Introduction

Florian Sprenger and Christina Vagt

> A body is never moved naturally, except by another body which touches it. Any other kind of operation on bodies is either miraculous or imaginary.
>
> —Gottfried Wilhelm Leibniz

When Gottfried Wilhelm Leibniz in his exchange with Samuel Clarke in 1715/1716 famously attacked Newton's theory of gravity for introducing "imaginary operations" and "occult forces" into physics, he evoked the classic Aristotelian ban of action at a distance: Every motion requires a conjoined mover. No action can occur without a loss of force and thus without duration. Only by postulating some underlying medium could the effects of gravity, as well as electricity and magnetism, be conceived as contact forces or action through contact. Aristotle's dictum was translated into modern physics: Every transmission of a force from the location of its cause to that of its effect requires a medium to ensure its interaction. In the context of this debate, media were regarded as mediating instances that enabled what was called communication. If cause and effect were not immediately connected but rather spatially separated from one another—as in the case of gravitation, magnetism, or electricity, for instance—then there had to be a medium to ensure both the transmission of the force and the causal connection.

x Even though it is a matter of debate if Newton believed what Leibniz attacked him for, his thinking, exemplary for modern physics, revolved around media: Newton used the terms "ambient medium," "refracting medium," or "transparent medium" (each written with lowercase letters) to refer to mechanical transmission capacities that infuse everything, leaving no empty spaces. At the same time, he used the term *medium* (both in English and Latin) when speaking about transmission media or intermediate media such as air, glass, or the ether. Clarke, as a substitute for Newton in the debate with Leibniz, summarized this necessity as follows: "Nothing can any more *Act,* or be *Acted upon,* where it is not present; than it can *Be,* where it is not" (Leibniz and Clarke 1956, 21). The spirits, ethers, and media introduced by Newton create such a material connection and in turn inaugurate, with the proximal effect explained by them, an action at a distance by means of an imperceptible medium. The intermediary is no longer simply spatial but also transmits forces such as gravitation, electricity, or light (see Spitzer 1948).

If things seem to act at a distance—if gravitation, magnetism, or electricity can overcome distances without evidencing a visible cause for doing so—then the question of the causalities, continuities, and materialities of this action gains considerable significance. Modern physics as a systematic science has to develop criteria for determining which forces are subject to a medium and which actions were simply miraculous or inexplicable. In this context, the philosophical debates about the *structure* of space and time were updated in light of their historical background and thus, as far as the present day is concerned, made legible in implicitly media-theoretical terms. They were propelled by a sense of unease about the material conditions needed for forces to be mediated over distances. For, if no force could be identified to account for such mediation, then the path was cleared for divine intervention, magic, and miracles.

In the course of the development of electrodynamic theories and technologies during the eighteenth and nineteenth centuries,

physics operated successfully within the framework of Newtonian mechanics and the speculative assumption of an intermediary—the ether—as the underlying medium that acts through contact on certain bodies. But the fact that nobody had ever seen or measured it occupied physicists and philosophers alike by evoking dazzling proofs and thought experiments from Immanuel Kant to Hendrik Lorentz (see Vagt 2007). After special relativity finally abolished the ether as physical medium, Albert Einstein famously attacked the theoretical physics of Niels Bohr and others, stating that quantum mechanics with its presupposed quantum states of "superposition" and "entanglement" of particles contained some "spooky" action at a distance (see Barad 2007, 317–31). Even though these physical debates took place at different times and on different scales (macro- and microphysics) they both stress the media question concerning modern physics: How is it possible that objects interact with each other from a distance, without touching?

When physics describes how things act on each other, how objects exert forces on other objects, it has to take the materiality of transmission into account. Physics, compelled to think about media, is one of the fields of knowledge in which terms of media are forged. This book follows some of the trajectories *action at a distance* has taken from physics to questions of human interaction, the binding and breaking of time and space, and the entanglement of the material and the immaterial in physics and aesthetics. The three texts each deal with historical constellations in which the mediality of transmission and the materiality of communication are debated as questions of acting at a distance—an action, it turns out, whose agency lies in a medium. They discuss different episodes of the epistemological history of mediation, and move through different modes of causation from the immateriality of the mind to the materiality of infrastructures and follow the trajectory of the transmission of forces. The common question that brings them together deals with the conceptual history of mediation: they trace the epistemological transformations of what *mediation* (and the related terms *communication* and *causation*) means in

different historical contexts. How is mediation represented and narrated, how does it challenge the boundary of the material and the immaterial, and how does it change in relation to technologies of mediation? In all three texts, the distance that mediation implies, the meanwhile, the difference and the in-between, turn out to be both the challenging and dis-unifying potential of mediation and the source of its technical implementations.

