Magic Mirrors: The Schüffan Process

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1 author:

Katharina Loew
University of Massachusetts Boston
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MAGIC MIRRORS
THE SCHÜFFTAN PROCESS

KATHARINA LOEW

In the history of special effects, the 1920s represent a key transitional period. The decade saw a steady proliferation of cinematic illusions in both the United States and in Europe. Simultaneously, the dominant function of 'tricks', as special effects were known throughout the silent era, changed as well. In early cinema and into the 1920s the vast majority of tricks depicted supernatural events or impossible physical feats. During the 1920s, however, cinematic illusions were increasingly employed for practical (usually financial) reasons. Pricey location shoots or extravagant sets were now inexpensively faked in the studio. By the time sound was introduced, the main purpose of trick technology had become the discreet imitation of physical reality.

Paramount to this functional change was the standardisation of trick techniques. In early cinema, film-makers devised tailormade solutions for trick shots that were expectedly far more troublesome and expensive than conventional scenes.[1] During the 1910s, producers of slapstick comedies and sensational melodramas in the US made important advances in trick technology, frequently to facilitate stunts. Respectable film-makers with artistic aspirations, however, often dismissed such devices as inauthentic and deceitful. Special-effects pioneer Norman O. Dawn, for example, failed to convince D. W. Griffith to let him create glass paintings for *Intolerance: Love's Struggle throughout the Ages* (1916). According to Dawn, 'Bitzer [Griffith's cinematographer] said he didn't want any of that fakey stuff.'[2] And so, Babylon was built full-scale. Since the late 1910s, however, versatile compositing procedures such as glass paintings, foreground miniatures and matte paintings became popular with film-makers and producers. Effective and economical, they began to be utilised routinely to imitate physical reality. In 1926, cinematographer and special-effects expert Carl Louis Gregory recalled how special effects took root in the American film industry:

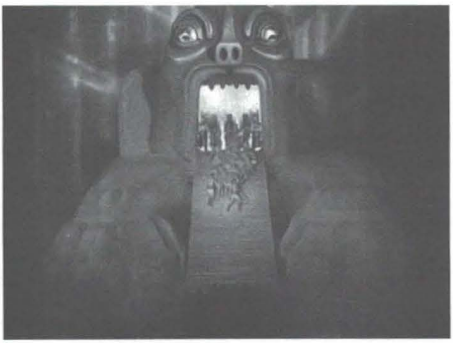
> For a long time [trick photography] was the step-child of the legitimate producers. The comedy producers, however, have always regarded it as one of their strongest allies. It is, in fact, mainly due to the patient research of serious workers on the slapstick lots that the credit for the present perfection of trick effects is largely due [sic]. Farsighted producers have awakened to the money savings that may be effected by the use of trick photography and now all the larger companies retain the services of high salaried experts who are specialists in the business of artistic photographic trickery.[3]

In European film-making, standardised, inconspicuous and economical special effects started gaining traction in the mid-1920s. This novel approach was epitomised in the much-publicised commercial launching of the Schüfftan process in Germany in 1925–6 and in Britain in 1927. In

contrast to previous practices, the Schüfftan process was not conceived to solve one specific problem. Applicable in a variety of contexts, it embodied the burgeoning European trend towards utilising special effects for practical purposes. The Schüfftan process economises space and time on location and requires little equipment. Only small portions of the set have to be built in full size since all purely scenic décor can be provided by reflected images. Although the arrangement of live-action and complementary sets demands considerable talent, the final composite can be monitored directly and does not rely on costly and time-consuming laboratory work. Although many contemporaries perceived the technique as an emblem of modernisation, 'Schüfftan's magic mirrors'[4] were still very much grounded in nineteenth-century traditions of handicraft and optical illusions. Inventor Eugen Schüfftan's main motivation in creating a universal, cost-efficient special-effects technique was to facilitate previously unattainable representations of the unreal and impossible; in his own words, he sought to 'visualise the imagination'.[5] Yet the potential of Schüfftan's invention to depict the fantastic was seldom realised: the most widely employed method for rendering synthetic images in European film-making from the 1920s to the 40s was predominantly used for set extensions. The fate of the Schüfftan process highlights how, in the 1920s, the standardisation of special effects changed their principal function. Compared to the total film output, 'fantastic effects' receded while 'invisible' uses prevailed. In time the Schüfftan process was marginalised in favour of high-tech processes such as rear-projection or travelling mattes. Nonetheless, due to its capacity to generate striking effects on a shoestring budget, it continued to play a role in film-making. Eventually, it became a nostalgic icon for a time in film history when film-makers were simultaneously craftsmen, artists and magicians.

