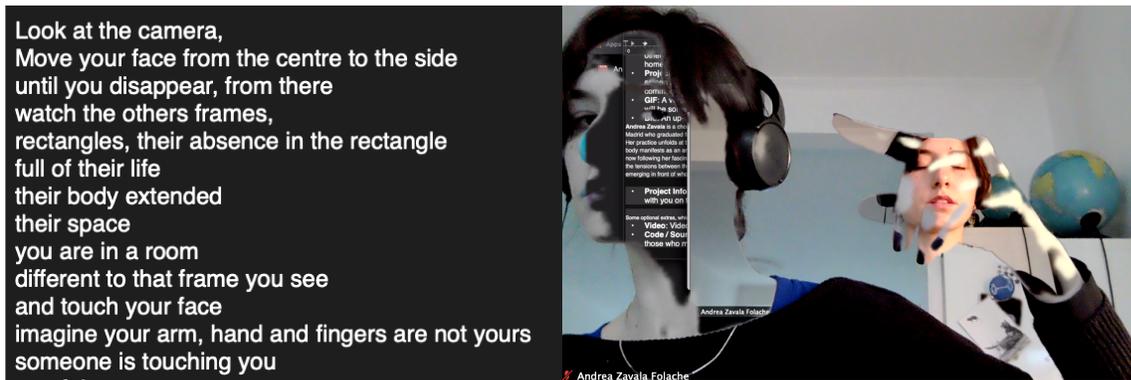


Fig. 2. Artist images for 'How to Touch through the Screen', including the first spoken lines of the score.

Normally one can... [a “positive function”].

Now one can not... [a “countered positive function”].

But now one might (not)... [a new (counter)function].

This analysis revealed key work that each project was doing to challenge and counter the Zoom assemblage. In particular it brought to the fore the assumed positive functionality, and norms, that are taken for granted about how video-conferencing works, and helps us to question why this is the case. Working in this way also supported some abstraction from individual projects goals and aims, and allowed us to consider the underlying design strategies that made them work.

5 COUNTERFUNCTIONALITY IN THE ZOOM OBSCURA PROJECTS

To report our findings, we discuss each project in turn. We briefly introduce the project, including key screenshots, extracts from the artists' statements, and explain its use and presentation in practice. We then address elements of counterfunctionality in each project. We have not conducted formal user studies with any of these artefacts, though they have been presented to multiple audiences, at multiple times, and articulated in multiple fashions. In addition, supplementary material for this paper includes short videos demonstrating each project, also available via the Zoom Obscura website¹³.

5.1 Andrea Zavala Folache: Erotics of Discontinuity / Touching through the Screen

“How to touch through the screen / Erotics of discontinuity is an invitation for the visitors to follow a simple choreographic score through an audio file. This score follows the curiosity of guiding in a poetic, philosophical and sensual manner, a series of instructions in order to open the possibility of giving and receiving touch on Zoom. By exercising calmness through breathing, visualisation and listening, it may become a playful yet serious performance on being present whilst not seen, on being connected whilst physically separated, on embodying touch and togetherness in the disembodied apparatus of Zoom meetings.” (Artist Statement, Andrea Zavala Folache).

¹³<https://zoomobscura.com>

5.1.1 Project Introduction. The final output for this project was an audio file, to be played during a Zoom call, with others during a Zoom meeting. The audio file offered a series of instructions, in the form of a choreographic score, such as: moving out of the screen while continuing to look at the emptied Zoom grid; touching one's face; and imagining that another person on the call was touching your face. In so doing this project brought acute attention to how we look at one another through the lens and within the particular arrangement of a Zoom call, as a kind of participatory performance and choreography [2]. The project hence explored the bodily experience of being 'on Zoom', the absence of touch in such spaces, and invited a certain voyeurism – to watch and be watched by others. The project considered how the presence of a live camera might extend the feeling and presence of one's body.

The first time Andrea shared her project with us and the other artists, she could not attend the workshop. In her absence, we were simply asked to collectively listen to an audio file she had sent. As we collaboratively followed her instructions, we both participated in and watched a kind of choreographed performance unfold, that was somehow meditative, touching, and even at times awkward and uncomfortable. This simple choreography upended conventional expectations of an office Zoom call, and tuned our attention to the true surroundings and context of the call: the various rooms we physically occupied, our bodily position in relation to the camera, evading the camera and removing ourselves from the call, and watching each other intently, as we were being watched by others. This intervention forced us to acknowledge and experience our bodies in a way that is mostly erased, or flattened by a conventional video call, with its focus on the face, speech and audio.

5.1.2 Counterfunctionality. There are two particular counterfunctional aspects at play in this work. Zoom calls typically assume physical presence in front of a front-affixed camera. While cameras are often switched off, and participation limited to audio, or chat messages, when the camera is on, normally a body is carefully positioned in front of it, in the foreground of the call. Many choose to employ a 'virtual background' or a blurring effect to further direct focus to the foreground. By contrast, *'How to Touch Through the Screen'* brings attention to one's own and others surroundings, by initially removing the body from the video, and producing a view of absence – of someone not there – whilst knowing others are also viewing this same absence. Countering the assumption of a torso or face in front of the camera provokes reflection on how these bodies are represented on a call, and how else video might be used to communicate with other participants in a call.

Counterfunctionality is also at play in regards to touch. An essential feature of Zoom is the remoteness of various parties, and hence, sharing any form of physical touch is, of course, impossible. This work sought to counter this by inviting audiences to first experience their own touch by bringing a hand to their face; then to imagine this hand belonged to someone else, and that they too were touching the face of someone else present on the call. The 'remoteness' of Zoom is not countered here in any technical sense, but through a dedicated, shared practice and choreography that aims to break through the screen, extending each other's bodies and sense of presence together.

5.2 B Wijshijer: Zoom Mod-Pack

"ZOOM_mod-Pack is a collection of webcam modifiers that video chat guests can run through a virtual camera, like OBS, to customize their video chat experience. The host-oriented, paying user-oriented structure of Zoom limits how the general individual accessing through a free account can engage in social conversation or activity... My collection of filters work to highlight the theatricality of the video chat platform while simultaneously offering different ways to regain agency within it. Each mod focuses on a different type of 'screen' we may use to communicate away from keyboard." (Artist Statement, B Wijshijer)

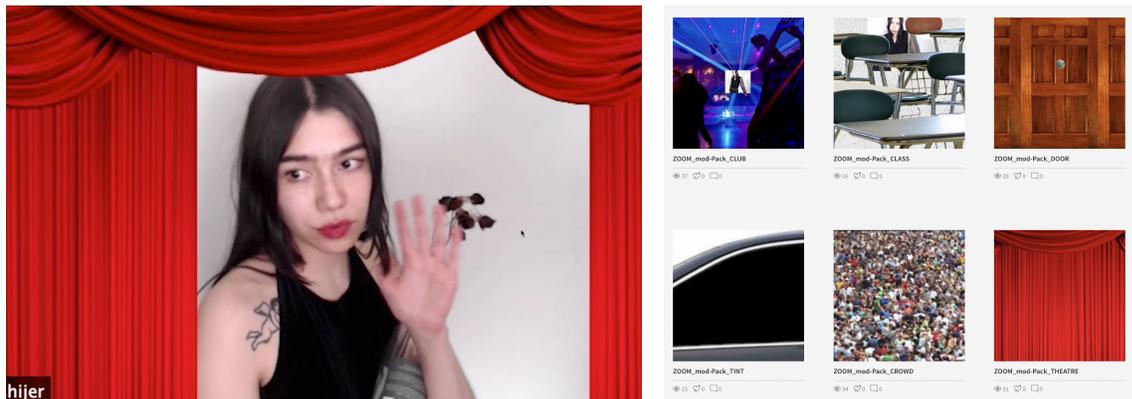


Fig. 3. Examples of various filters that could be used to reframe, resize or entirely obscure one's image within different everyday scenes

5.2.1 Project Introduction. This project was distinctly, playful, theatrical and described by the artist as 'sneaky'. They sought to empower audiences by offering more tools to manage their appearance and visibility in a Zoom call, and particularly contesting the power asymmetry between 'hosts' and 'attendees' in a Zoom call. Practically, the project provides a series of filters, a mixture of virtual foregrounds and backgrounds that can be manipulated to negotiate visibility, and regain control of one's own Zoom window. These are 'webcam modifiers', produced through sketches in p5.js, that can be routed into a Zoom call via a virtual camera, using streaming software such as OBS. These filters play on familiar everyday contexts where visibility and openness is already carefully managed: including doors with a peephole, windows with blinds, a car window that can be rolled up or down, a kiosk with shutters, stage curtains or a night club (Figure 3). They offer the user an alternative to the binary choice of switching a camera on and off, and provide more nuanced ways to signal one's availability, openness and position on the 'stage' of a Zoom call. The filters bring the necessarily performative nature of being on a Zoom call to the fore. In particular, by creating a foreground in front of the camera, and effects to zoom or scale one's image, the filters can create a sense of depth lacking from the flatness of a Zoom window [20]. While some filters suggest the user might hold the floor, and take centre stage, others allow them to hide, as one might in a crowd. The ability to manually adjust exactly how visible to make oneself, and even peek through a crack in the blinds provides control, but also asks the user to reflect on how they wish to be present in a call.

