Buttons and Stimuli: The Material Basis of Electroconvulsive Therapy As a Place of Historical Change

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While the "pill" is emblematic of the pharmacological turn in psychiatry, in addition to lobotomy, electroconvulsive therapy (ECT) is considered iconic for somatotherapy and shock therapies in the mid-twentieth century. However, it not only represents a particular complex of ideas about forms of psychiatric treatment, but, due to the concrete technological object, was an essential element of the therapeutic act and psychiatric practice. The central features of electroconvulsive therapy were a technical device, the unusually strong electrical stimulus, and patients who experienced an epileptic seizure while unconscious.[1] The first machines for electrically induced convulsive therapy were developed and presented in 1938 and 1939 in Italy and Japan. Lucio Bini (1908–1964), Ugo Cerletti (1877–1963), and their colleagues in Rome, as well as the Japanese psychiatrists G. Yasukoti and H. Mukasa in Fukuoka pursued electro-technical strategies to replace pharmacological substances such as Metrazol as triggers for seizures.[2] Shortly before and at the beginning of the Second World War, this information was disseminated especially by refugees and emigrants. For example, the Krakow neurologist and psychiatrist Zenon Drohocki (1903–1978) had publications and blueprints among his documents during his attempt to escape to Switzerland via France (Borck 2005: 258). The Berlin doctor Lothar Kalinowsky (1899–1992) – who was first an employee of Cerletti in Rome and later emigrated to the United Kingdom and the United States – also campaigned for the Italian device during his escape (Peters 1992: 361–362). In the 1940s numerous psychiatrists had their first contact with electroconvulsive therapy and its device. However, the economic and political conditions of the Second World War often prevented or impeded a deep engagement with the new therapy as well as the continuation of international exchange, so that it was only in the late 1940s that it became an established or mature form of therapy. Yet the 1940s were the time when the ECT device took

shape in the respective national contexts and fundamental technological decisions were made. Thus, based on the development of the device, a period can be defined within which electroconvulsive therapy arrived at its form. This example can be used to pose the question of how the relationship was shaped between a therapeutic practice and a technological object. In what form did the development of treatment and that of enabling technology define each other? How did established therapeutic processes influence the design of the devices? How were local conditions – material and conceptual – integrated into the construction of the new device?

The development of ECT as a technological object will be considered with examples from the history of its development in Switzerland and Germany. The case studies come from the company *Siemens-Reiniger Werke*[3] in Erlangen, Germany, as well as from the psychiatric clinic Münsingen, Switzerland, and from the mental hospital [*Heil- und Pflegeanstalt* (HPA)] Eglfing-Haar near Munich.[4] In the following, the main interest in the relationship between therapeutic practice and technological factors will be further defined. Then I will clarify the conceptual basis of the investigation and further outline the historiographic research on the topic.

The starting point is the basic assumption that the introduction of ECT changed the concrete practice of convulsive therapy. In the historical example this relates to the following aspects: How was the pharmaco-therapeutic unit of measurement of the dose altered through the use of electricity and adapted along with the technical design? Furthermore, I will follow the interaction between clinical practice and technological development, meaning the co-evolution of psychiatric therapy and the technological object. I am neither assuming that the technical apparatus was a functional and symbolic expression of the ideological or epistemic system of psychiatry, nor that the therapy was unilaterally determined by the artifact. Also, the relationships between therapeutic knowledge, action, and technical artifact are historically contingent. As Benoît Majerus has shown, the history of material culture offers a way of understanding this and can allow insights into the relationships and connections between things and their human and non-human environment as well as the everyday experience of doctors, patients, and caregivers (Majerus 2017b: 272–273).

The topic of therapeutic technology and material culture has receinicved some attention in recent psychiatric historiography. The research followed broader developments in historical studies, where at the latest since the turn of the millennium material questions have been an increasing focus (Ludwig 2011: 6–7). In this field, a new materialism was proclaimed in a gesture of distinction. In contrast to or in expansion of a cultural history that mainly studies texts and images, now the focus

