Brainmedia

One hundred years of performing live brains, 1920–2020

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Conclusion

In *Brainmedia: One Hundred Years of Performing Live Brains, 1920–2020*, I have examined how scientists, science educators, and artists perform knowledge of the brain at work. My main argument is that approaching the history of brain and mind sciences as a history of live brains helps to see the extent of media's imbrication in thinking the brain at work – not only of (medical) media technologies, but also recording and broadcast media. By describing and analyzing assemblages of brains and media in particular historical contexts as brainmedia, I have shown how specific practices *of* and ideas *about* mediation impacted how scientists and science educators conceptualized and demonstrated the active human brain. My five historical case studies of brainmedia assemblages spanning the period of 1920 to 2020 substantiate my thesis. I analyzed illuminated brain models from the 1920s until the 30s; staged brainwave recordings from the 30s to the 40s; live brains *on* television and conceptions of brains *as* television in the 40s and 50s; EEG feedback circuits and the rise of real-time interfaces around 1970; and "brain-to-brain" art-science experiments between 2013 and 2019.

While previous critical studies of twentieth century brain and mind sciences have emphasized the rhetoric of transparency and immediacy as having shaped the promise of watching the brain in action, my analysis of brainmedia points to the importance of liveness as a structuring element in enacting and staging the brain at work. I showed how research into cerebral processes and demonstrations of active brains were impacted by different forms of liveness, that is, the different historically situated temporal-spatial configurations offered by different conceptions and practices of mediation. I argue that when brains are rendered "live," they not only become transparent or immediate, but they also gain dimensions of directness, nearness, here-ness, aliveness, liveliness, and now-ness. In my analysis of live brains, I move away from a confined view of scientific (brain) image making. Instead, I establish the urgency of analyzing performing knowledges of the live brain. My study moves between scientists conceptualizing active brains in laboratories and scientific publications, and practices of developing, demonstrating, and exhibiting live brains in public. I thus take an inclusive and recursive approach to circulating knowledges as they are performed, mediated, and configured within and beyond the science establishment.

Ultimately, my account of brainmedia offers an alternative genealogy of the contemporary live brain. My histories of different forms of liveness show how the idea of the active brain depended on different cultural as well as technical spatio-temporalities and spatio-tempo-realities at different points in time over the past century. My analysis reveals how such forms of liveness are connected to emerging new media and concepts of mediation. The verbs in my chapter titles denote the historical assemblages that enabled these new forms of liveness: displaying,

demonstrating, broadcasting, interfacing, and synchronizing. Chapter 2 describes how the 1920s and 30s rise of new display devices (such as light indicators, illuminated circuit diagrams, and signaling systems) in city life were thought to offer new abstractions of active processes. These forms of technical mediation also impacted the way brain activity could be conceptualized and represented: visualized activities could now be viewed as immediate while being mediated, a form of liveness that I call a "logic of instant display." Chapter 3 explains how 1930s demonstrations of brainwave-measuring technologies (in texts, exhibitions, and a Hollywood film) wavered between attributions of "liveliness" (virtuously vivid demonstration strategies) and "aliveness" (the uncanny dimension that viewers were supposed to negotiate wisely). In Chapter 4, an experiment with a live TV broadcast of a brain-x-ray shows how the medium of television offered a vision of a networked intimacy between nearby screens and distant machines in the 1950s. At the same time, a number of scientists could perceive brains as TV-like scanning machines vulnerable to disturbance by flickering light (jittery images on a TV screen, for example), thus shaping an image of the brain as having a particular operative accessibility and also susceptibility. In Chapter 5, a new form of liveness manifests around 1970 in (artistic) EEG-feedback set-ups interfacing with the brain which presented brain activity as part of circuited energetic flows in media environments. At the same time, emerging brain–computer interfaces introduced the technical temporality of "real-time" into the brain–machine circuit, enabling micro-temporal measurements below human consciousness and new imaginaries of feedback. In the concluding case study, in Chapter 6, I analyze the contemporary discourse on "real-world neuroscience" and its search for more naturalistic social neuroscience experiments of synchronizing brains. Here, a new, "real-world" liveness is enacted through an artistic performance of a crowdsourced experiment, buttressing the claim to more life-like brain measurement.

