



A Leap into the Dark: Ufa's Tonkreuz, Germany's First Dedicated Sound Film Studio

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Ufa's Tonkreuz, designed by architect Otto Kohtz, was Germany's first sound film studio. Completed in 1929, the building continues to be used to this day for film and television productions. This article tracks the building's significance in connection with Ufa's decision to convert to sound. It explores the studio's location in Babelsberg and the environmental conditions that prevailed there. It discusses the state-of-the-art materials that were used to contain and control the natural environment and exclude all extraneous noise disturbance and considers the people who worked within its confines, how they were affected by working there, and how the building was adapted to accommodate changes in technology.

Keywords: Babelsberg; film production; architecture; Otto Kohtz; Sound film



Introduction

Although film studios have often been seen as synonymous with cinema's classical period in the 20th century, Brian Jacobson (2020: 4) notes that 'the studio — as a physical place — has consistently been overlooked in film and media studies'. It is only recently that this neglect has been addressed more systematically by a number of publications in addition to Jacobson's that have revisited studios as physical places and work environments, including that of Luci Marzola (2021) and a number of others working in the broader research field commonly referred to as 'production studies', spearheaded by scholars such as Vicki Mayer, Miranda Banks, and John Caldwell (2009). My article builds on this scholarly interest by drawing on additional information from a broad range of archival resources.

The Tonkreuz (which means 'sound cross') was completed in September 1929 and is remarkable for having been consistently in use for film production since then, apart from a brief hiatus between 1945 and 1946 (**Figure 1** and **2**), making it a rarity among German film studios built during the period from 1930 to 1960, the majority of which were either adapted for alternative use, demolished, or destroyed during World War II. The studio is noteworthy for its innovative design, the use of contemporary state-of-the-art sound insulation materials, and the recording technology that shaped its construction.

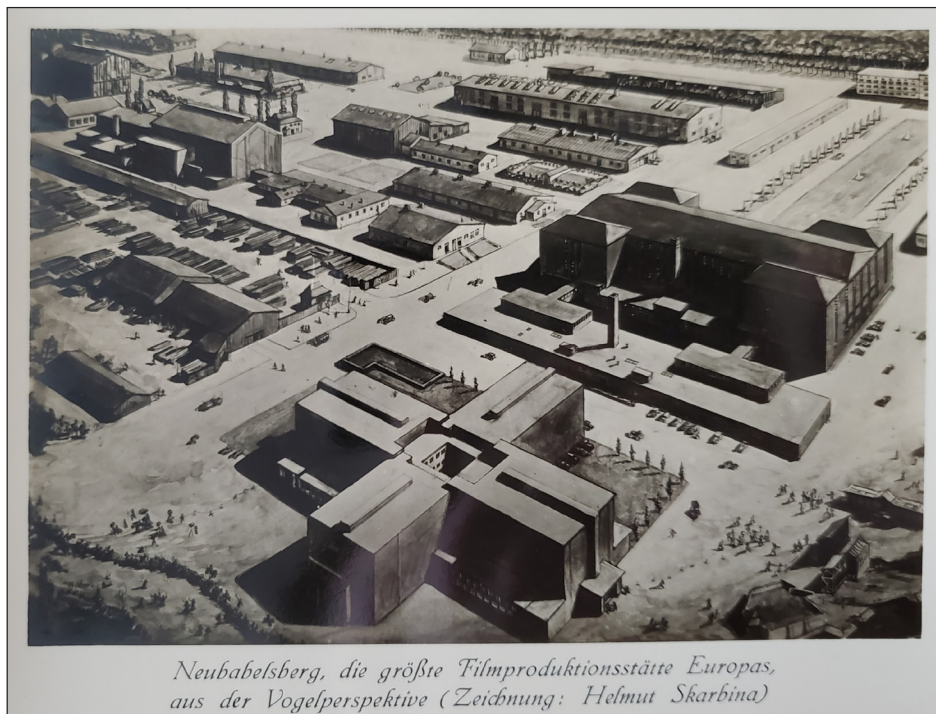


Figure 1: Aerial drawing by Helmut Skarbina showing the Tonkreuz in the foreground.

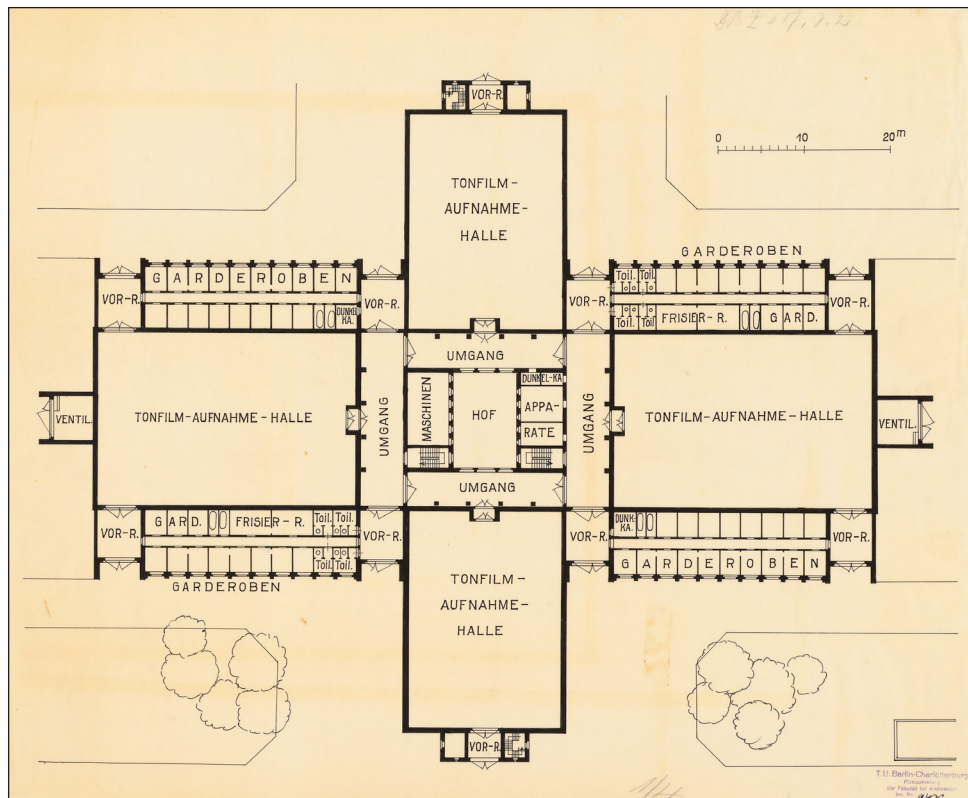


Figure 2: Ground-floor plan of the Tonkreuz by Otto Kohtz. Inv. Nr 9472, Architekturmuseum der Technischen Universität Berlin.