was on things, bodies, and practices (Daston 2004: 17; Sarasin 1999: 439; Stoff 1999: 145–146). Andreas Ludwig (2011: 7–8) and Simone Derix et al. (2016) offer an overview of these recent developments. In the history of science and medicine, research has been conducted on note-taking systems, materials, and substances (Rheinberger 2002; Stoff 2012; Hess/Mendelsohn 2013), and the history of psychiatry has also begun to explore the field (Topp et al. 2007; Majerus 2017a; Peter 2013). Psychiatric therapy in general, and electroconvulsive therapy in particular, have rarely been studied in terms of their practice or material culture. Conventional perspectives from medical history, economic history, and the history of ideas have dominated. In addition to the disciplinary development, in historical research on therapies the negotiation of success and effectiveness between doctors, patients, and relatives was considered a core problem (Braslow 1997; Pressman 1998; Schmuhl/Roelcke 2013). The fruitfulness of research perspectives that examine the practical and bodily dimensions of therapeutic work in psychiatry has been demonstrated in studies of the performance of insulin coma therapy as well as in studies about "tensions" and their "dissolution" in lobotomies, among others (Doroshow 2006; Meier 2015). Older works on medical history also provide points of reference, which, following the social history of technology in the 1990s, examined technical devices in medicine in the 19th and 20th centuries and, in addition to diagnostic instruments, also considered therapeutic devices in some cases (Blume 1992; Howell 1995; Stanton 1999).

The following chapter wants to supplement the previous works on the psychiatric history of the therapy with a focus on the question of how technological design changed the usage in concrete situations, meaning the therapeutic use of ECT devices by doctors and nurses on patients in psychiatric institutions.

Despite intensive engagement with somatic therapies, including the works of Joel Braslow and Jack Pressman, the historiographic discourse seems to remain polarized to the extent that affirmatively teleological or negative attitudes generally permeate the publications. By contrast, historiography in the 1990s in particular emphasized the historical contingency of knowledge and norms in psychiatric therapy and demonstrated how the effectiveness and success of certain therapeutic measures were the subject of discursive and social negotiations. Electroconvulsive therapy is still considered the cornerstone of a new biological neuro-psychiatry in recent works (Shorter/Healy 2013: 3–5; Rzesnitzek/Lang 2017: 67–68) and is rarely embedded in its historical context, in which psychoanalysis, cybernetics, and Nazism played important roles. In particular, examining the perspective on its material culture will allow these simplistic historiographical narratives on ECT to be expanded

and contrasted, since this involves considering the conceptual indeterminacy and potential diversity at the beginning of the development process in the 1940s.

In the following, I will conceptualize and operationalize this material dimension. Three points are central to this discussion: first, electroconvulsive therapy took place as a practice involving both people and things (Hirschauer 2004: 88–89). Second, it took place through and on historical bodies and machines. And third, the actual practice increased the contemporary knowledge about the body, the psyche, and machines (Haasis/Riesk 2015: 29–30). An example from an early publication by the Swiss psychiatrist Max Müller (1894–1980) on electroconvulsive therapy can illustrate this:

> Whether the seizure follows immediately or only after a latency is, as already suspected by Bingel and Meggendorfer, according to our investigations, directly associated with the current or duration used. The above-mentioned authors therefore rightly assume that increased dosages cause the latency to completely disappear. The question is only whether this is desirable; for us, the lack of latency, as already mentioned, is instead an indication of an overdose and of a subsequent overwhelming and not harmless seizure.
> (Müller 1941: 211–212)

As the quote by Max Müller shows, the proper use of the electroconvulsive therapy device as a historical norm of practice was dependent on a specific historical knowledge and by no means defined, but controversial within the discipline. But the "right" usage – that is, setting an adequate amount of current, while using as little as possible – was also determined by the space, the technical design of the device, the physical condition of the patients, the actions suggested by the switch design, and habits with other seizure-inducing substances. However, here this comprehensive perspective is limited to the question of how the technical design changed the material culture of the therapy. In order to pursue this focus, in particular I have examined the reflections of the French technical philosopher Gilbert Simondon (1924–1989) on the technological object and its development (1958 [2012]). Conceptualizations of the historical development of technical-human relations, such as the actor–network theory (ANT) developed in particular by Bruno Latour, and social-constructivist works have presented significant and fundamental insights into the social genesis of technology (König 2009: 49–52; Schulzer-Schaeffer 2008; Heßler 2012: 142–144). However, most of these works were remarkably uninterested in the technical and