In each of my case studies, I argued that the forms of liveness acquired in and through these assemblages of brains and media shaped new, historically variable types of "live brains" – that is, visions of brains that are, for example, more intimately connected to media; or more open to categorization, circuiting and training; brain activities that are strangely separate from bodies, or bodies that feel ever-more embrained. However, my analysis not only shows how these new visions of brains are produced, it also reveals emerging conceptions of media and mediation: respectively, conceptions of how to interpret abstractions on displays; how to marvel at projected brainwaves; how to approach the TV screen; how to dissolve into a media-technical environment; and how to engage with an artistic media installation. Rather than studying "representation in (neuro)scientific practice," my analysis offers a view of the complexly enmeshed media in hybrid processes of performing the live brain in- and outside the laboratory. The particular forms of liveness integral

to histories of live brains described here – instant display, liveliness/aliveness, networked intimacy, operative accessibility, circuited flow, real-time temporality, and real-world liveness – mark crucial junctures in the past century of brainmedia. My methodological proposal for a material-discursive approach to brainmedia also enables future studies of different or alternative forms of liveness. It is with this prospect in mind that I offer my genealogy of contemporary brainmedia: to contribute to a better understanding of the political scientific imaginaries shaped by the live brain today.

Understanding contemporary live brains

Here, I return to the first image discussed in this dissertation, the 1920 image of a female writer, a working woman with a working brain sketched inside her head. It opened Chapter 1, which located the emergence of a conception of a "live brain" in the early decades of the twentieth century. At a time when media were omnipresent (as were narratives about media technologies' ubiquity), the image of the neurological body became newly paired, I argued, with a conception of a "live brain": a body whose nervous system was understood as intimately imbricated with a network of mediating technologies, and whose active brain was about to be captured in action. The modern human subject – whose nervous system connected to the outside world via the senses – was understood as utterly caught up in, as well as changed by, a media-saturated environment. This particular environmental conception of media – media as milieu – has been an undercurrent of my analysis of brainmedia.

The brainmedia assemblages described in the preceding chapters address media not primarily as (new) media devices, but as medial presences in human life. By showing these assemblages of brains and media – of brain activity and active brains – as they were performed in and through specific historical mediations, I show how media have at key points been positioned as a type of nervous middle that exceeds their role as object or technology. Ultimately, these brainmedia are examples of what Jennifer Gabrys has called "atmospheric media": fields of relations shaping a *mediality* that inhabits humanity as its habitat.[1] I have historicized such fields of relations in this study by tracing particular discourses about mediation in relation to scientific brain research and performances of sciences in- and outside the laboratory. The brainmedia assemblages that emerge from my five case studies clearly have such an atmospheric role: as illuminated presences in city life, spheres of broadcasting, artistic media environments, interface assemblages,

[1] Gabrys cites Régis Debray: "Mediological man does not cohabitate with his technological surroundings, he is inhabited by his habitat; constructed by the niche he has constructed." Regis Debray, *Media Manifestos: On the Technological Transmission of Cultural Forms* (London: Verso, 1996), 11. cited in Jennifer Gabrys, "Atmospheres of Communication," in *The Wireless Spectrum: The Politics, Practices, and Poetics of Mobile Media*, ed. Barbara Crow, Michael Longford, and Kim Sawchuk (Toronto: University of Toronto Press, 2010), 53.

and (in the last chapter) as computational data infrastructures at the basis of a "real-world neuroscience" that allow potential correlations between social and neural data, and feed into future measurements of brain activity.

My historical approach to live brains emphasizes the different ways media have been conceptualized as fields of relations. The alpha-loving brainmedia environments envisioned in the 1970s were based on different approaches and different conceptions of atmospheric media than contemporary performances of EEG measurements. Yet taken together, these successive descriptions of brainmedia also present a historical backdrop to the intimate imbrication of the (conceptualization of the) sensing brain and technological mediation in the twentieth century. I thus add to the current work of media-theoretical scholars (such as Mark Hansen, Marie-Louise Angerer, Patricia Clough, and N. Katherine Hayles) who have proposed that the present media-technological landscape impacts the human nervous system in ways not only quantitatively but also *qualitatively* different than in previous periods in media history. Hansen, for example, sketches a present in which ubiquitous computational media impinge upon sensory experience and the "sensing brain" at micro-temporal, pre-perceptual levels.[2] By his account, we can no longer speak of media as devices or objects that extend the human sensorium in today's computational media landscape, we should instead interpret our media-saturated present as presenting a new technical mediality, a continuous background presence of informational flows that address the sensing brain and affect our experience of (and being in) the world without those mediations becoming perceptible. For Marie-Louise Angerer, this qualitative shift in mediation structures even constitutes a new "affective *dispositif*," an intertwining of media with power, law, and truth that effects both institutional practices as well as conditions of subjectivation.[3] In light of these studies, my argumentation in *Brainmedia: One Hundred Years of Performing Live Brains, 1920–2020* contributes to a view of the longer twentieth century emergence of such an affective dispositif by showing how new temporalities of mediation – new forms of liveness – came into being in relation to active-brain research.