5.2.2 Counterfunctionality. This project counters the functionality of the live camera, and the way these images are arranged in a Zoom window. Normally, a visual presence during a Zoom call is managed by switching a camera on or off. Hosts may often exhort attendees to turn their camera's on in order to be more present with each other. While Zoom's own 'virtual backgrounds' might obscure a messy bedroom or kitchen, the person on the call is typically centred in their window. Through filters that introduce a foreground, or radically scale up or down one's image, the user may be 'on' camera, but they cannot be seen by others on the call, or are only partially visible. Crucially, this counterfunctionality allows the attendee to contest the control of the host, make an entrance or exit, or create a sense of depth that positions themselves towards the 'front' or 'back' stage [33] of a meeting or performance.

The filters also counter the functionality of the Zoom window that each participant on a call is granted. This window is typically filled by the users face, torso and background, but also serves to crop the video feed in a particular aspect,

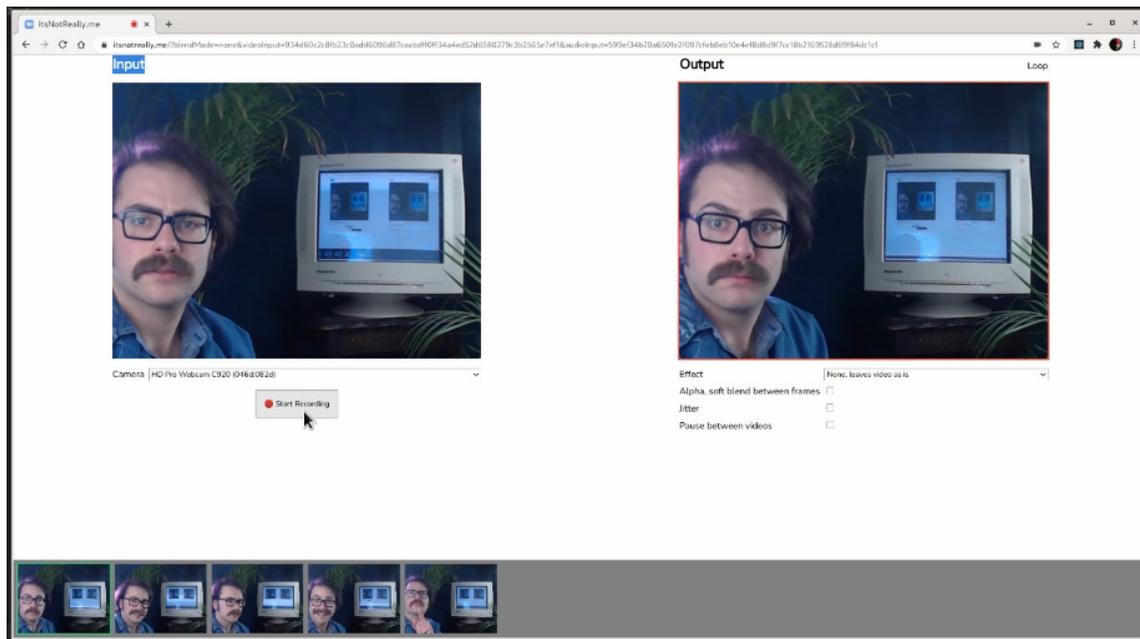


Fig. 4. Artist screenshot from *itsnotreally.me*. Users can record various loops which are stored locally and can be played into a Zoom call, with various additional effects added, such as jitter and lag.

that is notably rigid and square. While a speaker may be ‘spotlighted’ to make their video proportionally larger, neither host nor attendee can normally make themselves smaller. The *Zoom_mod-Pack* opposes the function of the window as a rigid boundary, and often even shrinks the video – either through imposing a foreground of some kind, or simply scaling the video input down. The boundary and cropping of the video can be very actively manipulated by the attendee. By doing so, they gain greater control over exactly how they use and manage their Zoom window, and gain means to make an entrance, and limit or amplify their visibility and importance in the meeting.

5.3 Foxdog Studios: *itsnotreally.me*

“*itsnotreally.me* is a webpage where you can record loops of yourself to playback via a virtual webcam in a video call, allowing you to fake your presence. You can record multiple loops which could be anything from you sitting at your desk smiling, nodding intently, laughing or even an empty chair. You can easily switch to your live cam when you need to engage in the conversation. Clips are quick and easy to record, so can be prepared in the minutes before a meeting, meaning clothes, lighting and background will be consistent with your live camera. The aim is to allow you to relax during a meeting, disengage when necessary and even save expressive energy with a “canned response”. (Artist Statement, FoxDog Studios).

5.3.1 Project Introduction. *itsnotreally.me* is the creation of FoxDog Studios, who describe themselves as “IT consultants who accidentally started making live comedy shows with technology”. This project challenges the use of Zoom within a corporate culture, and in particular the demand for continued video presence in a virtual meeting. As an antidote, the attendee can use *itsnotreally.me* to record various loops or canned responses (such as nodding, smiling, giving a

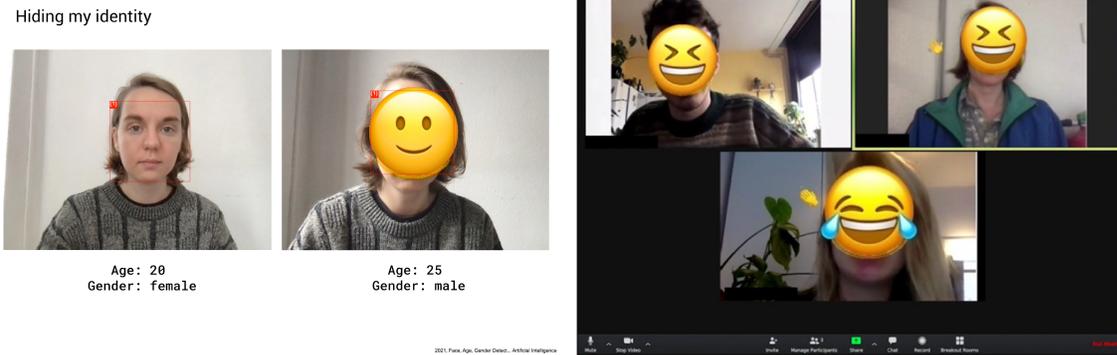


Fig. 5. Artist images for the Masquerade Call. Various emojis are mapped to the attendee's face, offering a mode of expression, while obscuring facial data.

thumbs-up) and quickly interchange between these looped recordings, and one's authentic live engagement. Once again using a virtual camera via software such as OBS, this alternate video can be surreptitiously routed into a Zoom call. The ease and speed with which users can both record loops, and switch between these, allows them to deceive other attendees. *itsnotreally.me* also offers various ways to degrade the quality of one's video. Switching between loops, users can introduce artificial pause or jitter to mimic lag or connection qualities. They can also introduce forms of compression, to produce an increasingly pixelated video, or slow down or speed up the video playback, to mimic low bandwidth or connection problems that are common during video-calling. Exploiting these glitches is similar to other 'butler lies' [37] and 'privacy lies' [70] – where users rely on potential faults in technology, to politely deceive or avoid others. Depending on the audience, this tool could be used to reduce 'Zoom Fatigue' [52] and the corporate gaze and its power, or it could also be used in highly comedic and theatrical ways to simply disrupt and meddle with expectations of being on Zoom.