functional design of the devices, their circuit, and ultimately their concrete material form, and instead focused on the needs and appropriations of users and their social consequences. Similar to cybernetic approaches, the devices were black-boxed as actors and their social position was examined in interconnections and social developments (Schmidgen 2012: 122–123). Georges Simondon set himself apart from both cybernetic designs and Martin Heidegger's philosophy of technology. His notion of a fundamental purpose-boundness and his interpretation of the technical as a subjugation of people and nature to technical rationality were replaced with a symmetrical and historicizing perspective by Simondon.[5] He positioned human beings "among the machines" in order to act meaningfully together with them. Ultimately, these technical objects only existed with human beings, but they went through an independent development that revealed their essence (Simondon 2012: 10–11). In this way, Simondon criticized first the assumed finality of the seemingly functionally fixed technical object, and secondly, he made possible an investigation of genetically unfolding variance inherent in the technical object as a process (Hörl 2011: 19–20). In his imagination, this evolution tended toward an increasing integration [*concrétion*] of discrete – logically and materially separate – parts of the technical object.[6] The genetic examination of this concretion of the circuitry, technology, and the form of the technical object is a methodological starting point for historical research and deals with the technical artifact as a subject of cultural-historical inquiry (Simondon 2012: 19–21). I will take up this approach in the following and follow it in the examination of the technical development of electroconvulsive therapy.

The Dose in Electroconvulsive Therapy

The examination in this first step will take place based on the technical attempts to determine the dose, which historically was an indeterminate unit of therapeutic practice. Thus, the changes in psychiatric therapy can be understood based on and through an altered understanding of the dose. In March 1939, physicians in the cantonal clinic in Münsingen received information about electrically induced seizure therapy for the first time, which had been developed over the previous few years in Rome. Lothar Kalinowsky had informed the head of the Swiss institution, Max Müller, about a finished device and its major advantages (Müller 1982: 244–249). However, only in September of the same year did Müller succeed in testing the new

device in a clinic in Milan.[7] Despite this, he had already ordered a device from the Italian company Arcioni in the summer of 1939 and eagerly awaited it, as illustrated by letters to the Swiss psychiatrist Oscar Forel (1891–1982) (Müller 1939a). What did he want to do with it? Convulsive therapy as a psychiatric practice was received throughout Europe beginning in the mid-1930s. Especially the cardiac drug Metrazol was injected in large doses (3 to 5 cc) in patients who suffered a grand mal seizure after a short period, usually accompanied by anxiety and unpleasant feelings (McCrae 2006: 71–72). The seizure, also called an epileptic seizure, was typically done on a wooden treatment table on which the patients were laid before treatment. First, the now unconscious patient thrust their arms and legs upward and writhed convulsively. Frequently doctors tied down the patients or nurses tried to hold their bodies still. Subsequently, the seizure slowly dissipated, accompanied by convulsions. The strong kinetic forces exerted by the patients' muscles during a seizure often led to dislocations, vertebral fractures, or even fractures of the long bones of the upper limbs. After a while, the patients regained consciousness. The medical history of 52-year-old Rosina M., who had been hospitalized in Münsingen since June 1939, is a remarkable source for the transition from pharmacologically to electrically induced convulsive therapy in the second half of the year (Kantonale Heil- und Pflegeanstalt Münsingen 9997, 1939). Rosina M. initially received some treatments with "sleep therapy" as well as with Metrazol convulsive therapy to alleviate her depressive feelings and suicidal thoughts. After an exhausting and complicated series of Metrazol, in November 1939 the psychiatrists decided to try ECT on Rosina. This step is very clearly noted in the patient file. While the rest of the page in her medical history is filled with typewritten descriptions of the failing attempt at Metrazol convulsive therapy, the following note appears in pencil at the bottom:

> 130 V (0,3) | 300
> (KHPA Münsingen 9997, 1939: 12)

But what does this mean? At this time, the psychiatrists in Münsingen used the device made by the Italian company Arcioni, as developed by Cerletti and Bini. A belt with electrodes at the height of the temple was put on the patient resting on a stretcher. The doctor set the voltage, strength, and duration of the electric stimulus on the quite large and heavy device on a trolley. Then they triggered the stimulus, and for a brief moment the current flowed. After a latency of 5 to 20 seconds, the

patient had a seizure. This Italian device, as well as the prototype from Siemens, included two circuits (Müller 1939b: 1). The first circuit with low voltages around 1 volt was used to measure the electrical resistance of the patient's skull. Based on Ohm's law, a direct proportionality between electrical resistance, voltage, and current was initially assumed. In the first considerations on using electroconvulsive therapy, the voltage and current entailed the highest potential for risk and were applied in as low doses as possible, which is why the electrical resistance of the patient's skull was an important variable for the Italian builders and the psychiatrists who performed the therapy.[8] The second so-called treatment circuit offered the ability to regulate the duration, voltage, and current of the circuit.[9] The note is thus a description of the electrical impulse used for Rosina M.'s treatment: 130 volts at 300 milliamps for 0.3 seconds were the settings for the treatment dose of electric current. But the question arises of what this information meant for electroconvulsive therapy. For contemporary psychiatrists, this information was also hardly self-explanatory, because electrical stimuli differ significantly in their characteristics from pharmacological substances, with which doctors had previously gained experience. From this position of a lack of knowledge, the psychiatrists initially devoted themselves enthusiastically and meticulously to the measurement and calculation of the stimulus before the actual treatment. With the measuring circuit, the electrical resistance of the patient's skull was measured at 1 volt in order to have a basis for calculating the electrical stimulus. On this basis, the physician was to attempt to get as close as possible to the therapeutic dose for the individual patient, which meant gradually bringing the human and a machine into alignment (Ewald/Haddenbrock 1942: 641).