From its inception, the Tonkreuz attracted widespread attention and admiration, and not just from the film industry. *Wasmuths Monatshefte für Baukunst und Städtebau* (1930) and the *Deutsche Bauzeitung* (Die Tonfilmateliers der Ufa in Neubabelsberg 1930) considered it a triumph of contemporary functional architecture and design. British architect F. R. S. Yorke (1931) hailed it because he thought it exemplified how sound film studios should be built and the ideal location for them. In the realm of contemporary scholarship, Wolfgang Jacobsen's detailed study (1992: 146–164) of the building in the context of sound film history, in which he uses the term 'Tonfilmmaschine' ('sound film machine'), anticipates the work of Brian Jacobson, who also describes film studios as 'machines' (2015: 22). Corinna Müller (2003) considers the building's appearance in her seminal study of Germany's transition to sound film.

While these accounts of the Tonkreuz provide important information regarding the history of the building, they do not consider it as an organic unit in its own right but instead simply as an extension of histories of sound film technology or of specific production companies. Jacobsen has suggested that the history of film studios can

be theorised by conceptualising them as environments (virtual and material), as methodological, material, and sociological nodes, and as symbols (2020: 12–17). All of these three approaches are productive when considering the history of the Tonkreuz. My article focuses on the specific motivations behind the creation of the Tonkreuz and the challenges its construction posed, on its geographical context and local infrastructure, and on the prominent influence of architect Otto Kohtz and his designs on the building's development, which has been neglected in previous scholarship. As Jacobson argues, 'the changing conditions through which architects and designers fulfilled studios' worldmaking ambitions reveal a great deal about the underlying ideals that drove what the (film) world should be' (2020: 11). I also explore how those who had jobs at the Tonkreuz experienced the transition to sound film by considering the working environment of the building.

Converting to Sound

Germany's pioneering experiments with sound film began when Joe Engl, Joseph Massolle and Hans Vogt developed a system of converting sound waves into electrical impulses (Kreimeier 1995: 210–219). They eventually attracted interest from Ufa in January 1925 but the screening of *Das Mädchen mit den Schwefelhölzern* (The little match girl) ended up being abandoned in December that year owing to technical faults (Jacobsen 1992: 146). Minutes from the company's records in 1928 recorded that 'the problem of sound film has put the business in a difficult situation, the impact of which it is no longer possible to ignore' (31 May 1929, R109-I/5670, BArch).¹ Over the winter of 1928–1929, Ufa commissioned one team to visit Britain and another to visit America to examine the construction and design of sound studios in those countries (28 December 1928, R109-I/1027a, BArch).

By 10 April 1929 Ufa's supervisory board was finally ready to take that leap into the dark, acknowledging that conversion was now an unavoidable requirement if the company was to have any future in filmmaking (doc. 319, R109-I/2421, BArch). But Ufa's desire to stay in the business was only one motivator. Alfred Hugenberg, the powerful and archnationalist owner of the Scherl publishing group which controlled Ufa, was also determined to improve Germany's global standing and saw converting to sound film as creating opportunities for German businesses and innovators to match, and preferably excel, Hollywood's position as global leader in film production. Concerns about Ufa's financial health in the face of this significant commitment were not unreasonable; the board's members were advised that the cost of constructing the new sound studio was estimated at 2.75 million Reichsmarks (RM), a significant sum which had to be added to the ongoing cost of modifying cinemas so they could project sound (doc. 350, R109-I/2421, BArch).

Müller (2003) provides detailed discussion of the challenges Ufa faced in deciding which sound recording system to adopt, challenges stemming in part from the fact, as Klaus Kreimeier (1995: 212) points out, that 15 different systems protected by some 3,000 patents were available in Europe at the time. In November 1928, Ufa's management board commissioned a study to evaluate the existing sound systems, which of them held patents for Germany, and the likely cost of the appropriate hardware (28 November 1928, R109-I/1027a, BArch). The company initially leaned towards Western Electric's system, but ultimately decided against it because Western Electric's terms were punitive and expensive (Müller 2003: 31–42). The company instead decided to go with the Klangfilm system, a choice Ludwig Klitzsch, Ufa's managing director, defended on the grounds that it supported German invention (doc. 323, R109-I/2421, BArch). Two days before the supervisory board met, Klitzsch had signed a contract with the newly created company, Tobis Klangfilm GmbH (doc. 323, R109-I/2421, BArch), formed from the Tobis Syndikat, founded in 1927 as a subdivision of Tri-Ergon-Musik-AG and part of consortium to produce sound film that included H. J. Küchenmeister KG, Deutschen Tonfilm AG and Messter Ton AG, and Klangfilm AG, a daughter company of AEG and Siemens established in October 1928 (Kreimeier 1995:212). Ufa's decision to contract with Tobis Klangfilm came a matter of weeks after the two companies had finally reached a settlement in the form of a *Freundschaftsvertrag* (friendship agreement) that ended a period of protracted patent conflicts, legal disputes that were common in many countries during this time (Kreimeier 1995: 212).

Production of sound film brought significant changes that affected every activity in the film studio. Some forms of work that had been established for silent film production became obsolete, but new types of work were created; the sound engineer became crucial, a job that required a support staff, the establishment of which created a steep hierarchy of specialist and subordinate roles. Lighting engineers had to adapt to new forms of lighting, and sets had to be constructed using materials compatible with clean sound recording, materials that would not produce the hollow spaces that had characterised silent sets (Sudendorf 2009: 241). Each of these adjustments in turn gave rise to further unexpected challenges as well as additional risks for workers.

Location

By the 1910s, Berlin's growth and density was impairing film production. The city lacked light and clear sightlines, but most significantly it lacked space for expansion. At that time, the Deutsche Bioskop studio, which was founded by Jules Greenbaum in 1899 and eventually merged with Ufa, was situated in Friedrichstraße, a central Berlin location home to several film production companies and studios. The company

was urgently searching for less crowded spaces outside Berlin as well as a reliable and powerful supply of electricity, without which production would grind to a halt (Orbanz 2013: 31). Deutsche Bioskop's requirements in 1911 were to have unimpeded daylight from the south and southwest, clean air and an absence of chimney smoke, and easy access to railway networks and roads that could transport materials and people to the site (Müller 1992; Paschke 1993). The company's technical director Guido Seeber was tasked with finding alternative locations, and one of the places he investigated was Nowawes, a neighbouring town of Potsdam located some 25 kilometres to the southwest of Berlin.