5.3.2 Counterfunctionality. Normally, high-quality video-conferencing expects and depends upon an almost live video stream, carefully synchronized with the speaker's audio, to improve the sense of presence. *itsnotreally.me* counters this imperative by relying upon pre-recorded, 'canned', video – rather than a live stream – to mimic presence in a call. This counterfunctionality allows polite disengagement, and again, challenges the binary choice of camera on / camera off. In so doing, the attendee regains agency in exactly how and when their truly live video is broadcast to the call.

Furthermore, lag, jitter, and other connection issues are normally a significant impediment to video-conferencing. Zoom employs several features to smooth out these issues. In this project however, they are leveraged to intentionally degrade the video quality. This potentially facilitates a deception; but also, more radically offers the attendee means to entirely disengage from an unwanted call. While this feature could clearly be used disrespectfully, this counterfunctionality also offers means to redress power asymmetries and the increasing expectation that employees are always on and available from home.

5.4 Ilse Pouwels: Masquerade Call

"The emoticon "face mask" is a playful approach to show your visibility. People understand that you are there, listening, thinking, talking, expressing yourself. The hand gestures actively allow you to use all the

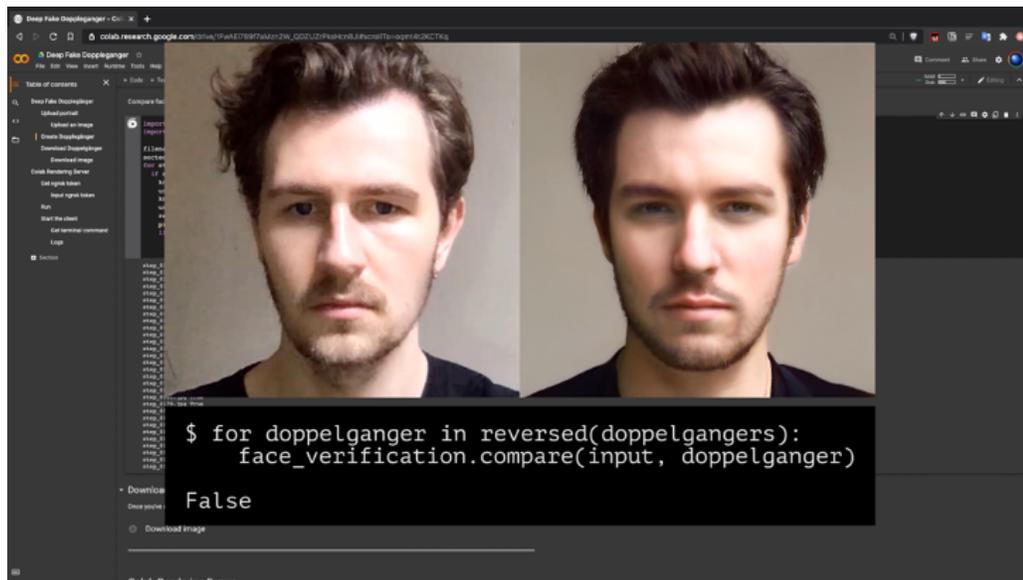


Fig. 6. Artist image for 'How they Met Themselves'. The image on the left is the artists veridical image; the image on the right is the closest doppelganger that a facial detection algorithm views as a different person.

pixels in the grid to communicate in a fluid and creative way. The layer of emoticons on top of the video feed pollutes the video data that Zoom is getting from you. It is now likely to classify you as a 25-year old happy man.” (Artist Statement, Ilse Pouwels)

5.4.1 Project Introduction. *Masquerade Call* directly addresses the harvesting of facial biometric data by video call platforms. Through facial tracking with p5.js and the use of virtual camera, the user can use a variety of emoticons as a mask, which obscures their face from both Zoom and others on the call. Using hotkeys, they can switch between various ‘masks’, to react and respond to others on the call. In some respects, emoticons are a more reductive ways of representing oneself. However, in comparison to physical forms of masking, may offer more universally understood meaning [47]; and may encourage attendees to reflect on how they feel, and how to express themselves to others on the call [48]. The title of the work references a long history of mask wearing, in various circumstances – especially around strangers – to preserve anonymity, and facilitate alternative interactions.

5.4.2 Counterfunctionality. Counterfunctionality in this work primarily concerns obscuring the face, normally the primary object of the video. Through masking, one’s identity and capacity for expression is greatly reduced, and hidden. However, through such an explicit and broadly understood symbol as emoticon, the mask may allow someone to communicate more than they are ordinarily comfortable with. By countering the visibility and importance of the face in a Zoom call, attention is drawn to other aspects of the video, and other means to express oneself, besides the face. Especially in larger group contexts, where participants may be reticent to switch on a camera, this counterfunctionality, and the potential for coded meanings through emoticons [79], could encourage participants to be more forthright and engaged through video, much like traditional masquerade ball.

5.5 Martin Disley: How They Met Themselves

“How They Met Themselves is an investigation into how algorithmic and human schemas of facial identification, verification and perception differ and how these differences can be leveraged to control how our identity is coded in the images we put online. A bespoke software tool called Deepfake Doppelgänger was developed to exploit some of these differences. The application generates a bespoke avatar based on the user’s uploaded portrait image that preserves the likeness of the face in the image whilst obscuring the biometric data linking the avatar to the user.” (Artist Statement, Martin Disley)

5.5.1 Project Introduction. ‘How they Met Themselves’ was potentially the most technically complex project in Zoom Obscura, and offers an alternative approach to masking. This project aims to produce a ‘deepfake doppelganger’ that closely resembles the attendee, and could be used within a Zoom call to mask the user’s facial biometrics [80]. The project relies upon NVidia’s *StyleGan* to generate a ‘fake’ face that closely resembles a photograph of the user. As a generative adversarial network, the *StyleGan* works iteratively to produce a face that a facial detection algorithm recognises as the same face as the original. Crucially here, in order to avoid facial detection, this system chooses the fake that is closest to the original, but is detected as a different face – thereby giving an accurate impression of someone (their doppelganger), while shielding their biometric facial data. ‘Avatarify’ is used to map the doppelganger image onto the real movements of the users face. This ensures speech and audio are realistically mapped to the video, but also incorporates many of the original facial expressions of the individual, such as the way someone’s eyebrows or lips actually move when they talk, increasing the likeness. Finally, this animated doppelganger is routed into Zoom via a virtual camera.

To use the doppelganger successfully requires maintaining a very consistent, uncomfortable and still posture in relation to the camera. Any significant movements result in glitching – where the mask is distorted and torn from the users face. For those who know the speaker well, the doppelganger is quite clearly a false image – even though it offers a likeness. Yet, there is an uncanniness to the way that very familiar expressions are mediated through this false face. To an audience of strangers, the doppelganger can be convincing, at least for a while. One of the authors employed the doppelganger throughout a public event to profile the Zoom Obscura artworks – and many took some time to recognise the deception. Lastly, while this masking intervention obscures facial data from Zoom and any other participants in the call, it relies on several other third-party and proprietary services and servers (the project runs through Google Colab¹⁴ to take advantage of the considerable computing power required to run the doppelganger). This illustrates the considerable difficulty of overcoming and challenging the data being shared with one platform, without become implicated in the web of others.

5.5.2 Counterfunctionality. Normally in a Zoom call, you show your own face on camera; in this case you show a face that is similar, but different. This counterfunctionality is primarily employed to avoid facial recognition algorithms. Beyond obfuscation, a user may become more comfortable appearing, speaking and being recorded in public online contexts by using the doppelganger. Mapped to authentic facial expressions the doppelganger is very finely tuned to be as human and alike as possible, in such a way that is recognisable to those who are familiar with the speaker, but is able to fool algorithmic recognition.

An unintentional counterfunctional feature of this project is to require the user to remain quite still. Normally one can move relatively freely in relation to a front facing camera without degrading the quality of an interaction. This

¹⁴<https://colab.research.google.com/notebooks/intro.ipynb>

counterfunctionality is far less useful and productive, and somewhat detrimental to the experience of the user. While there is an artistic and bewitching quality to the glitches produced if the user does move, for the most part it is a limiting factor, especially to how long one could use this tool. This is an example of how aiming to counter one function, can also counter others.