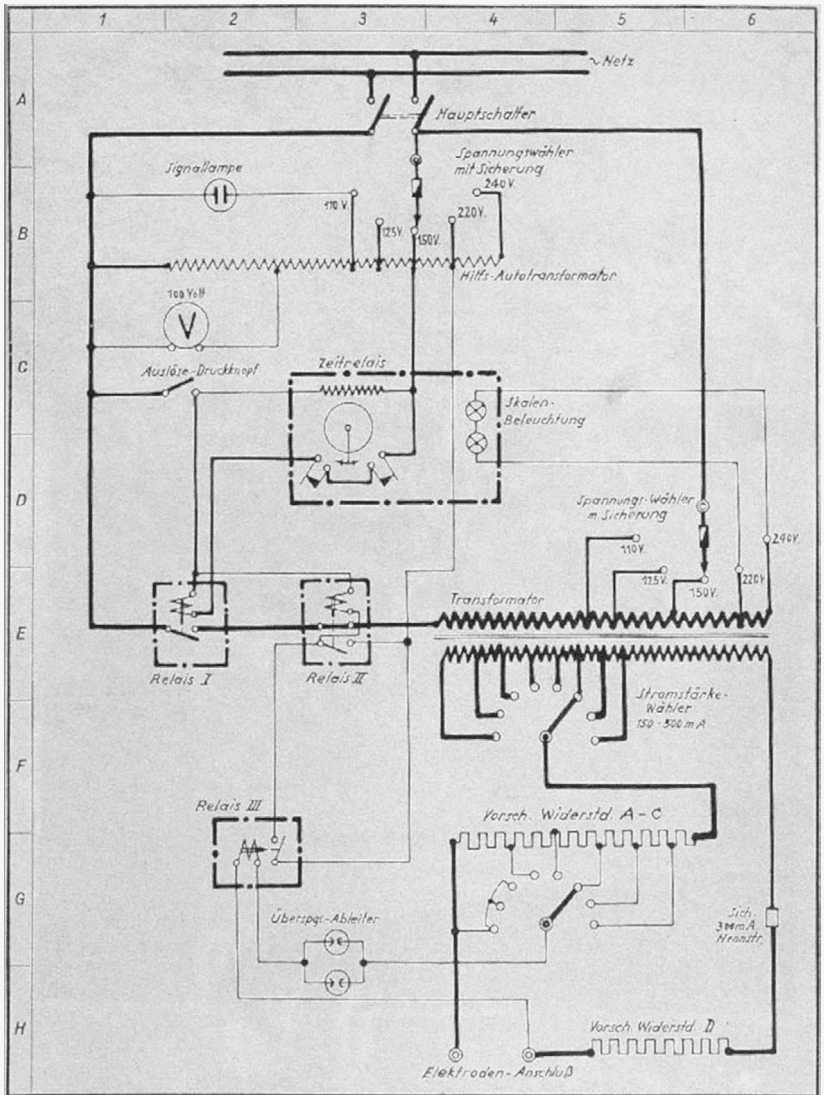
Initially this approach was the norm for all first-generation devices developed by companies such as Arcioni in Italy, Purtschert in Switzerland, Edison Swan in the United Kingdom, and Siemens in Germany in 1939 and 1940.[10] The detailed measurement combined with a calculation of the dose and the individual setting of the device gave the physician performing the treatment a performative feeling of control and a specific therapy tailored to the individual patient (Doroshow 2006: 220–221). At the same time, the physicians and engineers soon became aware that measuring with low voltages was very prone to error due to the characteristics of the skin. Measuring the electrical resistance of the patient's skull at 1 volt often resulted in high values because the skin had its own resistance at these low voltages, a property that was lost at higher voltages (Pätzold 1941: 277–278). The measured and sometimes greatly fluctuating values therefore had no equivalent in the treatment circuit at 100 volts and regularly resulted in excessively high calculations for the electrical stimuli.[11]