With the advent of electromagnetic telegraphy in the 1830s, a notion emerging from the history of the sciences of electricity diffused into popular knowledge: the instantaneous transmission of electric action. Ever since Stephen Gray, as described by Florian Sprenger's essay, explored the possibility of electric transmissions through copper wires in 1730, the speed of electricity was an item of interest and subject of investigation. Speed was conceived as the possibility of nonspeed, as instantaneity means to neglect speed. Instantaneity means that transmission does not take any time. Electricity and telegraphy were described as timeless and thus having no speed. There is a small difference between slow speed and no speed, but this difference means everything to physics. Because nothing can take place in two places simultaneously and because any distant effect requires a medium, the experiments that Sprenger's paper describes were stalked by phantasms of instantaneity, immediate transmission, and *actio in distans*. Simultaneity thus becomes a matter of cultural techniques of synchronization.

As John Durham Peters shows, such means of control of simultaneity—be it through knowledge, narration, or action—are deeply embedded in Western history. His text engages with a host of examples of what he calls "meanwhile structures" situated at the intersections of time and space. For knowledge and for narration, time and space are no barriers and action at a distance is a way of synthesizing them: Being at two places at the same time turns out to be necessary to narrate stories and know the world—knowledge and narration, again, have an agency that acts also at historical distances. But being at two places at the same time is only possible under the rarest of conditions: when one can work in the no-speed

mode of instantaneous access of nonlinear movement. Most efforts at action at a distance are, instead, subject to the demons of microtime, who mischievously filter, distort, block, warp, or delay action at a distance.

Action at a distance through language and communication, concepts and models is typically human. German philosopher Hans Blumenberg introduced the Latin neologism *actio per distans* as a philosophical term that signifies a prominent type of preemptive action among humans: action in absence of the object that is acted upon. Christina Vagt's paper discusses this version of action at a distance in the form of concepts, models, and simulations in the field of today's biosciences, where models determine under which conditions material action takes place. When an Australian banksia cone suddenly opens its follicles after a wildfire to release its seeds, cause and effect are evident to the careful observer (the fire gets rid of the competition), but *how* something that is technically dead can perform this kind of dynamic motion does appear somehow magical—until imaging and modeling technologies finally enable the scientists to procure a viable model. Addressing the media question underlying material research in the age of computer simulation moves the discussion away from *actio in distans* and the inherent causality, instantaneity, and simultaneity debates of theoretical physics and toward aesthetic procedures that mediate between matter and mathematics and between scientists and their epistemic objects.

The term *medium,* this book argues, is—at least partly—a historical effect of the philosophical and physical challenges of actions across distance, but it also conveys a certain ambivalence: The term *medium,* Leibniz claimed, was always in danger of being used willy-nilly to explain a situation that might otherwise seem to be miraculous on account of its unknown logic, causality, or mode of operation:

> If the *Means,* which causes an *Attraction* properly so called, be constant, and at the same time inexplicable by the Powers of Creatures, and yet be true; it must be a

> perpetual *Miracle*: And if it is not miraculous, it is false. 'Tis a Chimerical Thing, a Scholastick *occult Quality*. (Leibniz and Clarke 1956, 94)

Miracles, Leibniz thought, were evoked when a mediating principle was needed to explain physical phenomena without explaining their specific operations. Associated with this danger was the fact that the mediation of a physical effect could only be explained by replacing the miraculous with a medium that was itself unexplained. The mediation might have occurred in an inexplicable manner, but the medium did not appear to be miraculous because, by means of its alleged physical properties, it was more or less able to explain the phenomenon in question. Although the mediation of the medium took place in an inexplicable way, it seemed to explain one process or another by its mere introduction, and this was because media, according to the physics of the time, were defined as material connections that ensured the causality between cause and effect. To summarize Leibniz's critique: If media could be used in such a way to explain physical processes, then they served as "argumentative resources" (Cantor 1981, 152) for explaining the inexplicable while hiding, beneath the cloak of a medium of communication, the fact that the process in need of explanation was not explained at all but rather replaced by the postulation of a causal connection that was itself left unexplained. In all of its arbitrariness, the medium would thus come to acquire a sort of magical power, for it was used to explain the inexplicable simply by being mentioned—"groundless and unexampled" (Leibniz and Clarke 1956, 94). His advice is a theory of media: Never replace a miracle with a medium, and never mistake a medium for a miracle. The medium always has physical properties that mediate its actions even at a distance.

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