5.6 Michael Baldwin: Group Dialogues

“Group Dialogues is a composed conversation in five parts. A group of three participants enter into a series of dialogues mediated by visual and sonic cues. The conversation touches on the medium of video conferencing technology, addressing the topics of conversational responsibility, latency, speech disfluencies, turn taking, and the process of disconnection.” (Artist Statement, Michael Baldwin)

5.6.1 Project Introduction. Group Dialogues is a multi-layered project that challenges the norms and functionality in Zoom to construct conversation. The project offers a variety of sonic and visual cues to mediate a conversation with at least three participants. In an initial configuration to explore responsibility in conversation, only the mouth of the host or primary speaker is visible. Their Zoom window is augmented with instructions that point to other callers in the Zoom grid, suggesting when they should ‘speak’ or ‘read’ [see Figure]. At some point, the primary speaker is muted, however, and when they do speak, a speech-to-text system displays what they are saying to other attendees. Whoever is instructed to ‘read’ is invited to give voice to the primary speaker’s words, others are then instructed to ‘speak’. In another set-up to explore speech disinfluences, the system introduces disruptive sonic cues – such as ‘uums and aahs’, that often occur in crosstalk, or as a speaker attempts to interrupt. Appearing throughout the call, these disruptions require speakers to repair and reflect on how they communicate in this medium. The artist, a composer and performer, ran several extensive sessions with participants to develop, hone and explore how these and other features expose the etiquette, speech patterns and experience of conversation in Zoom calls.

The result of these unfolding group dialogues, is conversations that are slower, demand more attention, and disrupt hierarchies and common patterns of speech. By prompting cycles of breakdown and repair in conversation, heightened attention is drawn to the way issues such as lag, interruption and forms of online etiquette mediate communication in Zoom. By introducing various artificial means to structure and interrupt dialogue, the project intends to critique the way Zoom itself detects, highlights, filters and optimizes sound for each speaker.

5.6.2 Counterfunctionality. This project counters several features and norms in conversation on Zoom. Through various artificial visual and sonic cues, functionality is introduced to upset, reveal and counter various cues normally relied upon to determine who speaks, when they speak, and how they are heard. One of the distinctive features about Zoom is audio filtering, and the yellow box, that gives prominence to a single speaker. This tends to produce clearer, carefully ordered speech, reducing cross talk, creating extra pauses between speakers, and additional etiquette to interrupt or redirect conversation. This can be especially important in large group calls, whereas face-to-face many concurrent conversations might be possible, instead, only a single conversation is possible. The various dialogues proposed in this project counter such composed conversation, and invite participants to attend carefully to various instructions guiding their speech, somewhat at random. In the *Responsibility* dialogue, the primary speaker is mute, and requires others to voice his speech – giving voice to a muted speaker is profoundly counterfunctional. Other dialogues that focus on speech disinfluences counter Zoom’s focus on producing legible speech and filtering out other sounds that might ordinarily interrupt. The resulting dialogues are arguably somewhat more chaotic, challenging and crucially slower than the carefully structured turns typically normally produced. In some of the dialogue, the legibility of the call,

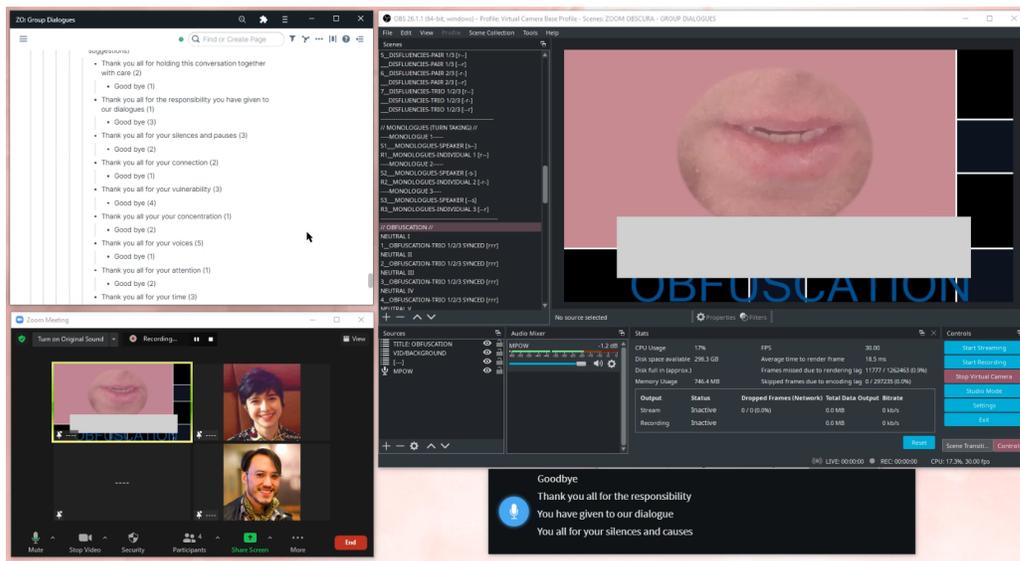


Fig. 7. Artist image for Group Dialogues, showing various aspects of the system, including the speech to text algorithm, and video input of the speakers mouth through OBS.

especially to automated transcription of conversation analysis is significantly perturbed. The agency produced here is hence to defamiliarize, and draw attention, to how the conversation is being constructed, broken down, and repaired, and how Zoom mediates this.

5.7 Paul O'Neill: For Ruth and Violette

“For Ruth and Violette plays with poetry and encryption to subvert networked communications infrastructures. Based on a code-poem used by intelligence operatives in the Second World War, the piece harnesses alternative uses of the video conferencing platform Zoom to engage with the complex history of obfuscation in relation to covert broadcasting methods. The title of the project is in reference to origins of the poem and the lives encoded within it.” (Artist Statement, Paul O'Neill)

5.7.1 Project Introduction. This project exploits a particularly subtle, and often overlooked means to communicate in Zoom – the ‘rename’ function. If permitted by the host of the Zoom meeting, participants can rename themselves during a call. Typically, attendees might do this to reflect a particular role, a professional affiliation or when they share an account. Names are displayed prominently during a Zoom call. When video is enabled, the name of a speaker appears in the corner of their window, like a badge. Names are used to identify chat messages and recorded in the chat log. Crucially, when video is disabled for an attendee without a profile picture, the blank window is filled by an enlarged name. Participants can rename themselves multiple times during a call. This project explores how the flexibility of renaming allows a more covert means to communicate in Zoom. Referencing a famous ‘code-poem’ employed by WW2 spies [54], For Ruth and Violette is a short and evocative video of a poem by operative Leo Marks, written out via the renaming of two participants in a Zoom call. Each line, is split across the two participants. As they are renamed, a new line is formed, demonstrating an alternative means to communicate, poetically, in Zoom.

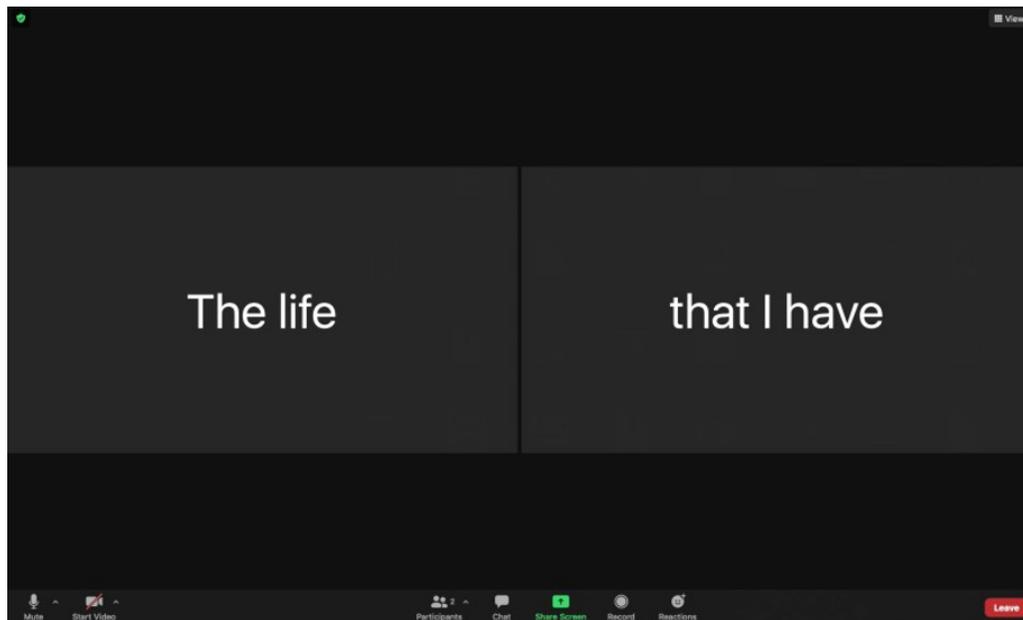


Fig. 8. Artist image from 'For Ruth and Violette'. A still from a short film where an entire poem is played out via renaming the 'attendee' in each window.