In the middle of the 18th century Nowawes had been home to a weaver colony, but as the 19th century came to an end, the town emerged as a centre of manufacturing, eventually becoming the largest industrial region in the state of Brandenburg. Although Nowawes had a number of factories and workshops, it offered space to expand, and so Deutsche Bioskop eventually settled on a site in the area of the town that had been named Neubabelsberg in 1925. Here Seeber had identified a disused factory (Figure 3) for artificial flowers that suited the studio's requirements, a building 'both prestigious and functional and spacious enough to house the entire production including workshops, prop rooms and offices' (Paschke 1993: 51).



Figure 3: The building in Nowawes that became Ufa's administrative headquarters after Deutsche Bioskop merged with it. Kohtz's *Trickfilmatelier* (animation studio) is visible to its left. Photo by Eleanor Halsall.

Deutsche Bioskop moved its operations to Nowawes in 1912, and the studio became the setting for some significant productions of the period prior to World War One, including Urban Gad's *Der Totentanz* (Dance of death [1912]), starring Asta Nielsen, and Henrik Galeen and Paul Wegener's *Der Golem* (1915), although at this time, the studio had not yet achieved the dominant position it would later hold. Shortly after the end

of World War One, Deutsche Bioskop merged with Decla, founded in 1915 by Erich Pommer, becoming Decla-Bioskop. By 1921, Decla-Bioskop was amalgamated into Ufa, which had been founded in 1917 and which also owned studios in central Berlin. During the 1920s, Babelsberg gradually became more important for German film production, hosting the shooting of classics of Weimar cinema such as Fritz Lang's *Der Müde Tod* (Destiny 1921), his *Nibelungen* cycle (1922–1924), and, perhaps most famously, his *Metropolis* (1926). The studio complex expanded significantly during this decade, with large, blacked out buildings replacing the glasshouse structures of the early years. The most important addition before the arrival of sound was the Große Halle, which was constructed in 1926 and which remains to this date the largest studio facility at Babelsberg. It was renamed the Marlene Dietrich Hall in 1991.

The criteria for sound film production were radically different from those for silent film. Where silent film had benefited from natural conditions, the new technology depended on their absence. Noise and vibration from transportation networks and factories needed to be controlled or better yet eliminated, pitching the new technology against the very modernity on which filmmaking itself depended. The large-scale industrial concerns extending in clusters to the north and west of the Babelsberg site included an iron foundry, textile weavers, a chemical factory, asbestos production, and a manufacturer of gramophone records, while almost due south of the studio grounds, at a distance of less than one kilometre, lay the sizeable works of Orenstein & Koppel (O&K) a dense centre of metalworking that employed hundreds of metal workers, turners, and engineers, many of whom lived in the adjoining streets in buildings owned by O&K, and that was the source of invisible bands of sound and vibration (Figure 4). The level of noise and vibration in the surrounding streets must have been significant, even before taking into account the compound effect of other neighbouring centres of production.

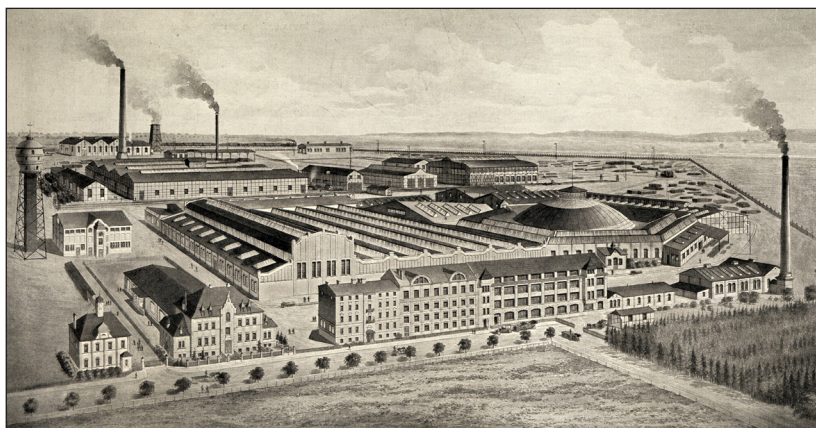


Figure 4: View of O&K's factory and surrounding works with Ahornstraße in the foreground. Drawn in 1913 by Benno Orenstein (d. 1926).

Architecture

Framed by Stahnsdorfer Straße to its north and Grossbeerenstraße to its south, the Tonkreuz (Figure 5) was located a short distance from the intersection of the Berlin-Potsdam railway line and the Berlin-Brandenburg line at its northeastern corner. The creative force behind it was Otto Kohtz (1880–1956), who designed many of Ufa's studios and buildings at Babelsberg and Tempelhof over the decade that followed. Although he was discussed in contemporary architectural journals at the time, he barely gets a footnote in historiographies of film production. Jacobsen mentions him, but Kreimeier and Müller overlook him entirely. Before receiving the commission to design Ufa's new sound studio, Kohtz had already devised a broad range of buildings, from monuments and factories to high-rises and residences (Schäche, Jacob, and Pessler 2011), including his own private residence.

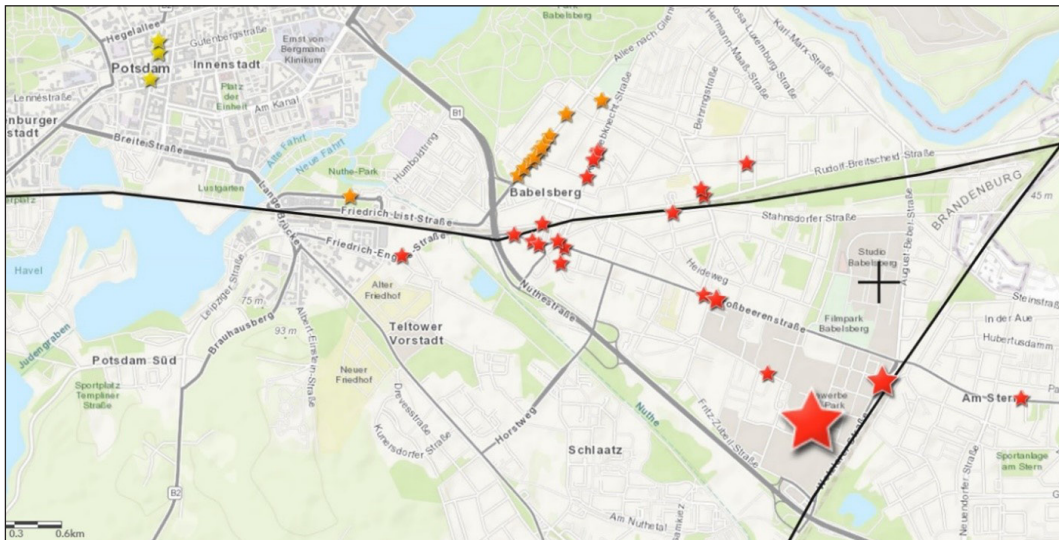


Figure 5: Location of the Tonkreuz indicated by large cross. The largest star marks O&K's factory.