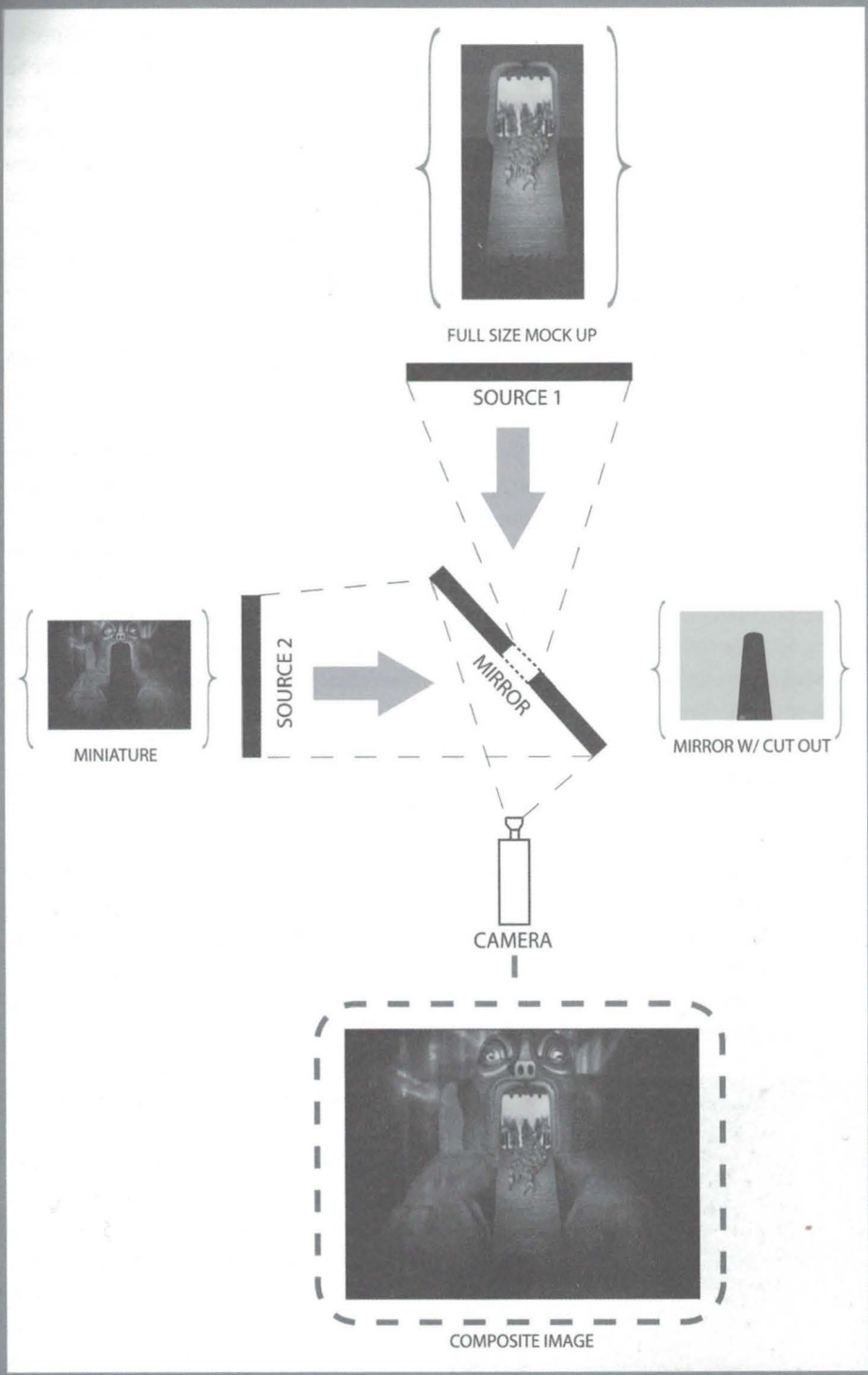
How the Schüfftan Process Works

The basic principles of the Schüfftan process are simple. A model is set up to one side of the camera while a live-action scene is staged straight ahead of it. A front-silvered mirror is placed at a forty-five-degree angle directly in front of the camera and parts of the mirror's reflective surface are removed.[6] The model is reflected in the mirror's remaining silvered portions and replaces parts of the live-action scene. The mirror is positioned quite close to the camera's short focal (wide-angle) lens, which is focused on infinity. As a result, the reflection of the model is in focus, whereas the mirror's surface itself is blurred. Optically, the two scenes merge and are recorded simultaneously.