5.7.2 *Counterfunctionality*. Normally one relies on a combination of three channels to communicate in Zoom: video, audio and typed text messages in a chat window. All three of these are excluded in this project. Instead, communication takes place by subverting a feature to rename participants. Names are usually something constant, and simply an identifier for participants – here they become the primary means to communicate. The effect of renaming is in fact amplified by the absence of video, and any other inputs.

Compared to text input via the chat window, names are fleeting, and are not normally recorded in the way a chat log may be. It's unclear if and how Zoom itself records and processes data related to participants names during a call. Hence, renaming offers a means to communicate in Zoom with an absolute minimum of personal data being transmitted. Beyond an approach to maintain privacy, the necessary slowness of renaming oneself, produces a certain tension, narrative, and patience that is often absent from Zoom calls. The viewer is left waiting for the next line to appear. Watching the video of For Ruth and Violette, is a little like waiting for the schedule board in a train station to update. Similarly, the very limited means of communication, lends itself to succinct, evocative language and dialogue – or poetry – where much can be said, in very few words.

6 DISCUSSION

In our discussion, we return to the two central contributions of this paper: first, identifying particular counterfunctional strategies towards regaining agency; and second, reflecting on how these projects reveal important features and design considerations for living with ubiquitous video-conferencing.

6.1 Strategies for Counterfunctional Video-Conferencing

We briefed artists to both *counter* the potential for surveillance via video-conferencing, but also to consider functionality to regain agency in these spaces. As a body of work, we can identify several promising counterfunctional strategies that could be developed further as design propositions.

6.1.1 Reducing Visibility. All of artists' projects reduced the visibility of a subject in a Zoom call in some way. Specific strategies included: limiting when live video was visible; limiting which parts of the body were visible; reducing the size of one's image; introducing foregrounds that could be hidden behind; or switching the camera off entirely. Producing partial visibility offered a more nuanced way to manage presence, beyond simply switching a camera on or off. It also arguably heightens the value of being authentically and fully present. The use of virtual cameras that manipulated the image before it was presented to Zoom were essential to achieve this in many cases. A crucial requirement is to be able to manipulate and vary one's visibility subtly, without disruption or dislocation for other participants. Extending this counterfunctional strategy could mean: finding ways to limit who can see one's image; considering hardware (e.g. a fish eye lens, partial webcam covers) that manipulate the camera's view directly; and further exploring how a user can configure different degrees of visibility easily and elegantly within different contexts; and settings, to manage one's entrance and exit.

6.1.2 Resisting the Zoom Window. A second strategy was to resist the particular rigid framing and arrangement that is universal across Zoom meetings. Strategies included using filters to bound, shrink or focus one's image; using emojis to interact between windows; communicating via the names of each window; or simply stepping out of a window altogether. Other video-conference platforms such as Gather and Mozilla Hubs create a core point of difference by facilitating attendees to move around a virtual space, and break out of a rigid grid. Extending this counterfunctional strategy could include: presenting new ways to crop and bound one's image to different shapes and sizes; making the boundaries of one's window less rigid, and more flexible and interactive.

6.1.3 Countering the Face. Several projects challenged how the face is presented and prioritised in video-conferencing. Similar to previous adversarial and anti-surveillance projects [22, 58] one key strategy included masking of various kinds – via emojis that obscure the face entirely, or a deepfake doppelganger that aims to algorithmically replicate a recognisable likeness, which can evade facial recognition tools. In the context of video-conferencing, a key concern for this strategy is who the attendees are aiming to mask their face from – specific platforms, specific attendees or publics, or perhaps both? The emojis and the doppelganger both have very different qualities as masks, which lend themselves to particular contexts. The doppelganger is more expressive, easier for other attendees to understand, but can be more complicated to set up and maintain. A further key strategy was to withdraw one's face altogether and consider what alternative scenes, camera angles, or imagery might take its place. Extending counterfunctionality further here could include: identifying masking strategies for different contexts; considering how facial data is leaked or shared with other auxiliary services (e.g. Google Colab or OBS); and experimenting with other meaningful imagery and video to share in place of one's face.

6.1.4 Switching Off. Perhaps the most basic counterfunctional strategy is to switch off and refuse to engage with certain technologies at all [7]. Notable in the artists projects was the exploration of alternative ways to communicate when either audio or camera were switched off (of course, difficulties connecting to audio or video are a routine issue in video-conferencing). Specific strategies here involved employing speech-to-text software to overcome a muted

microphone; appropriating the renaming function; or recording an audio file that is played into a call in someone's absence. These counterfunctional approaches challenge the assumption that each attendee has full access to high quality video and audio, and / or wishes to use them. By exploring meaningful ways to communicate with certain essential functionality switched off, we can consider not only how to contest surveillance and regain agency in these tools, but think about how to improve participation when these aspects of video-communication fail or are unavailable. There are therefore rich possibilities and opportunities to make these platforms more accessible, by considering how attendees can equitably participate in video-conferencing if they, or others, cannot be seen or heard.

6.1.5 Introducing New Temporalities. A final important counterfunctional strategy was to counteract the assumed liveness and present temporality of a Zoom meeting. *itsnotreally.me* lets attendees switch between pre-recorded and live video; Group Dialogues disrupts the ordering and pace of conversation through various cues and interruptions, often working to slow down conversation and draw attention to other temporal oddities of video-conferencing. Synchronizing speech and video, across multiple networked participants is a core functionality and technical challenge of multi-party video-conferencing; however, has led to concerns about excessive demands to be present and available in vivo, and is used to justify ever more intensive facial and audio detection and processing. Extending counterfunctional strategies may include: exploring opportunities to incorporate pre-recorded content (video or audio); drawing on slow technology and design principles [36, 62] in the context of video-conferencing tools; and examining further how interruptions and delays can be used as resources produce meaningful social interactions [66, 81], rather than simply seen as problems to be solved.

6.2 Design Considerations for Living with Zoom

Counterfunctional design inquiry provides an opportunity to defamiliarize [8] otherwise mundane technologies and experiences, allowing us to reassess their meaning, use, and qualities. A key aim of Zoom Obscura was to foster a critical community responding to the ubiquity of video-calling, at a time when we were all, ourselves, dependent upon these technologies in our daily personal and professional lives. Through this process, and our subsequent reflections on, and presentations of this work, a number of particular features of how we live with Zoom came to the fore.

6.2.1 Revisiting Norms and Expectations. Several of the projects relied heavily on performative, as much as technical, interventions. *How to Touch the Screen* requires nothing more than an audio file, and yet fundamentally perturbs one's experience of Zoom. The *Zoom_Mod Pack* is effective because it brings implicitly performative nature of a Zoom call to the fore. Often the counterfunctionality employed was to counter norms and expectations in how we use these media spaces, as much as the technology itself. Over the course of the project, as a research team, we became increasingly aware how rapidly, and often without question, we had settled into these spaces, adopting rather particular, and potentially strict ways of being there. In addition, as we craved human and social contact that was not possible during the pandemic, we appeared to place particularly high expectations on each other to be present, and authentic, with a live camera, a real background, one's own face. *itsnotreally.me* directly challenges this demand, and raises questions about how we manage these expectations, even through inauthentic means, such as relying on 'canned' video, or for example, face and eye alignment features that make it appear one is looking directly at a front-facing camera, rather than at a screen or off-camera [77].

Looking forward, this suggests that much more equitable, sustainable and interesting uses of video-conferencing may be afforded simply by considering more carefully how we set expectation of each other's presence and performance. The context in which Zoom rapidly entered the mainstream was as an urgent replacement for in-person, face to face,

experiences; many of the norms and expectations we have carried into video-conferencing stem from attempting to reproduce this. However, when we look back at the history of remote communication, we see very often that meaningful connections can be made at a distance by reducing the demands for presence and performance in front of a lens.