The companies and numerous psychiatrists nevertheless continued to make the measurements until the late 1940s, since they considered the attentiveness to the device and the patient an important verification routine for the safety of the procedure. Anton von Braunmühl (1901–1957), psychiatrist and director of the so-called insulin ward at the Eglfing-Haar clinic near Munich, by contrast, chose a different path. He explained that he usually works with a relatively strong electrical stimulus (350 mA for 1 second) that reliably triggers epileptic seizures without putting the patient at risk, in his view (Von Braunmühl 1942: 152–154). It was precisely von Braunmühl's strong electrical stimuli, which triggered epileptiform seizures with only a short latency or no latency at all, that were the cause of Max Müller's above mentioned critique of the correct use of electroconvulsive therapy. The engineers at *Siemens-Reiniger Werke*, who worked with physicians at the university clinic Erlangen as well as with Anton von Braunmühl in 1939 and 1940, also attempted to eliminate the factor of uncertainty in the measurement of resistance (Pätzold/Koersche/Olbrich 1940: 5–6). The theoretical and technical transformation went hand in hand with the work of the Siemens engineers around Johannes Pätzold (1907–1980). The starting point was the practical observation during the therapy that at high voltages of 100 volts the electrical resistance had a lower value and barely fluctuated (ibid.: 2–3). By adding further high-impedance resistors to the treatment circuit (cf. fig. 1), possible variations in resistance in the patient's skull became entirely insignificant.

By eliminating the measurement as an initial step in electroconvulsive therapy, the usage of the device was changed. Physicians could assume that the devices and patients were in alignment and immediately set the values of the electrical stimulus. This changed the conceptualization of the stimulus on the part of the engineers, whose focus was no longer on the complex relationship between current intensity and voltage as a function of the electrical resistance of the skull. They adopted a thinking about electrical energy based on pharmacological substances and "conceptualized" the electrical stimulus subsequently as an amount of electricity per unit of time (SRW Erlangen 1940: 1). Thus, through experimenting and developing, between the device, doctors, and engineers the reproducible triggering, the necessary time, and ultimately the seizure itself developed as the operative unit of electroconvulsive therapy. For von Braunmühl, the strategy of the fixed standard dose was strengthened and further simplified by this technical development. Thus, he came to describe the seizure as a dose and no longer annotated individual sessions with data on the electrical stimulus, but with details on the seizure (fig. 2).

This means that in this phase of development, the Siemens electroconvulsive therapy device took on a form that was based on a fundamentally different function. While at first the emphasis was on the measurement and calculation of the correct electrical stimulus, the device was now developmentally optimized and its use was designed for the production of seizures – a process that was also ultimately reflected in the choice of "Konvulsator" (Latin: *convulsio*) as a brand name. The previously described measures of testing and measuring had been central to Max Müller and the Italian devices. They had forced a special attention to the arrangement of the device, the patient, and the doctor and were bound to a special medical and technical expertise, but they lost their plausibility in the new setting and were obsolete. The doctor's ability in dealing with the device and the patient was replaced with technical reliability and allowed for a certain carelessness in dealing with the new device. This circumstance made it possible to increasingly turn to the operationalization of the seizure as a therapeutic tool. At Eglfing-Haar, this development took place in a specific institutional and personnel context and resulted in a form of work that required very little time and personnel resources. The insulin ward of the Eglfing-Haar clinic suffered a dire shortage of personnel since the mobilization at the start of the war, as a large proportion of the male nurses had been conscripted.[12] Von Braunmühl has described the situation in his ward: there together with two nurses he treated 60 patients with ECT in one morning, which required the use of an efficient regime. The Siemens device allowed him to treat all patients in the same way, without the need for specific measurements or adjustments, and no complications were expected. On this basis, psychiatrists began to organize electroconvulsive therapy like an assembly line. The treatment ward was operationalized as a place where all patients underwent a uniform convulsive therapy session. The tailoring to the individual patient took place with a treatment scheme that specified the sequence of treatment days according to the diagnosis or the reason for treatment (Von Braunmühl 1947: 182). The following treatment certificate (fig. 3) from the patient file of Rosalie H. accompanied the treatment as a paper documentation system and attests to the administrative and technical rationalization that characterized electroconvulsive therapy at Eglfing-Haar. The patients were brought to the ward according to the chosen treatment regimen and the individual seizure was simply checked off.

Fig. 1: Circuit diagram of the Konvulsator 1 with series resistors A–D (Pätzold/Koersche/Olbrich 1940: n-1)



1940	Tag	Name	CBE
Konstr.	23.9.	Bingl	
Gepr.	24.9	Kunz	Faba
Normgepr.			

Änd. Mitty.	Dat.	Name	gepr.	Faba	Dat.