The Moloch-scene in *Metropolis* (1927)

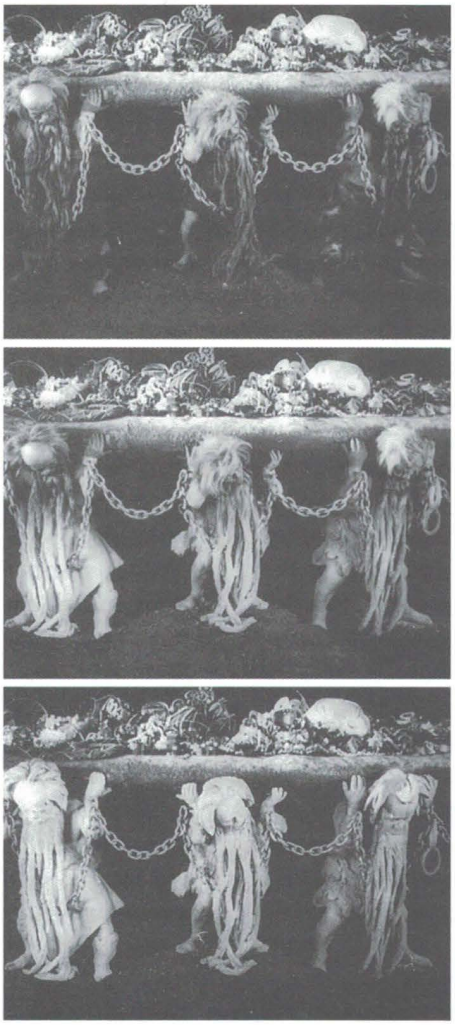
The Schüfftan process facilitates the combination of live-action scenes with a variety of visual components, both still and in motion, including photographs, models and projected images. The transition between the Moloch miniature and the full-size stairs in *Metropolis* (1927) is remarkably difficult to spot. This is a result of Schüfftan's broad jagged zones where the reflective surface gradually peters out.



The Moloch-scene in *Metropolis*, created by means of the Schüfftan process

These transitional areas, which render objects indistinct and partially transparent, help to conceal dissimilarities in lighting between image components, but can also be revealing. Apart from minor defects, i.e. their soft image quality and blurry transition zones, Schüfftan shots have few unique visual features. Instead, they reproduce those of the image components involved. When employing models, for instance, Schüfftan shots exhibit the advantages and disadvantages of conventional miniature shots: the Moloch appears relief-like, but its face lacks aerial perspective. Similarly, when mobile models are being used, miniatures in Schüfftan shots often seem to be moving at an accelerated pace.

The Schüfftan process opened up great new possibilities for film-makers. To begin with, it could render transformations unattainable by any other analogue technique. This is particularly apparent from its first application in Fritz Lang's *Die Nibelungen: Siegfried* (1924). Here, the eponymous hero slays Alberich (Georg John), king of the Nibelungs, whereupon the dwarfs who are chained to the king's treasure basin turn into stone. The execution of the dwarfs' petrifaction remains impressive today. To achieve this shot, two treasure basins were constructed, one in front of the camera for the live actors and a replica, complete with petrified dwarfs, situated beside the camera. Because it would have been exceedingly difficult to create a mirror-inverted mould of the live-action scene, two mirrors were used: one fixed and fully reflective and one that was partially transparent and could slide up and down. Initially, the live-action scene was shot through the transparent part of the sliding mirror. At the moment of petrifaction, the mirror slowly moved up, allowing the reflective part to replace the live actors with their plaster copies.[7] Conventionally, this effect could have been realised by means of a dissolve from the live actors to their stone replicas. It would have been impossible, however, to represent the dwarfs' transformation from the bottom up and it is precisely this aspect that gives the shot such an eerily realistic quality.