6.2.2 Challenging the Fixed Camera Lens. Susan Sontag wrote powerfully on the potential violence, aggression and predatory nature of a camera lens [72]. In the context of desktop video-conferencing the camera is arguably a leash, or tether, which restrains how and where the individual can position themselves. The rapid adoption of video-conferencing could only take place as most people already had access to devices with built-in, high-resolution, front-facing cameras. This particular positioning, housed above a screen dictates the kinds of foreground, background, body positions that are possible – it contributes significantly to the aesthetic flatness of video-conferencing [20]. Many of the projects were contesting this feature in some way. *Group Dialogues* adopted an extreme focus on the mouth of a speaker. *How to Touch through the Screen* produces a powerful moment of reflection and release as one moves out of view of the camera, but maintains sight of the screen. *Zoom_Mod Pack* provides ways to introduce a foreground, or scaling of one's image that restages how one is seen and presented through the lens. The use of virtual cameras – where the camera image is manipulated before it is provided to Zoom – was crucial to five of the seven projects.

In particular, projects pulled at this leash by challenging a binary choice of camera 'on' or camera 'off'. There is very little subtlety here in terms of how one can manage presence, and identity, by bringing oneself front or back stage, becoming visible to some and not others, etc. This also reflects the difficulties of evading surveillance, without complete withdrawal or rejection of a platform. The work in these projects only scratches the surface on how attendees might either performatively, or technically, gain more choices in how they are present in front of a lens.

6.2.3 Reclaiming and Customising Media Spaces. The workshops we undertook with artists were exciting because they challenged our expectations and setting of what Zoom could look and feel like. Returning to the theme of 'aesthetic flattening' [20], it is striking the extent to which all Zoom meetings look essentially the same – board meetings, classrooms, first dates and funerals are all compressed into the same rigid squares. While individual attendees can apply various virtual backgrounds, neither the host nor an attendee can really customise the setting and context of the whole meeting. The minimalism of Zoom and focus on call quality are arguably reasons for its success [78], but the platform is closed and inflexible. None of the artists projects tried to, or were able to, customise, or 'hack' Zoom itself – instead they relied on manipulating the media presented to Zoom, or the performance of participants within it.

Other online meeting spaces such as *Gather*, *Whereby* and *Mozilla Hubs* emphasise the customisable nature of their platforms. Alternatively, media platforms such as *Streamyard* employs Zoom as infrastructure that handles video and audio, while *Streamyard* is used to customise the final presentation of these. Elsewhere, the adoption of Zoom as a medium for theatre productions demonstrates the rich and imaginative possibilities in customising and decorating media spaces [27, 51]. Zoom currently only has two modes – a meeting mode where all attendees are participants, and a webinar mode where attendees can only view. We are left wondering what other modes we require for video-conferencing in the future. Dinner mode? Prayer mode? Pub Quiz mode? This is not necessarily to say that Zoom as a platform should expand to consume every aspect of our personal lives – but to suggest that as we increasingly appropriate and absorb video-conference tools into our lives, being able to make these spaces our own will be crucial to regaining agency within them.

7 CONCLUSIONS

We undertook Zoom Obscura to support and work with a diverse group of artists and creative technologists, responding to the sudden and overwhelming adoption of video-conferencing tools, such as Zoom, in the course of the Covid-19 pandemic. Specifically, we sought creative interventions that offered means to resist the potential for surveillance through these tools, and to enable users to regain personal agency in these spaces. What this paper contributes is a close study of the role that *counterfunctional design* played in each of these seven projects.

We identify five counterfunctional strategies that were particularly fruitful in the context of Zoom, and could be extended considerably through future work. These include: **a)** reducing one's visibility within a meeting **b)** resisting the boundaries of a Zoom 'window'; **c)** countering the centrality of the face; **d)** switching off certain features entirely; and **e)** introducing new temporalities within a Zoom meeting. These are by no means the only strategies, and they reflect particular cultures of Zoom use shared between the artists and ourselves, all based in the UK, North America and Europe. However, we offer these strategies as fertile starting points, to help us revisit the implications of dominant norms and cultures of video-conferencing, challenging the control and power of the camera lens, and beginning to reclaim media spaces as more of our own. Counterfunctionality is hence both a rich way to understand the underlying logics of a diverse set of critical projects, but also generative of new concepts and opportunities for more equitable and sustainable experiences of technologies. In particular, we see that counterfunctionality applies not only to opposing the technical functionality and affordances of a closed platform, but spills out towards consideration of how dominant norms and cultures of technology use can be subverted through considered performative work. In this respect, as a collection of works, Zoom Obscura highlights how both technical and performative interventions are vital to understanding and addressing our contemporary relationships with dominant networked technologies.

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REFERENCES

- [1] Stefan Agamanolis, Alex Westner, and V. Michael Bove Jr. 1998. Reflection of presence: toward more natural and responsive telecollaboration. *Multimedia Networks: Security, Displays, Terminals, and Gateways* 3228, 174–182. <https://doi.org/10.1117/12.300888>
- [2] Sarah Fdili Alaoui and Jean-Marc Matos. 2021. RCO : Investigating Social and Technological Constraints through Interactive Dance. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3411764.3445513>
- [3] Morgan G. Ames, Janet Go, Joseph 'Jofish' Kaye, and Mirjana Spasojevic. 2010. Making love in the network closet: the benefits and work of family videochat. *Proceedings of the 2010 ACM conference on Computer supported cooperative work*, 145–154. <https://doi.org/10.1145/1718918.1718946>