While his designs for the Berlin headquarters of the Scherl publishing house (Figure 6) and the Ledigenheim, a hostel for single men in Berlin-Moabit, were realised, his designs for high-rises (Figures 7 and 8) remained on paper, drawings that, interestingly, resonate with the dystopian urban atmosphere of Lang's *Metropolis*, some of the sets for which on the backlot at Babelsberg were demolished to make way for the Tonkreuz. Kohtz, who had trained at the Technische Hochschule Charlottenburg (now the Technische Universität Berlin), had not previously designed a film studio, but his successful design of the Scherl building in 1925 had brought him to the attention of Ufa's board via the connections of Hugenberg and Klitzsch.



Figure 6: Kohtz's design for the Scherl building. Inv. Nr. 9292, TU Berlin Architekturmuseum.



Figure 7: Kohtz's design for a high-rise building in Berlin's Potsdamer Platz. Inv. Nr. 9015, TU Berlin Architekturmuseum.

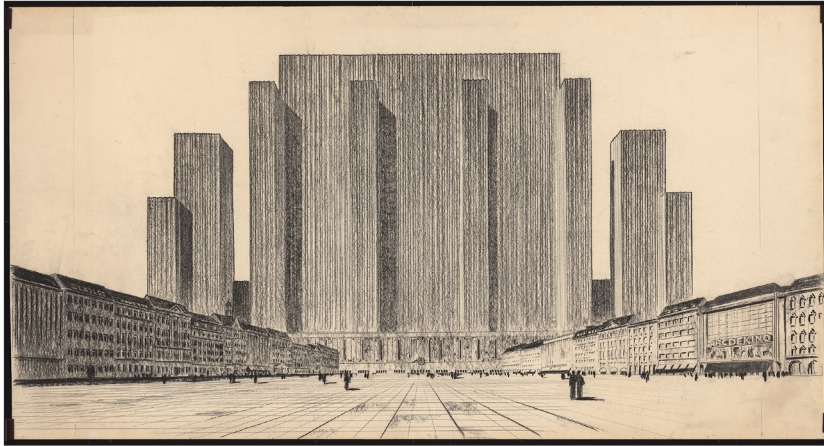


Figure 8: Kohtz's design for a high-rise building in Berlin. Inv. Nr. 9163, TU Berlin Architekturmuseum.

Kohtz designed and oversaw the conversion to sound film production at the Ufa studios at Tempelhof between 1931 and 1934, the animation studio at Babelsberg, and the Nachwuchs (“new talent”) studio, the building that housed Ufa’s Lehrschau, which was an archive and a library as well as a visitor information centre, after 1939. Subsequently, Kohtz contributed a series of drawings for the reconfiguration of the complex into Filmstadt (“film city”) Babelsberg, a National Socialist project whose goal was to make it possible for German film production to achieve world supremacy; however, only the new talent studio was actually realised (**Figure 9**).



Figure 9: Nachwuchs studio at Babelsberg designed by Kohtz. Photo by Eleanor Halsall.

Kohtz was also commissioned to design buildings for the Afifa printing lab in Tempelhof, which included the canteen, but he fell out of favour when Emil Fahrenkamp gained ascendancy, who then became the dominant architect in the planning of the film city (Jacob 2007). That Kohtz's name was missing from the regime's list of the *Gottbegnadete* (the divinely gifted) signalled his loss of influence (R 55/20252a, BArch), and it is possible that with Hugenberg's departure from Ufa in 1937 after it was nationalised, Kohtz lost his main patron. He was also forced to seek approval for all aspects of his designs from Albert Speer, Hitler's favoured architect who held the position of general building inspector for the Reich capital (*Generalbauinspektor für die Reichshauptstadt*), with whom Fahrenkamp had a close relationship. Around the same time, however, Kohtz was engaged in the design of an administration building in Dresden (**Figure 10**), and he also contributed to the Heinkel works in Oranienburg.



Figure 10: Dresden administration building at Ammonstraße 8 designed by Kohtz in 1938. Photo by Christian Gebhardt. Wikimedia Commons.

Despite his loss of influence, what Kohtz achieved through his first commission for Ufa cannot be overestimated. Kreimeier maintains that the addition of the Tonkreuz significantly transformed Babelsberg's architecture, its windowless structure resembling a fort (1995: 215). Although the sightlines have changed with the encroachment of surrounding buildings and with the loss of the green space that was originally planted around the building, the external structure of the Tonkreuz has remained largely intact to this day. Changes have been made to the equipment located on the roof, and inside the building doors have been added, internal windows have been blocked up, and rooms have

been repurposed to accommodate new demands. That so little has changed indicates how enduring Kohtz's original designs are, making it a perfect example of what Stewart Brand (1995: 190) calls 'adaptive architecture'. The Tonkreuz's red brick façade hides the inner frame: the corridors and walkways, studios and back rooms, where the gritty work of filmmaking still takes place, the architectural masking echoing the artifice of filmmaking itself. This is a working building which bears the scars of heavy use.

The Tonkreuz's architecture was influenced by significant increases in noise levels that were part and parcel of 1920s urban soundscapes. Whilst noise was often considered as a sign of progress, its perceived effect on public health caused concern in many countries (see Bijsterveld 2013 and Mansell 2016 for more on this topic). Ufa star Liane Haid (1929), for example, commented on how 'our lives are so affected by loud bangs which play on our nerves'. The need for better sound insulation pushed development of soundproofing materials for residential and public buildings, many of which served equally well as insulating materials for the retention of heat.