I have shown how brainmedia conjoined with forms of liveness and allowed for conceptualizing particular intimacies between media and brains, as well as visions of active brains that were impressionable and could be viewed at work – all before today's omnipresent computational media and before the circulation of blinking functional brain images in the 1990s. Consequently, my brainmedia genealogy offers an alternative path to answer the questions that

[2] "qualitative" shift and "sensing brain" in Mark Hansen, "Ubiquitous Sensation: Towards an Atmospheric, Collective and Microtemporal Model of Media," in *Throughout: Art and Culture Emerging with Ubiquitous Computing* (Cambridge, MA: MIT Press, 2013), 72; ibid., 67.
[3] Marie-Luise Angerer, *Desire after Affect* (London: Rowman & Littlefield International, 2015), xv.

arise when faced with a media environment operating on levels that are beyond consciousness and that make it hard to envision, as Angerer puts it (drawing on Deleuze), a way to "deviate from the great wave" of "all-encompassing modulation."[4] My historical approach to brainmedia as assemblages makes it possible to study the constitution of forms of liveness through the lens of performing knowledges. By carefully considering the ways we are asked to engage with performances of live brains, we might start to see beyond the space of engagement marked out for us.

Engaging live brains today

When people asked me what my dissertation was about, I would usually describe my project as a history of showing and staging the active brain, or a history of scientists and other researchers employing new media to understand brains. More often than not, the response was an enthusiastic yet puzzled "That's so fascinating." And indeed, *fascination* seems to be the endemic mode of engagement assigned to the public display of images and imaginaries of seeing the brain at work. The most common use of the word fascination today, according to the Oxford English Dictionary, is "to attract and 'hold spellbound' by delightful qualities; to charm, enchant."[5] In my Introduction, I described how functional brain images, especially fMRI and PET since the Decade of the Brain, were positioned as a type of *eidola*, viewed as exerting undue persuasive powers over the spectator, temporarily short-circuiting the rational thinking of laypeople or even scientists. Fascination signals the fact that narratives about brain science have a proximity to the spectacular, what Jonathan Crary has called "an organization of appearances that are simultaneously enticing, deceptive, distracting, and superficial."[6] We say we are fascinated, as philosopher Ackbar Abbas notes, when we appreciate something but do not have much to say, or, alternatively, when there is too much to say. Being fascinated is an "enigmatic experience," it "captures our attention without at the same time submitting entirely to our understanding."[7] For Abbas, fascination is "neither knowledge nor ignorance," but conjures a "*paracritical* mode of attention" shaping an "enigmatic relation to what we do not know."[8]

In critical accounts of the brain and mind sciences, it is precisely this paracritical mode of attention to the unknown that fascinating public appearances of the brain conjure up, which is

[4] "Postscript: A New Affective Organization," in *Desire after Affect* (London: Rowman & Littlefield International, 2015), 130.
[5] Oxford English Dictionary, *"Fascination, N."* (Oxford University Press).
[6] Jonathan Crary, "Spectacle," in *New Keywords. A Revised Vocabulary of Culture and Society*, ed. Tony Bennett, Lawrence Grossberg, and Meaghan Morris (Malden, Oxford, Victoria: Blackwell Publishing, 2005), 335.
[7] M. A. Abbas, "Dialectic of Deception," *Public Culture* 11, no. 2 (1999): 348.
[8] Ibid.

viewed as suspect. Scientists use the power of fascination to frame future-oriented endeavors, for example, about the eventual possibility of viewing the mind at work in the brain. Fascination sustains what Nicolas Rose calls the "promissory culture" of technoscience and biotechnology in which brain science partakes, a domain in which groundbreaking transformations are predicted, always "imminent," but "just out of reach."[9] To say that brain images are fascinating means to be dazzled by the sight of something that might be known. Michael Hagner and Cornelius Borck have dubbed this promissory logic in neuroscience a "proleptic structure," emphasizing the present-day conception of neuroscience as based on a promise that is not yet fulfilled, as a science that anticipates "a future of comprehensive understanding,"[10] At the same time, neuroscience's proleptic structure is not only due to its promise of revelation, Borck and Hagner contend, but also its ever-present enigma: while gaining more understanding of the brain, researchers at the same time get a better grasp of the *difficulties* in understanding the brain, thus framing the issue as a secret to be uncovered. This dialectic between mystery and revelation is crucial to brain discourses, a "chronic anticipation of the solution to one of the last big mysteries of mankind."[11]

With *Brainmedia: One Hundred Years of Performing Live Brains, 1920–2020* I augment these critiques with a situated historical view of experiencing brains at work. Fascination and its paracritical mode of attention is itself inscribed in historical narratives about engagement and discourses of wonder about the live brain. Earlier, I aligned myself with historians of public performances of new (media) technologies and historians of staging science all rallying for no longer approaching the spectacular and the fascinating with a sweeping critique of the "spectacle-as-commodity," but by historicizing experiences of the spectacular and the fascinating instead. My study of live brains as instances of performing knowledges was in pursuit of such a historicized approach to shifting fascinations with the technologically mediated active brain. It has allowed me to study the circulation of knowledge about the active brain between scientific publications and platforms for making science public.