- [4] Jakob E. Bardram, Thomas R. Hansen, and Mads Soegaard. 2006. AwareMedia: a shared interactive display supporting social, temporal, and spatial awareness in surgery. *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work*, 109–118. <https://doi.org/10.1145/1180875.1180892>
- [5] Jeffrey Bardzell, Shaowen Bardzell, and Erik Stolterman. 2014. Reading critical designs: supporting reasoned interpretations of critical design. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1951–1960. <https://doi.org/10.1145/2556288.2557137>
- [6] Eric P.S. Baumer, Morgan G. Ames, Jed R. Brubaker, Jenna Burrell, and Paul Dourish. 2014. Refusing, limiting, departing: why we should study technology non-use. *CHI '14 Extended Abstracts on Human Factors in Computing Systems*, 65–68. <https://doi.org/10.1145/2559206.2559224>
- [7] Eric P. S. Baumer, Jenna Burrell, Morgan G. Ames, Jed R. Brubaker, and Paul Dourish. 2015. On the importance and implications of studying technology non-use. *Interactions* 22, 2 (25 2 2015), 52–56. <https://doi.org/10.1145/2723667>
- [8] Genevieve Bell, Mark Blythe, and Phoebe Sengers. 2005. Making by making strange: Defamiliarization and the design of domestic technologies. *ACM Trans. Comput.-Hum. Interact.* 12, 2 (6 2005), 149–173. <https://doi.org/10.1145/1067860.1067862>
- [9] Victoria Bellotti and Abigail Sellen. 1993. Design for privacy in ubiquitous computing environments. *Proceedings of the Third European Conference on Computer-Supported Cooperative Work 13–17 September 1993, Milan, Italy ECSCW'93*, 77–92. [http://link.springer.com/chapter/10.1007/978-94-011-2094-4\\$\\$_6](http://link.springer.com/chapter/10.1007/978-94-011-2094-4$$_6)
- [10] Gabrielle Benabdallah, Sam Bourgault, Nadya Peek, and Jennifer Jacobs. 2021. Remote Learners, Home Makers: How Digital Fabrication Was Taught Online During a Pandemic. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–14. <https://doi.org/10.1145/3411764.3445450> [Online; accessed 2021-09-01].
- [11] John Berger. 1972. *Ways of seeing*. Penguin UK.
- [12] Michael Boyle, Carman Neustaedter, and Saul Greenberg. 2009. Privacy Factors in Video-Based Media Spaces. In *Media Space 20 + Years of Mediated Life*, Steve Harrison (Ed.). Springer, London, 97–122. [https://doi.org/10.1007/978-1-84882-483-6\\$\\$_7](https://doi.org/10.1007/978-1-84882-483-6$$_7) DOI: 10.1007/978-1-84882-483-6_7.
- [13] Jon Brodtkin. 2021. Zoom to pay 85M for lying about encryption and sending data to Facebook and Google | Ars Technica. <https://arstechnica.com/tech-policy/2021/08/zoom-to-pay-85m-for-lying-about-encryption-and-sending-data-to-facebook-and-google/> [Online; accessed 2021-09-09].
- [14] Kieran Browne, Ben Swift, and Terhi Nurmikko-Fuller. 2020. Camera Adversaria. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–9. <https://doi.org/10.1145/3313831.3376434>
- [15] Finn Brunton and Helen Nissenbaum. 2015. *Obfuscation: A User's Guide for Privacy and Protest*. The MIT Press. <https://mitpress.universitypressscholarship.com/10.7551/mitpress/9780262029735.001.0001/upso-9780262029735>
- [16] Tatiana Buhler, Carman Neustaedter, and Serena Hillman. 2013. How and why teenagers use video chat. *Proceedings of the 2013 conference on Computer supported cooperative work*, 759–768. <https://doi.org/10.1145/2441776.2441861>
- [17] Autumn Caines. 2020. The Zoom Gaze. *Real Life* (2020). <https://reallifemag.com/the-zoom-gaze/> [Online; accessed 2021-09-09].
- [18] Vince Carducci. 2006. Culture Jamming: A Sociological Perspective. *Journal of Consumer Culture* 6, 1 (1 3 2006), 116–138. <https://doi.org/10.1177/1469540506062722>
- [19] David J. Chatting, Josie S. Galpin, and Judith S. Donath. 2006. Presence and portrayal: video for casual home dialogues. *Proceedings of the 14th ACM international conference on Multimedia*, 395–401. <https://doi.org/10.1145/1180639.1180723>
- [20] Jaz Hee-jeong Choi and Cade Diehm. 2021. Aesthetic flattening. *Interactions* 28, 4 (30 6 2021), 21–23. <https://doi.org/10.1145/3468080>
- [21] Kate Crawford and Vladan Joler. 2018. Anatomy of an AI System. <http://www.anatomyof.ai>
- [22] Patricia de Vries and Willem Schinkel. 2019. Algorithmic anxiety: Masks and camouflage in artistic imaginaries of facial recognition algorithms. *Big Data & Society* 6, 1 (1 1 2019), 2053951719851532. <https://doi.org/10.1177/2053951719851532> publisher: SAGE Publications Ltd.
- [23] Audrey Desjardins, Afrodit Psarra, and Bonnie A. Whiting. 2021. Voices and Voids: Subverting Voice Assistant Systems through Performative Experiments. In *Creativity and Cognition*. Association for Computing Machinery, New York, NY, USA, 1–10. <https://doi.org/10.1145/3450741.3466807>
- [24] Carl DiSalvo. 2012. *Adversarial Design*. The MIT Press.
- [25] Paul Dourish and Sara Bly. 1992. Portholes: Supporting Awareness in a Distributed Work Group. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 541–547. <https://doi.org/10.1145/142750.142982>
- [26] Anthony Dunne. 2008. *Hertzian tales: Electronic products, aesthetic experience, and critical design*. MIT press.
- [27] Elizabeth Falter and Sarah Neville. 2020. William Shakespeare's Much A-Zoom About Nothing. *International Journal of Performance Arts and Digital Media* 16, 3 (1 9 2020), 306–318. <https://doi.org/10.1080/14794713.2020.1831828>
- [28] Batya Friedman, Peter H. Kahn, Jennifer Hagman, Rachel L. Severson, and Brian Gill. 2009. The Watcher and the Watched: Social Judgments about Privacy in a Public Place. In *Media Space 20 + Years of Mediated Life*, Steve Harrison (Ed.). Springer, London, 145–176. [https://doi.org/10.1007/978-1-84882-483-6\\$\\$_9](https://doi.org/10.1007/978-1-84882-483-6$$_9) DOI: 10.1007/978-1-84882-483-6_9.
- [29] David Garcia and Geert Lovink. 2008. The ABC of Tactical Media. <http://www.tacticalmediafiles.net/articles/3160/The-ABC-of-Tactical-Media> [Online; accessed 2021-09-09].
- [30] Cally Gatehouse and David Chatting. 2020. Inarticulate Devices: Critical Encounters with Network Technologies in Research Through Design. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*. Association for Computing Machinery, New York, NY, USA, 2119–2131. <https://doi.org/10.1145/3357236.3395426>
- [31] William W. Gaver. 1992. The affordances of media spaces for collaboration. *Proceedings of the 1992 ACM conference on Computer-supported cooperative work*, 17–24. <https://doi.org/10.1145/143457.371596>

- [32] William W. Gaver, John Bowers, Andrew Boucher, Hans Gellerson, Sarah Pennington, Albrecht Schmidt, Anthony Steed, Nicholas Villars, and Brendan Walker. 2004. The drift table: designing for ludic engagement. *CHI '04 Extended Abstracts on Human Factors in Computing Systems*, 885–900. <https://doi.org/10.1145/985921.985947>
- [33] Erving Goffman et al. 1959. The presentation of self in everyday life. (1959).
- [34] Jessica Goodfellow. 2020. 'Zoom's practices violate our human right to privacy'. <https://www.campaignlive.co.uk/article/zooms-practices-violate-human-right-privacy/1679551/> [Online; accessed 2021-09-09].
- [35] Jens Emil Gronbaek, Banu Saatci, Carla F. Griggio, and Clemens Nylandstedt Klokmose. 2021. MirrorBlender: Supporting Hybrid Meetings with a Malleable Video-Conferencing System. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–13. <https://doi.org/10.1145/3411764.3445698>
- [36] Lars Hallnäs and Johan Redström. 2001. Slow technology—designing for reflection. *Personal and ubiquitous computing* 5, 3 (2001), 201–212.
- [37] Jeff Hancock, Jeremy Birnholtz, Natalya Bazarova, Jamie Guillory, Josh Perlin, and Barrett Amos. 2009. Butler lies: awareness, deception and design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 517–526. <https://doi.org/10.1145/1518701.1518782>
- [38] Steve Harrison. 2009. An Introduction to Media Space. In *Media Space 20 + Years of Mediated Life*, Steve Harrison (Ed.). Springer, London, 1–8. https://doi.org/10.1007/978-1-84882-483-6_1 DOI: 10.1007/978-1-84882-483-6_1.
- [39] Carrie Heeter. 1992. Being there: The subjective experience of presence. *Presence: Teleoperators & Virtual Environments* 1, 2 (1992), 262–271. publisher: MIT Press.
- [40] Yasamin Heshmat and Carman Neustaedter. 2021. Family and Friend Communication over Distance in Canada During the COVID-19 Pandemic. In *Designing Interactive Systems Conference 2021*. Association for Computing Machinery, New York, NY, USA, 1–14. <https://doi.org/10.1145/3461778.3462022>
- [41] Manyu Jiang. 2020. The reason Zoom calls drain your energy. <https://www.bbc.com/worklife/article/20200421-why-zoom-video-chats-are-so-exhausting> [Online; accessed 2021-09-09].
- [42] Matt Jones. 2013. Videophones. <http://berglondon.com/blog/tag/videophones/> [Online; accessed 2021-09-09].
- [43] Tejinder K. Judge and Carman Neustaedter. 2010. Sharing conversation and sharing life: video conferencing in the home. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 655–658. <https://doi.org/10.1145/1753326.1753422>
- [44] Tejinder K. Judge, Carman Neustaedter, Steve Harrison, and Andrew Blose. 2011. Family portals: connecting families through a multifamily media space. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1205–1214. <https://doi.org/10.1145/1978942.1979122>
- [45] Matthew K. Miller, Martin Johannes Dechant, and Regan L. Mandryk. 2021. Meeting You, Seeing Me: The Role of Social Anxiety, Visual Feedback, and Interface Layout in a Get-to-Know-You Task via Video Chat. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–14. <https://doi.org/10.1145/3411764.3445664>
- [46] Joseph 'Jofish' Kaye, Mariah K. Levitt, Jeffrey Nevins, Jessica Golden, and Vanessa Schmidt. 2005. Communicating intimacy one bit at a time. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1529–1532. <https://doi.org/10.1145/1056808.1056958> [Online; accessed 2021-09-09].
- [47] Philippe Kimura-Thollander and Neha Kumar. 2019. Examining the "Global" Language of Emojis: Designing for Cultural Representation. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–14. <https://doi.org/10.1145/3290605.3300725>
- [48] David S. Kirk, Abigail Sellen, and Xiang Cao. 2010. Home video communication: mediating 'closeness'. *Proceedings of the 2010 ACM conference on Computer supported cooperative work*, 135–144. <https://doi.org/10.1145/1718918.1718945> [Online; accessed 2021-09-01].
- [49] Margit Kristensen and Morten Kyng. 2009. Media Spaces, Emergency Response and Palpable Technologies. In *Media Space 20 + Years of Mediated Life*, Steve Harrison (Ed.). Springer, London, 325–349. https://doi.org/10.1007/978-1-84882-483-6_20 DOI: 10.1007/978-1-84882-483-6_20.
- [50] Alison Lee, Andreas Girgensohn, and Kevin Schlueter. 1997. NYNEX portholes: initial user reactions and redesign implications. *Proceedings of the international ACM SIGGROUP conference on Supporting group work: the integration challenge*, 385–394.
- [51] Heidi Lucja Liedke. 2020. The Tempest (2020) by Creation Theatre: Live in your Living Room. *Miranda. Multidisciplinary peer-reviewed journal on the English-speaking world* 21 (13 10 2020). <https://journals.openedition.org/miranda/28323>
- [52] Geert Lovink. 2020. The anatomy of Zoom fatigue. <https://www.eurozine.com/the-anatomy-of-zoom-fatigue/> [Online; accessed 2021-09-09].
- [53] Joe Malia. 2012. Notes on videophones in film. *BERG blog* (2012). <http://berglondon.com/blog/2012/03/13/notes-on-videophones-in-film/> [Online; accessed 2021-09-09].
- [54] Leo Marks. 2012. *Between Silk and Cyanide: A Code Maker's War 1941-45*. The History Press.
- [55] Michael Massimi and Carman Neustaedter. 2014. Moving from talking heads to newlyweds: exploring video chat use during major life events. *Proceedings of the 2014 conference on Designing interactive systems*, 43–52. <https://doi.org/10.1145/2598510.2598570>
- [56] Daniel Miller and Jolynna Sinanan. 2014. *Webcam*. John Wiley & Sons.
- [57] Julius Molnar. 1969. *Picturephone Service - A New Way of Communicating*. Technical Report. <https://www.beatriceco.com/bti/porticus/bell/pdf/picturephone.pdf>