Board member Hermann Grieving reported to the supervisory board on 10 April 1929 that a cruciform design for the Tonkreuz would create the quickest link between the Klangfilm recording devices in the studios and their sound-processing machines in the *Abhörräume*. These dedicated listening rooms, 'located at a height of 5 m above the floor on the internal wall of each studio', were 'equipped with soundproof, thick glass' that enabled 'the sound engineer to observe the recording and simultaneously determine the quality of the sound by means of playback devices' and then to 'quickly inform the director whether the recording' was 'successful from the acoustic perspective' (doc. 342, R109-I/2421, BArch). Fritz Fischer and Hugo Lichte (1931: 436) describe these listening rooms as 'command post[s] for the technical processing of the recording, namely, control room[s], where, using the mixing board, the sound engineer can control the function of the individual microphones and check them on the loudspeaker'.

Reporting to the supervisory board in October 1929, Ernst Hugo Correll, Ufa's director for production, explained that 'the arrangement of the apparatus, the architecture, the cross shape with the machine heart in the middle, are original ideas from Ufa' (doc. 446, R109-I/2421, BArch). However, Otto Riedrich (1930: 144) notes that 'planning was further complicated because [Ufa] was unable to present precise requirements' of what it needed, suggesting that Klangfilm, which was constantly refining its technology, contributed significantly to Kohtz's design.

Departing from methods he had adopted for much of his previous work, Kohtz settled on an industrial approach for the Tonkreuz, using 'simple and functional forms suitable for a factory' both inside and outside the building on the grounds that 'film production is also a factory' (1930). Although the studios themselves have no windows,

large internal windows (Figure 11) flank the inner court at east and west. The building's high red brick walls and windowless appearance resonates with other contemporary industrial buildings, such as Hermann Distel's abbatoir, Seegrenzschlachthof, in Hamburg, and J. Theo Halliday and Giles Gilbert Scott's power station in London's Battersea, where work began in 1929, and its internal windows recall those designed by Walter Gropius for the Fagus factory.

Ufa's windowless building had the added benefit of shielding film production from the unauthorised gaze. As Jacobson (2020: 4) has argued, this feature that was common to many studios may even have contributed to their critical neglect as physical spaces: film studios, 'a hidden necessity for illusionary forms of cinematic and televisual production', were 'rarely noticed by film and television viewers or acknowledged by critics. Hiding in plain sight, these critical sites readily faded into the background of text- or exhibition-focused critical discourse'.

To achieve a high standard of sound insulation, Kohtz chose state-of-the-art materials, specifically Aphonon, Celotex, and Torfoleum, materials that had been developed principally to reduce noise and retain warmth in domestic and public buildings. Whilst Aphonon was relatively new, both Torfoleum and Celotex had been around for a few years. Aphonon was developed and named by Martin Hahn and Kurt Eisenberg, and a German patent (DE 466 022) for this new composition was approved in 1928. The patent claimed that this substance, which was composed of 65% lime, 25% oil, and 10% clay, was capable of reducing sound energy to 0.5% and could be used either as an intermediate layer or as padding material. The *Prager Tagblatt* (Schallsichere Hotelzimmer 1928) described it as 'a solid, wax-like material suitable for use as a padding to provide sound insulation when applied to walls in hotels'. Kohtz sandwiched layers of Aphonon between solid wood for the large studio doors. Celotex/Cellotex was a composite made from sugar cane fibres. It was manufactured in Potsdam under a US patent, most likely American patent US 1633594 for retted bagasse fibers, which was first registered in 1924. Mashed into a pulp, the sugar cane fibres trapped air, thereby preventing temperature equalisation. In this way they retained heat and insulated against sound.



Figure 11: Interior windows.
Photograph by Amy Stone.

Kohtz used Cellotex boards on the walls above a height of roughly 5 metres, leaving the lower brickwork exposed. Heavy drapes could be used to reduce reverberation from the brick walls during recording. Shortly before construction was finished, Ufa's board also approved covering 'the wide iron girders in the ceiling construction of the sound film studios with Cellotex' at a cost of RM880 (19 September 1929, R109-I/1027b, BArch).

Torfoleum was created from *Torf* (peat). A patent registered in 1915 by the Gesellschaft für Torf-Isolation GmbH may have been the original formula, although a slightly later patent registered by Eduard Dyckerhoff in May 1916 — DE 356 334 — is most likely the source of the Torfoleum trade name. This patent described the substance as 'bodies or masses of pure peat that may be rendered water-resistant' by being heated to 120°C and that could be 'used to fill hollow wall spaces and the like, especially such as are subject to the effects of dampness'. Kohtz used Torfoleum boards for the base of the soundproof doors in the Tonkreuz. The result, a veritable 'laboratory of sound', was evidently a success. Riedrich (1930: 144), for example, comments that Kohtz had built a sound film studio that 'not only meets the requirements for sound insulation but goes far beyond what would have been necessary in view of the sensitivity of the recording equipment'.

Fischer and Lichte (1931: 440) describe further elements of the soundproofing measures taken. To prevent noise transmission within the building, the windowless walls were

doubled with interstices of air and sound-insulating materials. The doors are also two-skinned and of heavy iron construction. Signal lamps prevent them being opened prematurely. Because the machine rooms needed to be located close to the studios, it was necessary to place all the machines on concrete blocks with sprung pedestals. These blocks lie over a foundation layer on top of the main foundations, which are built down to the ground level. Solid girder constructions between the studios and the machine rooms were avoided.

The combination of insulating materials, absence of windows, and the introduction of new lighting systems demanded a ventilation system that controlled the temperature and provided fresh air for those working inside the building. Paul Lehmann, technical director on Ufa's management board, announced a new offer for the ventilation system for the sound film studio using the Cärrier system (**Figure 12**) that, according to the board minutes, was 'built by a German company under American patents' (a company called Cärrier Lufttechnische Gesellschaft established by Albert Klein in 1924) and was 'much better than Ufa's previous offer under German systems, which very often fail. Mr Kohtz has had the opportunity to observe a ventilation system of this kind at a silk factory in Premnitz, and their verdict is very favourable' (25 April 1929, R109-I/1027a, BArch). Once taken up by Ufa, the Cärrier company lost no time in using the name of its famous client in advertisements.