Focusing on such circulation and boundary work has also allowed me to pay significant attention to the way the fascinated layperson – often standing in for any subject with a brain addressed by brain research – was invoked at various historical junctures. In Chapter 3, for example, I show how 1930s accounts of EEG as a new research technology asked readers and viewers to be amazed by a new scientific accomplishment while at the same time not attributing

[9] Nikolas Rose, *The Politics of Life Itself: Biomedicine, Power, and Subjectivity in the Twenty-First Century* (Princeton University Press, 2009), 79.
[10] Michael Hagner and Cornelius Borck, "Brave Neuro Worlds," in *Der Geist Bei Der Arbeit: Historische Untersuchungen Zur Hirnforschung*, ed. Michael Hagner (Göttingen: Wallstein, 2006), 36. Cornelius Borck, "Through the Looking Glass: Past Futures of Brain Research," *Medicine Studies* 1, no. 4 (2009): 330.
[11] Hagner and Borck, "Brave Neuro Worlds," 36.

too much mind-reading power to the new technologies with which they were presented. Later, analyzing a contemporary art-science project in the recent field of brain-to-brain synchronization research in Chapter 6, I show how participants of a public scientific experiment are viewed as being educated about the uncertainties of a "science in the making," while at the same time being asked to perform a civic duty in contributing to brain research. These interpellations of non-experts signal the power of scientific discourse in instituting normative views of *how* one is supposed to engage with science on display.

In the end, my situated view of moments of performing knowledges opens up a better understanding of the modes of engagement, as well as the demarcations of knowledges, inscribed in science demonstrations. My analysis prompts a set of questions about engagement with contemporary practices of neuroscience: What types of publics are evoked? How are publics asked to understand brain science on display? How are they supposed to engage with new technological media? I contend that identifying this boundary work in circulating and performing knowledges is a first step towards Angerer's "deviating from the great wave" of the current assembling of brains with computational media. It is recognizing and acknowledging such demarcations in particular assemblages of brains and media, especially when brainmedia are performed in public, that can open up a new view of a situated politics of fascination.

Recently, philosopher and historian of science Isabelle Stengers has urged us to think of engagement in terms of fostering "public intelligence."[12] Here, the "public" is no infantile crowd, nor an attentive body of laypeople eager and capable to participate. Rather, Stengers shows how the current form of scientific life has fostered an atmosphere in which scientists are ever more restricted by the funding opportunities of the knowledge economy and more than ever need to uphold a "fable of 'free' research" and an imaginary of curiosity-driven research of the "mysteries of the world."[13] What is lacking is the work of what Stengers' calls "demanding connoisseurs" who would "hold scientists to the task of taking care when making normative judgements about what does or does not matter, or of presenting their results in a lucid manner that actively situates them in relation to the questions they really can answer, rather than as a response to whatever is the object of a more general interest." Connoisseurs are those who can both appreciate the originality of an idea and pay attention to questions it does not take into account. Public intelligence then means fostering a milieu of connoisseurs dense enough to approach particular scientific propositions with intelligence.

[12] Isabelle Stengers, *Another Science Is Possible: A Manifesto for Slow Science* (Cambridge: Polity Press, 2018).
[13] Ibid., 6.

Stengers is suspicious of that which fascinates. The first challenge is for the public "to not let itself be fascinated," by Science with a capital S, "not to be too easily impressed."[14] As my analysis of the entwined histories of forms of liveness and active brains has shown, however, being impressed and fascinated are integral parts of performing knowledges and brainmedia. Perhaps what we need in order to critically engage contemporary live brains is to learn how to be *intelligently fascinated*. Stengers speaks of connoisseurs meeting scientists in the spirit of a "shared perplexity."[15] It is in this spirit of intelligent fascination and shared perplexity that I propose to engage brainmedia today.

[14] Isabelle Stengers and Penelope Deutscher, "Another Look: Relearning to Laugh," *Hypatia* 15, no. 4 (2000): 53.
[15] Isabelle Stengers, *Invention of Modern Science* (Minneapolis: University of Minnesota Press, 2000), 65.