- [58] Torin Monahan. 2015. The Right to Hide? Anti-Surveillance Camouflage and the Aestheticization of Resistance. *Communication and Critical/Cultural Studies* 12, 2 (3 4 2015), 159–178. <https://doi.org/10.1080/14791420.2015.1006646>
- [59] Torin Monahan. 2018. Ways of being seen: surveillance art and the interpellation of viewing subjects. *Cultural Studies* 32, 4 (4 7 2018), 560–581. <https://doi.org/10.1080/09502386.2017.1374424>
- [60] Carman Neustaedter, Carolyn Pang, Azadeh Forghani, Erick Oduor, Serena Hillman, Tejinder K. Judge, Michael Massimi, and Saul Greenberg. 2015. Sharing Domestic Life through Long-Term Video Connections. *ACM Transactions on Computer-Human Interaction* 22, 1 (17 2 2015), 3:1–3:29. <https://doi.org/10.1145/2696869>
- [61] A. Michael Noll. 1992. Anatomy of a failure: picturephone revisited. *Telecommunications Policy* 16, 4 (1 5 1992), 307–316. [https://doi.org/10.1016/0308-5961\(92\)90039-R](https://doi.org/10.1016/0308-5961(92)90039-R)
- [62] William Odom, Richard Banks, Abigail Durrant, David Kirk, and James Pierce. 2012. Slow technology: critical reflection and future directions. *Proceedings of the Designing Interactive Systems Conference*, 816–817. <https://doi.org/10.1145/2317956.2318088>
- [63] James Pierce and Eric Paulos. 2014. Counterfunctional things: exploring possibilities in designing digital limitations. *Proceedings of the 2014 conference on Designing interactive systems*, 375–384. <https://doi.org/10.1145/2598510.2598522>
- [64] James Pierce and Eric Paulos. 2015. Making Multiple Uses of the Obscura 1C Digital Camera: Reflecting on the Design, Production, Packaging and Distribution of a Counterfunctional Device. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, 2103–2112. <https://doi.org/10.1145/2702123.2702405>
- [65] Shauna M. Rice, Emmy Graber, and Arianne Shadi Kourosh. 2020. A Pandemic of Dystopia: “Zooming” into the Perception of Our Appearance. *Facial Plastic Surgery & Aesthetic Medicine* 22, 6 (1 12 2020), 401–402. <https://doi.org/10.1089/fpsam.2020.0454> publisher: Mary Ann Liebert, Inc., publishers.
- [66] Sean Rintel. 2013. Video Calling in Long-Distance Relationships: The Opportunistic use of Audio/Video Distortions as a Relational Resource. *The Electronic Journal of Communication / La Revue Electronique de Communication (EJC/REC)* 23, 2 (1 6 2013). <https://www.microsoft.com/en-us/research/publication/video-calling-in-long-distance-relationships-the-opportunistic-use-of-audiovideo-distortions-as-a-relational-resource/>
- [67] Sabirat Rubya and Svetlana Yarosh. 2017. Video-Mediated Peer Support in an Online Community for Recovery from Substance Use Disorders. *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*, 1454–1469. <https://doi.org/10.1145/2998181.2998246>
- [68] Daniel Russell, Carman Neustaedter, John Tang, Tejinder Judge, and Gary Olson. 2021. Videoconferencing in the Age of COVID: How Well Has It Worked Out? In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–2. <https://doi.org/10.1145/3411763.3450398> [Online; accessed 2021-09-09].
- [69] L. M. Sacasas. 2020. A Theory of Zoom Fatigue. <https://theconvivialsociety.substack.com/p/a-theory-of-zoom-fatigue> [Online; accessed 2021-09-09].
- [70] Shruti Sannon, Natalya N. Bazarova, and Dan Cosley. 2018. Privacy Lies: Understanding How, When, and Why People Lie to Protect Their Privacy in Multiple Online Contexts. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3173574.3173626>
- [71] Jaeyoon Song, Christoph Riedl, and Thomas W. Malone. 2021. Online Mingling: Supporting Ad Hoc, Private Conversations at Virtual Conferences. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–10. <https://doi.org/10.1145/3411764.3445776>
- [72] Susan Sontag. 1977. *On photography*. Macmillan.
- [73] Hito Steyerl. 2013. Shattered images and desiring matter: A dialogue between Hito Steyerl and Domitilla Olivieri. *Carnal aesthetics: Transgressive imagery and feminist politics* (2013), 214–225.
- [74] Bob Stults. 1986. *Media Space*. Technical Report. <https://people.cs.vt.edu/~jsrh/Downloads/Media%20Space%20Report.pdf>
- [75] Marc Teyssier, Marion Koelle, Paul Strohmeier, Bruno Fruchard, and Jürgen Steimle. 2021. Eyecam: Revealing Relations between Humans and Sensing Devices through an Anthropomorphic Webcam. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3411764.3445491>
- [76] Jim Thatcher, David O’Sullivan, and Dillon Mahmoudi. 2016. Data colonialism through accumulation by dispossession: New metaphors for daily data. *Environment and Planning D: Society and Space* 34, 6 (1 12 2016), 990–1006. <https://doi.org/10.1177/0263775816633195>
- [77] James Vincent. 2020. Nvidia says its AI can fix some of the biggest problems in video calls. <https://www.theverge.com/2020/10/5/21502003/nvidia-ai-videoconferencing-maxine-platform-face-gaze-alignment-gans-compression-resolution> [Online; accessed 2021-09-09].
- [78] Kieran Walsh. 2021. How Skype lost its crown to Zoom. *Wired UK* (2021). <https://www.wired.co.uk/article/skype-coronavirus-pandemic>
- [79] Sarah Wiseman and Sandy J. J. Gould. 2018. Repurposing Emoji for Personalised Communication: Why [Pizza emoji] means “I love you”. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–10. <https://doi.org/10.1145/3173574.3173726>
- [80] Leslie Wöhler, Martin Zembaty, Susana Castillo, and Marcus Magnor. 2021. Towards Understanding Perceptual Differences between Genuine and Face-Swapped Videos. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–13. <https://doi.org/10.1145/3411764.3445627>
- [81] Matin Yarmand, Jaemarie Solyst, Scott Klemmer, and Nadir Weibel. 2021. It Feels Like I am Talking into a Void: Understanding Interaction Gaps in Synchronous Online Classrooms. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–9. <https://doi.org/10.1145/3411764.3445240>

- [82] Shoshana Zuboff. 2015. Big other: surveillance capitalism and the prospects of an information civilization. *Journal of Information Technology* 30, 1 (13 2015), 75–89. <https://doi.org/10.1057/jit.2015.5>
- [83] Shoshana Zuboff. 2019. *The age of surveillance capitalism: The fight for a human future at the new frontier of power*. Profile books.