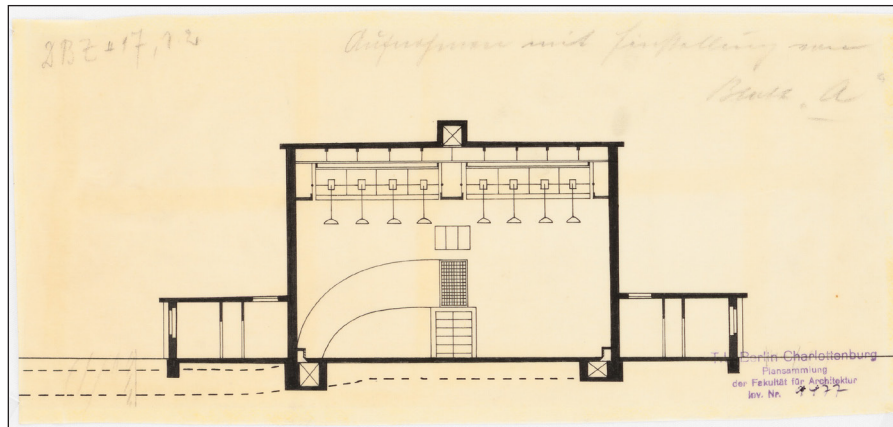


Figure 12: Kohtz's drawing of the studio interior showing the Carrier ventilation shaft. Inv. Nr 9477, Architekturmuseum der Technischen Universität Berlin.

The warm façade that greets visitors to the Tonkreuz was built with Sommerfeld clinker bricks (bricks that are fired at temperatures between 1,100–1,300°C and undergo a process known as sintering that hardens them and produces a distinctive variety of shades) laid in a Flemish bond formation. Flemish bond formation alternates between header bricks (the short end of the brick) and stretcher bricks (the long side of the brick), a laying method that adds extra strength to brickwork. In mutating daylight, the orange brick façade shifts to red, creating a visual ambiguity that smudges the palette of shades and colours from steel grey and olive green to burnt ochre and salmon pink. The building's cornices are made of concrete. The architectural drawings prepared by Kohtz include many details about furnishing and fittings, even noting the best material for upholstery. The emphasis was on ease of cleaning, and so the furniture made of birch and walnut was upholstered with washable cretonne fabric. Kohtz's later designs for other Ufa buildings also included details about light fittings and other interior fixtures.

Once the decision to convert to sound had been taken, Ufa was anxious to proceed without delay. The Tonkreuz had to be ready within 82 days if the contractor, Heilmann & Littmann, was to avoid costly penalties (16 April 1929, R109-I/1027a, BArch), a situation that emblematised the hurried modernity that was being ushered in. The building contract called for a series of escalating bonus payments for each day that was saved on the construction time, provided that the work was satisfactory. This tight schedule meant that activity continued day and night, which must have considerably increased the ambient noise in the locality. Clearance work on the site began on 25 April 1929 and on 1 May 1929 the *Spatenstich*, the groundbreaking ceremony, took place. The building's frame was completed on 25 June 1929.

It was not plain sailing, however, as in July 1929, as board minutes record, 'the plasterers at Heilmann & Littmann' went on strike. The minutes note the solution the

board arrived at for this problem: 'Since this work is of the utmost importance for the timely installation of the sound film recording equipment, Mr Grieving is authorised by Ufa to pay these workers special allowances up to a maximum of RM3,000 however he deems it appropriate' (12 April 1929, R109-I/1027b, BArch). A follow-up does not appear in the board minutes as to whether this payment was actually made; however, in later planning for the completion ceremony, the directors discussed whether or not to abide by the normal practice of special payments for individual builders on the occasion of the ceremony (19 September 1929, R109-I/1027b, BArch).

The fact that Klangfilm continued to tinker with its technology during the construction process led to disagreements between it and Ufa, and Ufa blamed Klangfilm for the slow conversion of its cinemas when what should have been a sound film premiere on 14 May 1929 was delayed until the middle of July that year (11 October 1929, R109-I/2421, BArch). Ufa also complained that Klangfilm had supplied equipment for the *Behelfs-Atelier*, the temporary studio located in the large glasshouse while the Tonkreuz was being constructed, that had not been fully tested and subsequently needed adaptive work (11 October 1929, R109-I/2421, BArch).

While arguments inevitably ensued as a result of this adaptive work as to which company owned the intellectual property of a particular innovation, the work itself arguably increased the skills of Ufa employees and pushed them to be more inventive. Grieving advised his board colleagues that sound 'requires new, often complicated equipment, which has the effect of almost turning the studio into a physics laboratory' (doc. 336, 10 April 1929, R109-I/2421, BArch), a prescient observation, as, like other film studios around the world, the Tonkreuz was indeed a form of laboratory, one where technological changes continued to be tested on a living workforce, first with changes to sound film technology and subsequently with colour film when temperatures in the studio rose beyond comfortable levels, testing human endurance.

Meeting minutes from Ufa's management board provide much information enabling one to chart modifications made to the Tonkreuz from its completion in September 1929 to 1939. In January 1931, for example, the board discussed the purchase, at a cost of RM1,300, of an iron staircase 'to initially connect one of recording rooms with a studio' (23 January 1931, R109-I/1027b, BArch). Two months later it was decided to invest in three more staircases to link the remaining recording rooms to each of the studios at a cost of RM 4,200 (17 March 1931, R109-I/1027b, BArch). Some adjustments that were made are not recorded in the minutes, raising questions about when they were made. For instance, at some stage a smaller door was added to each studio alongside the large doors (**Figure 13**).



Figure 13: A smaller door for personnel was added at a later stage. Photo by Eleanor Halsall.

The layout of the Tonkreuz was also reconfigured, as technological improvements changed requirements, sometimes eliminating the need for task-specific spaces. Perhaps the most significant of these came in 1935 when Klangfilm's technology changed, freeing up space in the studio for other functions. The original Klangfilm system was designed with the central court at its heart and with the four sound recording rooms looking into each studio respectively. Once the system was revised, however, the windows into the studios became obsolete and were filled in, thereby creating rooms without any natural light (in later years provided with skylights). The introduction of the new system gave the board the opportunity to make more significant changes to the configuration of the *Mittelbau*, the core of the Tonkreuz. In 1935, a glass roof was added to cover the central court of the building to create a workshop for sound technology; markings are visible that indicate the earlier existence of a pitched roof, which does not appear in early photographs from 1929 (**Figure 14**).



Figure 14: Recent photograph of the inner court. Photograph by Amy Stone.

People at Work

The people who worked in the Tonkreuz play as significant a role in understanding the building as the bricks and mortar that constitute its frame. Who were they and what roles did they fulfil? What was their experience of working in this iconic space? How did they use the building and adapt it as their own? Those whose names were listed in the film credits are easily traced. But what of the numerous but unnamed women and men who worked behind the scenes, a tiny handful of whom inscribed their names as graffiti on the bricks which survive to this day (**Figure 15**)? Physical reminders such as these speak to Hannah Frank's (2019: 1) suggestion that we try to 'imagine studying a building not by walking its hallways or perusing its blueprints, but by examining each of its bricks: the pockmarks produced by air bubbles in the clay, the whorls of reds and browns, the trowel's impressions in the mortar'. What other signs or adaptations of their presence might be traced? Where did workers live, and how did they journey to work?