SIEMENS-REINIGER-WERKE AG. ERLANGEN

M

Prinzipschaltbild zum Konvulsator

E. str. 30 a

Ersatz für

Ersetzt durch

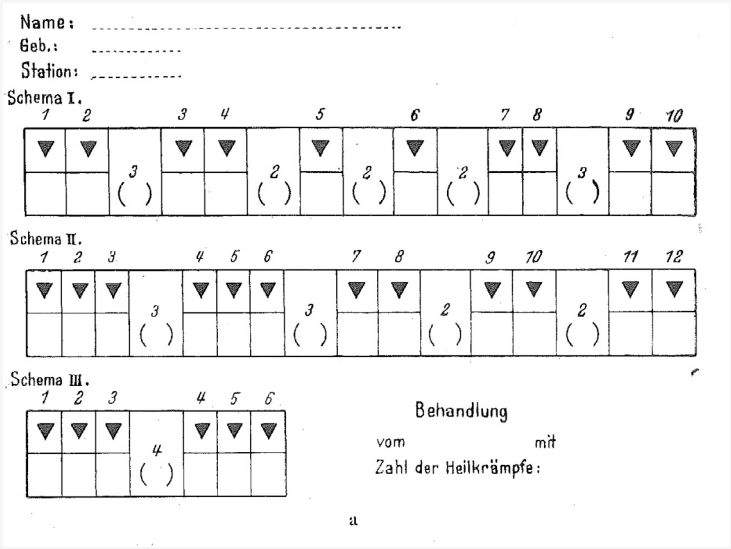


Fig. 2: Treatment scheme for convulsive treatment (Von Braunmühl 1947: 183)
Fig. 3: Treatment certificate for Rosalie H., October 1943 (HPA E-H 7662, 1941)

In the postwar period, this strategy of rationalization was taken one step further by running power lines through the walls of the treatment ward. For example, the treatment electrodes could be plugged into power sockets above the head end of the beds and the doctor performing the treatment could do so without any major preparatory measures. The room itself provided the psychiatrist with the necessary electrical stimuli and became the carrier of the therapeutic affordance of the seizure (Von Braunmühl 1947: 160–161). While previously the adjusting of settings, indeed the technology of the electroconvulsive therapy device, were moved out of view and into the interior of the device, now the entire technical device moved below the surface of the treatment room. The dose formed a key point, because it now differed completely from pharmacological convulsive therapy insofar that no longer the stimulus, but the treatment session itself was referred to as a dose. This circumstance marked the transition from pharmacologically to electrically induced convulsive therapy particularly clearly. In the same step, it was clinically understood that it was neither the electric current nor substances such as Metrazol, but the seizure that constituted the core element of the therapy. It was only here that it became possible to organize the therapeutic practice in such a way that instead of the individual treatment session being designed, the individual session formed the element of a therapeutic sequence.

Pushbutton Psychiatry

I first followed the change in practice with a specific aspect of the therapy. In the following I would like to look at the use of the treatment from an additional perspective by means of "pressing buttons" and thus investigate how agency was created and negotiated on the material level in electroconvulsive therapy. At Eglfing-Haar, the triggering of the seizure took place in an increasingly standardized and uniform manner. The pressure on the button to trigger the stimulus on the machine, and later directly on the treatment electrodes, was a relatively small movement, but triggered a chain of events: first the electrical impulse, then the epileptic seizure, the healing process, etcetera. This cascade of effects and consequences contrasts starkly with the minor act of pressing a button. In view of the exceptional potency inherent in the pushing of a button, the term "pushbutton psychiatry" (Kneeland/Warren 2008) seems to directly correspond to the situation. The German psychia-

Fig. 4: SRW Erlangen (1949), Konvulsator II brochure cover

trist and medical historian Werner Leibbrand also viewed this material consolidation of therapeutic practice critically in 1947:

> When people today speak of "progress," they mean ... the summation of some kind of complicated energetic or mechanical processes in a simple gesture – one presses a button and this or that happens. (1947: 148–149)

Another dimension evoked by the concept of pushbutton psychiatry is that of the uniform, disciplined, and disinterested treatment regimen, which therapeutically "shocked away" disorders as well as affective failures (Braslow 1997: 9). While these two dimensions can be analytically separated, they are held together in practice by the pushbutton, whose potential to trigger the seizure was at the center of the negotiations over who should actually press the button.