The dwarfs' petrifaction in *Die Nibelungen: Siegfried* (1924)

Before the major problems of rear-projection could be addressed satisfactorily, the Schüfftan process was the only feasible

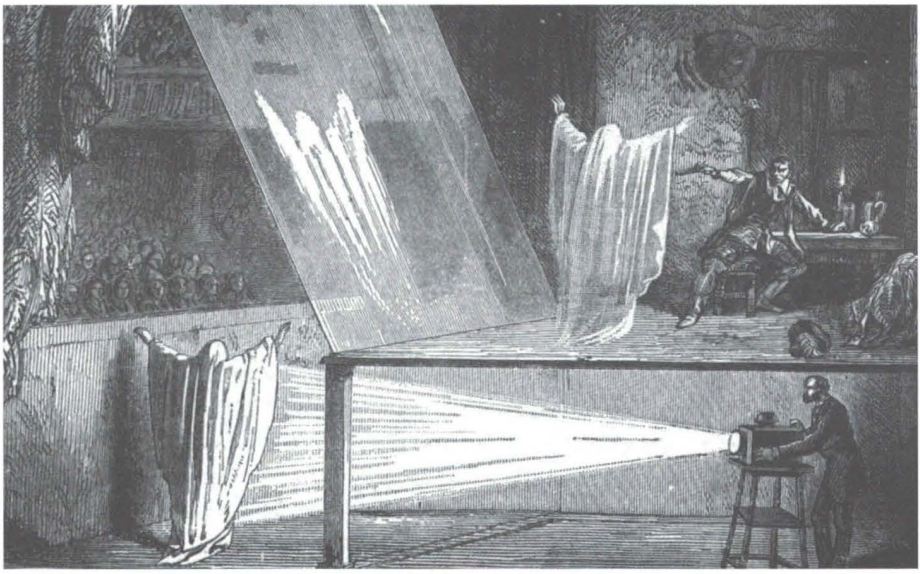
single-exposure technique for rendering previously recorded moving images.[8] In addition, the Schüfftan process allowed for the integration of moving models with live-action footage. Finally, 'Gulliver' effects, i.e. the rendition of extreme size differences between living things, became convincing and flexible enough to sustain a feature film. Although *Gulliver's Travels*, one of Schüfftan's pet projects and a main selling point of his invention, was never realised with its help, the Schüfftan process was used to achieve 'Gulliver' effects for instance in *Knock, ou le triomphe de la médecine* (1925)[9] and *Das kalte Herz* (1950).

Eugen Schüfftan: The Man behind the Process

Born in Breslau in the German empire (today: Wrocław, Poland), Eugen Julius Schüfftan (1886–1977) was trained as a painter, architect and set decorator at the reputable Königliche Kunst- und Gewerbeschule (Royal Art and Vocational School) in Breslau. In 1912, he applied for his first film technological patent, a motorised projector that could alternately display two reels of film. During the early years of World War I, Schüfftan was wounded in France and subsequently honourably discharged.[10] After having unsuccessfully attempted to commercialise his projector patent,[11] he began collaborating with his former teacher, architect Hans Poelzig[12] and contributed to Poelzig's acclaimed renovation of Max Reinhardt's Großes Schauspielhaus (1919) in Berlin.[13] Around the same time, Schüfftan started to work as an animator for the studio Deutsche Lichtbild-Gesellschaft and devised the trick technique that would become known as the 'Schüfftan process'. Having spent the 1920s refining and promoting his invention, Schüfftan grew frustrated that the technique was mostly used for set extensions. He consequently launched a career as a cinematographer with *Menschen am Sonntag* (1930). Forced into exile by the rise of the National Socialists in 1933, Schüfftan went to France where he photographed several masterpieces of poetic-realist cinema, most notably *Drôle de drame* (1937) and *Le quai des brumes* (1938). The German invasion of France in 1940 forced him to flee once again, this time to the US, where his career came to a virtual standstill. Because of Hollywood studios' closed-shop labour environment and the rigid protectionism of the American Society of Cinematographers (ASC), Schüfftan, 'the master and patriarch of German cinematographers at the time',[14] was only able to find sporadic and mostly uncredited employment as a cameraman or special-effects supervisor. In the 1950s and 60s, he worked primarily in Europe, but could never revive what had once been a distinguished career. Despite his major accomplishments as a cinematographer, Schüfftan's name is now mainly associated with his early trick technological invention.