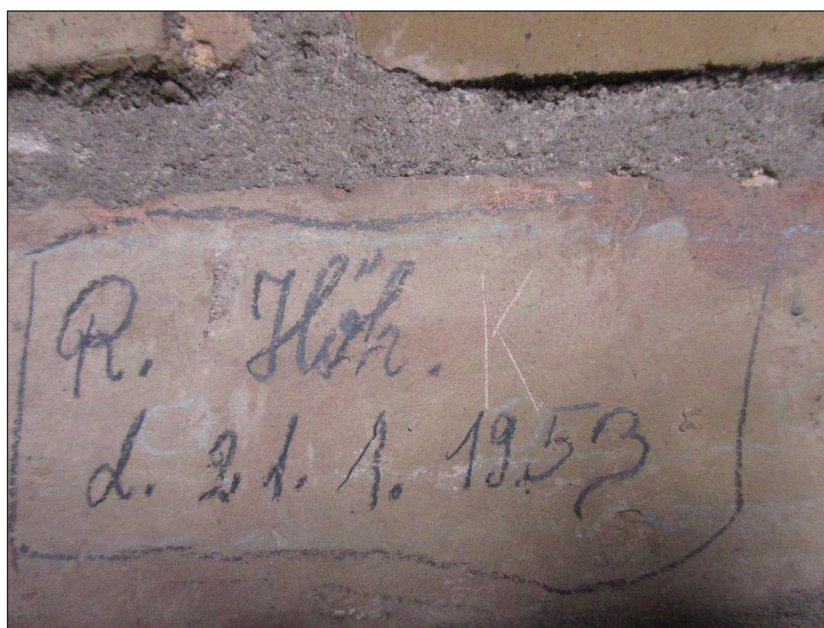


Figure 15: Autographed brick in the Tonkreuz. Photo by Eleanor Halsall.

The local train station to Babelsberg was in Drewitz. This was served by regular trains from Berlin, 'a comfortable journey through the Grunewald' (R109-I/2796, BArch), according to one worker. Judging by reports in the contemporary press, travelling by rail may have been the most common form of transport to and from the capital, which was reported as increasingly gridlocked. I compared digitised address books for Berlin and Potsdam from 1929 to 1938 to Ufa's extant files, which allowed me to compile lists of residents that suggest that the majority of higher-ranking filmmakers

— producers, directors, cameramen and film architects — lived in Berlin rather than in Babelsberg. *Dietzlers Auto Adreßbuch*, published between 1926 and 1934, lists vehicle registration plates with names and addresses. Among the names is producer Erich Pommer, registered as the owner of a Cadillac 110 — conceivably the car in which he took Josef von Sternberg to the Tonkreuz to begin filming *The Blue Angel* (1965: 139). Fritz Lang, Thea von Harbou, Lilian Harvey, and Willy Fritsch all owned private cars that are documented in this publication. They were certainly in the minority, however; unless they lived near enough to walk to the studio, most studio employees would have been compelled to rely on public transport, but given the unpredictable and long hours of filmmaking, they probably often found themselves without a way to get home easily.

Digitised directories also assist in compiling demographics of the Nowawes streets which bordered the Ufa site. The data provides names and numbers of residents at each address, and it also lists their self-identified occupations. Seeber appears in the directories beginning in 1922, where he is listed as a director/cameraman living at Stahnsdorfer Straße (*Adreßbuch* 1922). By 1930, another cameraman, Herbert Stephan, lived nearby (*Adreßbuch* 1930). The residents listed in Böckmannstraße (now August-Bebel-Straße, briefly Film-Akademie Straße) were bank managers, doctors, and businessmen.

Comparing the 1930 directory with the 1938–1939 edition reveals that several of the surrounding streets were renamed once the National Socialists came to power. Similarly, Nowawes, which had been merged with Neubabelsberg, was renamed Babelsberg in 1938. Stahnsdorfer Straße, the arterial road bordering the north side of the complex became Ufa-Straße during this period, and the area itself was renamed Ufa-Stadt in anticipation of the monumental plans that were being designed, initially by Kohtz and subsequently by Fahrenkamp, for the film city that would fulfil Goebbels's aspirations for Germany to lead the world in filmmaking.

The network of streets to the south of the Babelsberg site (**Figure 5**), which included Grossbeerenstraße, and the streets running to its south such, as Ahornstraße and Husarenstraße, housed a variety of skilled workers — metal workers, bricklayers, painters, and carpenters as well as labourers. The majority of the properties were multiple occupancy dwellings, and several of them are recorded as belonging to O&K. The residents of these properties were more likely to have been employed at the factory. By 1938, the number of film-related personnel in the area appears to have grown. Film architect Herbert Nitzschke lived at Ufa-Straße; production manager A. Schmidt and film editor Lydia Christiansen were both nearby. The skills of other residents that are recorded in the directories may have provided at least sporadic employment with Ufa; after all, the studio regularly engaged carpenters and painters to build sets and

hairdressers and makeup artists to look after the performers, and bricklayers, plumbers and electricians were also needed on a regular basis for ongoing building projects on the site.

By 1944, most of the lists, which had been created principally as a means of keeping track for wartime conscription, suggest that more people had moved nearer to their place of work. For example, a list of 32 lighting engineers reveals that 14 of them lived in the Babelsberg-Potsdam nexus. However, the flow outwards from Berlin may also have been driven by ongoing bombardment of the city, and some of the engineers on the list would have been working at the company's other studio in Berlin's Tempelhof.

The Studio as Laboratory

Echoing Grieving's comment about the film studio becoming 'almost a physics laboratory', Riedrich (1930: 144) remarks that 'as far as the practical experience of sound insulation of buildings was concerned, the science could only show theoretical calculations and practical results from laboratory tests' and that Kohtz was faced with the 'huge task' of evaluating 'the advantages and disadvantages of the experiences and experiments'. Sound technology demanded stringent control of extradiegetic sound in the studio environment, and the worker in this novel space was expected to act against human nature in order to conform to the new requirements for silence, stillness, and containment. Karin Bijsterveld (2013) and James Mansell (2016) have focussed on urban noise and its effect on human welfare, but the effect of the *absence* of sound as perceived is another matter. Anecdotal evidence from this period suggests that people initially experienced a significant degree of discomfort before they adjusted to the new medium.