As I have already described, the first electroconvulsive therapy devices were equipped with numerous switches, buttons, and gauges, an arsenal that was increasingly reduced at Siemens until the "small device" of the Konvulsator II was introduced for "mobile clinical use." The K II, weighing six instead of 17 kilograms, was much more portable and was meant to facilitate its use in pavilion-style institutions and to allow for outpatient treatments.[13] The device had a reduced surface consisting of a central display/setting for the length of stimulation, a three-step setting for the stimulation strength, and an on/off switch (fig. 4). One striking aspect was the two widely spaced trigger buttons, which contradicted the general trend toward simplification and reduction. These were arranged in a sequential circuit and had to be pushed simultaneously to trigger the electrical stimulus.[14] Numerous psychiatrists who tried out the new device expressed their impression that its usage was made unnecessarily difficult. For example, the psychiatrist Friedrich Schmieder (1911–1988) wrote to Johannes Pätzold that this construction restricted his work because it was impossible to operate the device with one hand (Schmieder 1943: 1). However, this was exactly what the engineers had in mind, as Pätzold's marginal notes in Friedrich Schmieder's letter show. They wanted to make the use of the buttons so difficult that the device would not be accidentally triggered, in order to protect both the physicians and the patients, because in their view the simplified device entailed a greater risk. This shift of a social regulation into the technical form is clearly reminiscent of the examples that Bruno Latour used for his analyses of non-human agency. Among other things, based on the so-called Berlin key, he described how users of doors in apartment buildings were forced to lock the doors

due to the special shape of the key, since the key could only be pulled out of the door after the door was locked. In Latour's description, the key could thus replace the social control by the building attendant (Latour 1996: 37–40). Like the Berlin key, the electroconvulsive therapy machine demanded certain actions of humans and forced them to use both hands to trigger the electrical stimulus. With the two buttons of the device, negotiations were conducted in the sense of the actor–network theory over who bore the risk of the treatment and what concessions to the doctor's agency seemed reasonable. This interpretation is close to the view of the doctors, who depressed the annoying second button with tape so that the device could once again be used with one hand. This allowed them to practice their accustomed procedures, and they did not allow their autonomy to be questioned by engineers or devices. Here therapeutic agency was an intention embodied by physicians which took on a certain form through interventions in the device.

However, I would like to return to the fundamental question and, in view of the "pressing of buttons," ask how electroconvulsive therapy changed the material culture of psychiatric therapy. The starting points are Metrazol convulsive therapy or insulin coma therapy, both of which were determined by the injection of pharmacological substances. If we consider electroconvulsive therapy analogous to those historically parallel practices of injecting, it becomes clear how the device and the user brought about the new form of treatment in the joint act. The physicians – no longer with syringes, but with electrodes in their hands – learned to act as participants in this new electrical practice with and through the devices. Contrary to a description of device and machine as actors in the network, here the joint activity, in which both are involved as participants, is given the central importance, because only in joint practice did the agency granted to the actor come about and take on its form. Anton von Braunmühl's works offer a remarkable concrete example of these ideas (Von Braunmühl 1943: 2). After he had fixed one of the two triggering buttons in place, he went on to press the second button repeatedly. He attempted to use the rapid repetition of weaker stimuli to "shake" the patient into the seizure (Olbrich 1943: 2). Regardless of the technical and physiological evaluation of the procedure, it was the experience of the pushbutton with its immediate mediation of the electrical stimulus to the patient's body which created the knowledge and the ability to imagine and try out this form of treatment.[15] Thus, it was not only a negotiation of agency between human and non-human actors, but in common practice a "distributed agency [that] was no longer attributable to the unit of one actor" and took on a specific form (Hörl 2011: 21).

Conclusion

Using the example of electroconvulsive therapy, I have examined how the introduction of a technical device in the middle of the 20th century changed the material culture of psychiatric therapy. The differentiation from pharmacological procedures of shock therapies was the starting point for initial developments and remained a frame of reference for psychiatrists in Europe for a long time. By determining the "right dose" and "pressing the button," it was reconstructed how knowledge about the therapy emerged as a product of the application and the practical use of the new technology, thereby innovating as well as updating existing knowledge. By following existing experience with pharmacological substances and technically regulating the specific, surprisingly complicated electrical relationships between the physician, the device, and the patient – that is to say, making them unproblematic – the focus of the dose shifted from the electrical stimulus to the seizure. A second analytical focus was on the increasingly device-oriented and ultimately spatial affordance of seizures. Here it was possible to understand how actions became available by bringing people and machines together as technical systems. The resulting discomfort in clinical daily life was formulated by Werner Leibbrand in the above-mentioned place: "For many doctors, this therapy is indeed unpleasant … ; it is the fault of the first step – the stone once thrown (pushbutton!) cannot be called back!" (1947: 154).