Old and New Mirror Magic

Mirrors have constituted the single most important tool in optical illusions for centuries and the Schüfftan process is just one in a multitude of mirror-based effects. Mirrors are integral to optical toys like the Praxinoscope and to fairground attractions like halls of mirrors and mirror mazes. Nineteenth-century magicians relied on mirrors for various levitation, vanishing, decapitation and multiplication acts. The best-known trick for combining visual components live on stage makes use of a partially reflective mirror (i.e. a pane of glass) and is commonly referred to as Pepper's Ghost. This effect is based on the simple fact that glass can both reflect and transmit light and had already been described by Giambattista della Porta in 1558. The more



Pepper's Ghost on the nineteenth-century stage

the lighting conditions vary on both sides of a pane of glass, the more pronounced are the glass's reflective qualities: Objects on the lighter side of the pane appear 'superimposed' onto the objects on the darker side. Around 1863 John Henry Pepper and Henry Dircks adapted this phenomenon for the theatre stage and popularised it under the name of 'Pepper's Ghost'. An invisible glass plate in front of the stage reflects the image of a hidden and brightly illuminated actor, which the audience perceives superimposed onto the stage.

As Sidney W. Clarke concluded in 1926, it was Pepper's Ghost that for the first time 'brought home the immense possibilities of glass, plain or silvered, in the production of magical illusions'.[15] Its principles were subsequently utilised in a variety of theatrical illusions, in cinematic 3D performances since the 1910s[16] and also in conventional film.[17] Because the Schüfftan process also involves a mirror at a forty-five-degree angle, it is distantly related to Pepper's Ghost. However, in contrast with Pepper's Ghost, the Schüfftan process does not create superimposition effects. What is more, it is a technique that relies on monocular vision and cannot be implemented on stage.

While partially reflective mirrors such as those used in the Pepper's Ghost illusion confronted early film-makers with severe lighting problems,[18] fully reflective mirrors became a standard tool for creating image distortions, duplications and composites early on in film history. Widely publicised, for instance, was the mirror trick behind the confrontation between a human-sized smoker and live-action miniature fairies in the most celebrated trick film of its day, *Princess Nicotine; or, The Smoke Fairy* (1909).[19] Here, a conventional mirror that reflected actors performing next to the camera was integrated with a black backdrop.

This type of mirror composite differs significantly from Schüfftan's, which not only utilises reflected images but is also related to foreground model techniques like glass paintings and hanging miniatures. Indeed, the important innovation of the Schüfftan process lies in the fact

Mirror composite in *Princess Nicotine* (1909)

that the mirror is placed in the foreground rather than background of the scene without creating superimposition effects *à la* Pepper's Ghost. The use of reflected images compensates for problems with lighting, focus and depth of field and thus allows for a smoother integration of the additional image components with the live-action scene.

However, given the tradition of foreground models and reflected images in film-making, the novelty of the Schüfftan process was called into question, particularly in the US. Norman O. Dawn asserted that he had employed the same technique as early as 1912.[20] Carl Louis Gregory also raised objections to Schüfftan's originality: 'This method has lately been heralded as a wonderful German invention under the name of the Schuefftan process but is antedated by several American uses, among whom are David Horsely [sic], J. Searle Dawley, and myself.'[21] There is no doubt that mirrors, glass paintings and hanging miniatures had featured in single-exposure composites prior to Schüfftan. However, there is no evidence that others anticipated Schüfftan's specific approach with partial foreground mirrors. In addition, regardless of whether individuals previously experimented with similar setups or not, Schüfftan won all patent litigations and it was undeniably his specifications that established mirrors as standard tools for producing composites in film.[22]

Illusions Become Products

As the demands of an international and profit-oriented entertainment industry prevailed during the 1920s, film-making in Europe became progressively rationalised and globalised. At the same time, as long-established, popularly held aesthetic ideas would have it, art had to originate in the imagination, in subjective experience and in the mysterious, intangible and magical. The Schüfftan process can be understood as an attempt to reconcile these opposites and integrate prevalent romantic ideals with the realities of a modern film industry. On the one hand, the Schüfftan process harks back to earlier traditions. Its reliance on mirrors and the laws of optics echoes a nineteenth-century fascination with optical illusions and stage magic. The ardour of German film pioneers like Max Skladanowsky and Oskar Messter resonates in the dedication with which Schüfftan refined his process over a decade, developing complex modifications with a variety of mirrors, lenses, prisms and projectors. On the other hand, Schüfftan's commitment to trick technological innovation was also driven by commercial considerations. In fact, Schüfftan envisioned his process as a worldwide marketable product, which was both ambitious and highly unusual at the time. Until then, trick techniques were commonly seen as a cinematographer's personal assets and constituted closely guarded secrets. Schüfftan, in contrast, turned special effects into a commodity. Between 1922 and 1930, Schüfftan was granted over forty patents in at least eight countries for variations of his process and embarked on an unprecedented international business scheme. Ultimately, however, Schüfftan's attempts to establish his invention as a global brand proved barely profitable.