Inevitably, it is the voices of the film stars that come to the fore: they were, after all, the people the public most wanted to hear from. Haid (1929) described her first sound audition in detail:

At the appointed hour, I found myself in the [Tonkreuz]. I must confess that my heart was pounding, and I was no less excited than I had been when I had my very first screen test as a little girl in the Vienna art film studio. I felt as if my last moments had come and the room into which I was led emphasised this. Its walls were covered with heavy black drapes, containing nothing but the microphone — an eerie magic box. The cameraman and his equipment were hidden in a cell where he towered over me like an invisible judge. But the most overwhelming thing was the absolute dead silence that lay over the room. I had always read about the complete silence in the sound film studios. ... [I]t became more and more unbearable every second and I was already on the verge of rushing up and away when suddenly a bell signal sounded.

The big moment had come. ... I was to act and speak a small scene from the film that had been briefly explained to me beforehand. And fortunately, it began with an exclamation that matched my mood like no other. I had to exclaim, close to tears: 'I can't stand it, no, I can't stand it anymore'.

Actor Alfred Abel (1930) described his first experience of sound film production in a similar way: 'Now, for the first time, the concept of sound film really dawned on me. Infinite silence all around. Nobody moved. I was alone under three microphones that were hungry for sound and a flashing camera ... in no theatre in the world, in no big city, not even outside in nature is there such complete silence as in the sound film studio'.

Before the introduction of sound technology, studios were typically cold spaces, as indicated by an article regarding the hiring of children that reported that the police authority permitting minors to work in film studios stipulated that children were to be protected from draughts in them (*Bekämpfung der Kinderarbeit* 1928). Once studios became dark, however, and emphatically once sound technology enforced new conditions, cold, draughty studios were in the past and now the problem was excess heat. New forms of incandescent lights replaced the noisy carbon lights; these were quieter, but they raised the temperature significantly. The soundproofing materials retained the heat in spite of the C rrier ventilation system which blew 1,333 cubic metres of fresh air into the studio every minute (Jacobsen 1992: 150).

While during the silent film era, actors and technicians could move around freely when they were not actively working, this was not the case in the sound film era. Sound-film production techniques demanded a discipline which must at times have seemed extreme. The sensitive recording system also required the silencing of all nondiegetic sound and absolute precision in timing from the actors, so that sound and image could be perfectly aligned. How did workers respond to this? While one of the earliest publications in German from 1930 on the nature of the sound film was optimistic about the capacity of people and work environments to adapt, noting that 'people working in the studio will gradually become sufficiently experienced to avoid disturbances such as loud walking, knocking, coughing at an inappropriate moment' (Fischer and Lichte 1931: 441), the workers themselves were not sure. Film star Lilian Harvey (1930), for example, blamed the excessive heat in the *Tonkreuz* for the rude behaviour of her partner, Willy Fritsch, during one studio session:

I am certain that temperature has a great influence on the character of a person. Too much heat ... induces even the most benign natures to mischief and wickedness. And that opens up terrible prospects for the future of sound film actors, because it is always too hot in the sound film studio ... the heat emitted by the lamps and

spotlights builds up between the soundproofed walls and padded doors, and if the weather outside is also warm and sunny, it increases to such an extent that one could easily bake pancakes on the studio floor.

Josef von Sternberg (1965: 138) related his experience of working in the Tonkreuz during the making of *The Blue Angel* over the winter of 1929–1930: ‘To eliminate the noise of the camera mechanism huge crates had to be built, in series, to house the cameraman and me, each facing its set so as to permit us to hop from one crate to the other, thus preserving the continuity of sound, which differed from the continuity of the visual pattern’. He also commented on how the film’s star, Emil Jannings, used the director’s ‘incarceration in a booth’ to his own advantage (140).

Much work still needs to be done to populate the history of German film work at Babelsberg with information about the unnamed women and men who worked behind the scenes, as well as the large number of foreign workers who contributed their labour, both voluntarily as well as forcibly during the war (Püschel 2002). This data remains to be collated from a variety of sources: Ufa’s documents in the form of meeting minutes, employment contracts and offer letters, and, more obliquely, comments in the files related to disciplinary matters, special payments, workplace accidents, and deaths in service.

Conclusion

My article has focused in the main on the creation and early years of the Tonkreuz. But as I mentioned at the beginning, the building remains a symbolic fixture in German film production. National Socialism’s belief that film was useful for both propaganda and distraction purposes ensured that financial support flowed into the studios for expensive colour productions, such as Josef von Baky’s *Münchhausen* (1942). Inevitably, war led to shortages in materials, equipment, and people. While Babelsberg’s location outside Berlin meant the building suffered little bomb damage, all buildings there were subject to looting, and much of the equipment was seized and requisitioned by the Allies in 1945. The studio became part of the Russian sector of Germany when the Allies divided the country into four zones of occupation, contributing to Babelsberg’s revival as a centre of film production when the East German DEFA (Deutsche Film AG) was established in May 1946. The Tonkreuz continued to serve as a studio and was further adapted to accommodate television production by the end of the 1950s. German reunification in 1989 brought more changes, as the complex went from being under state control into private hands. The studio in the 21st century has hosted international as well as German productions, including Quentin Tarantino’s *Inglourious Basterds* (2009) and Tom Tykwer’s television series *Babylon Berlin* (2017–).

One might read the Tonkreuz as a functional machine that continues to earn its keep, not by dint of its architectural splendour but by the work it enables within its walls, its worn internal spaces, the paint, tiles, and metal visibly chipped and scarred from the passage of people, props, and heavy equipment over decades. Its inner recesses hide cubby holes that no longer serve their original purpose owing to technological improvements, and its unvarnished brick walls are autographed with the names of those whose contributions as lighting engineers or factotums were not credited during these early decades of cinema. The Tonkreuz remains at the heart of the Babelsberg complex, a survivor and an icon. But its iconicity extends beyond merely being a symbol for Ufa or even the German film industry. It is a building and work environment whose constancy as a centre of film production bears witness to changing occupancy and ownership, including expulsions, exile, and returns, the adaptation to new technologies and working practices, the catastrophic effects of war, and the exigencies of a variety of political systems. Thus my account serves as a reminder that the history of film studios constitutes a field of study where developments in technological innovation, architecture, social history, and urban archaeology intersect and help to illuminate each other.

Note

¹ All quotations from German sources have been translated into English by the author.

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The author has no competing interests to declare.

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