The condensed therapeutic agency that arose from the relationship between the device and the doctor became clear in the consequences of a banal push of a button. The push of a button mediated and was a meeting place where the possibility of the technical arrangement was realized in a concrete therapeutic action. The path to this point was the combination of the two developments, the push-button and the availability of electroconvulsive therapy embedded into the room.

Notes

1
Electroconvulsive therapy used a strong current in comparison to electro-medical applications established in neurological medicine at the time (cf. Steinberg 2014: 878).

2
After the publication of Metrazol convulsive therapy by Ladislaus Meduna in 1935, the search for alternative substances or techniques for triggering seizures began: in 1930, convulsive therapies were only one among numerous procedures that put the patient's body in a state of emergency (fever, coma, seizure) in order to alleviate or cure mental disorders. For further details, see Joel Braslow's work on shock therapies in California (1997) or the overview of their use in the German Reich by Hans-Walter Schmuhl and Volker Roelcke (2013).

3
The *Siemens-Reiniger Werke* was founded in 1932 as part of Siemens & Halske AG and, as part of the company, was responsible for the development of electro-medical technologies and their sales.

4
The institutions differed significantly in their number of beds, but generally served the region and devoted themselves in a publicly exposed manner to the shock therapies. For historical information, see Laehr (1937: 29, 153); for historiography see especially Richarz (1987); Germann (2013).

5
This very condensed presentation of the work of Heidegger (2000: 12–13) and the ANT serves to further define Simondon's theory and does not claim to offer a complete portrayal of the positions. Among others, Erich Hörl has done detailed work on Heidegger and Simondon (2008), as has Ingo Schulzer-Schaeffer (2008) on technical terms in Latour's work.

6
In Simondon's words, it is the increasing concretion of discrete parts, exemplified by the cylinder head, in which cooling fins combine previously separate functions of stiffness and cooling (2012: 23–24).

7
For this purpose he was invited by Guiseppe Corberi to Milan (Müller 1939b: 1; Müller 1982: 244–249). He had a close relationship with Corberi as well as Kalinowsky since the "Schizophrenia Conference" in 1937 in Münsingen. It was here that an informal group of doctors came together whom Cornelius Borck convincingly described as the "Internationale of Shock Therapy" (2013: 138–139).

8
Early publications dealt with the question of whether the duration or the current strength is the decisive unit in determining the "strength" of the electrical stimulus, with most authors varying only slightly in terms of voltage and using about 100 volts (cf. Müller 1941: 206–211).

9
These technical data were compiled in particular from the documents, schematics, and manuals for the Italian device in the archive of the *Siemens-Reiniger Werke* in Erlangen (SRW Erlangen 1939). On the state of the records, see also Gawlich (2018: 30–39).

10
I have discussed the differences between generations in the development of electroconvulsive therapy devices in more detail elsewhere, including detailed information on the individual devices and producers (cf. Gawlich 2018: 158).

11
An academic feud between the Italian inventors and their German competitors, including the *Siemens-Reiniger Werke*, developed out of this source of error, which was motivated not least by their aim to file for their own patent and thus economic interests (cf. Pätzold 1941; Gawlich 2018: 164–166).

12
This shortcoming was exacerbated by the fact that Eglfing-Haar was a relatively large institution with 2500 beds and that many patients were referred to the insulin ward (Stockdreher 1999: 328). Despite the difficult personnel situation at the beginning of the war, Eglfing-Haar had taken numerous patients from institutions that were closed. Added to this was the logistical role that the institution had in the context of the centrally controlled murder of patients. Patients were transferred to Eglfing-Haar before being sent via collective transports to killing centers or being murdered in the second decentralized phase of "euthanasia" in Eglfing-Haar itself (Süß 2003: 324–325; Tiedemann 2014: 37).

13
The trigger for the development was in particular the economic situation during the war, which made the acquisition of the expensive and resource-intensive predecessor model impossible for many clinics (cf. Pätzold/Koersche/Olbrich May 23, 1942).

14
Precisely this circumstance of the translation of social relations into technical conditions is at the center of the early ANT works by Latour (cf. 1991: 109–110).

15
Von Braunmühl theorized the procedure as a summation of subliminal stimuli, which through repetition built up a potential that triggered the epileptic seizure after a certain time. The engineers threw up their hands in the face of his severe technical abuse and misunderstanding and urged him to refrain from further attempts until they had built him a technical device that could handle the periodic interruptions of the electrical stimulus (cf. Olbrich 1943).

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