Ufa, Spiegeltechnik and the Menace of Modernity

After Schüfftan had demonstrated the great potential of his invention in *Siegfried*, Ufa acquired the licence to commercialise the patents in April 1925. However, rather than exploiting further the technique's capacity for realising fantastic scenes, the studio became interested in the Schüfftan process as a means to lower expenditure on set design.[23] Ufa set up an in-house mirror-trick department that was subsequently outsourced and merged into the specialised company Spiegeltechnik GmbH & Co. (roughly 'Mirror Technology Ltd').[24] Founded in September 1926, Spiegeltechnik GmbH & Co. produced made-to-order Schüfftan shots for Ufa and other German studios. In 1927, one out of every ten German films contained Schüfftan shots.[25] As one of Spiegeltechnik's shareholders, Ufa had an exclusive contract that entitled the studio to 1,000 metres of Schüfftan footage per year for an annual guarantee sum of 100,000 Reichsmark (equivalent to £5,000 or $25,000 in 1927). All 'external' licensees were charged per metre of Schüfftan footage produced. Rates were negotiated on an individual basis and covered the licence, rental fees for mirrors and cameras, salaries for the technicians and expenses.[26] Spiegeltechnik GmbH & Co. turned out to be a disappointment, mostly due to exaggerated expectations on the part of Ufa. In order for the contract with Spiegeltechnik GmbH & Co. to be profitable, approximately two-thirds of Ufa's total feature-film production would have had to include an average of more than three minutes of Schüfftan footage. In actual fact, however, in 1925 only about one minute of Schüfftan footage was used in one-quarter of Ufa's feature films.[27] Strangely, the use of Schüfftan process at Ufa almost ceased after Spiegeltechnik GmbH & Co. had been established: during the 1926–7 season, only one Ufa production featured Schüfftan shots.[28]

To be sure, other studios took advantage of the Schüfftan process and commentators were enthusiastic about the technique's allegedly unlimited possibilities. They even associated it with utopian ideas of artistic renewal. Art director Walter Reimann, for instance, envisioned:

> The film of the future will no longer need huge studios and warehouses full of props. The moving camera, the mirror image, the painted backdrop, veils, smoke, pyrotechnics, curtains and a few rags – and in between human beings, real human beings, with incredible expressivity and light in all nuances.[29]

In addition, the promotion of the Schüfftan process as the hallmark of German technological excellence also inspired national pride. Schüfftan shots featured prominently in Ufa's prestigious flagship productions such as *Varieté* (1925), *Metropolis* and *Die Liebe der Jeanne Ney* (1927). In the majority of smaller-scale Ufa films, however, where first-level management had greater bearing, negative attitudes towards the Schüfftan process adversely affected its use. Many filmmakers saw it as a threat to their artistic freedom. Cinematographers, for instance, felt limited in their creativity: '[T]he cameraman has to content himself with turning his handle in the usual way. His personal skills come less into their own, because the process … already prefabricates everything before the take.'[30] Fearful for their livelihood, set designers and set decorators viewed the Schüfftan process with trepidation, as it was supposedly 'a cinch to predict that the future belongs to this invention [the Schüfftan process] and that the set designer and the huge set will be ousted with its help'.[31] In view of the fears the Schüfftan process raised, it is not surprising that a 1927 report concluded that

> [c]ertain circles within [Ufa's] production departments are sabotaging the Schüfftan process. Despite the sympathetic support from the head of production, Dr. Grau, it has not been possible to obtain orders from directors or set designers, even though there had been plenty of opportunities to shoot scenes using the Schüfftan process.[32]

Given Ufa's substantial financial investment in Spiegeltechnik and the Schüfftan process's capacity to reduce production costs, the senior management was understandably interested in employing the technique. However, they evidently overestimated the studio's demands and also staff acceptance. Ufa ended up severely underutilising the Schüfftan process, thus incurring significant losses and withdrawing from the partnership in February 1928.[33] After Ufa's withdrawal, Spiegeltechnik continued to exist into the 1930s. At this point, however, Schüfftan no longer attended to his invention.

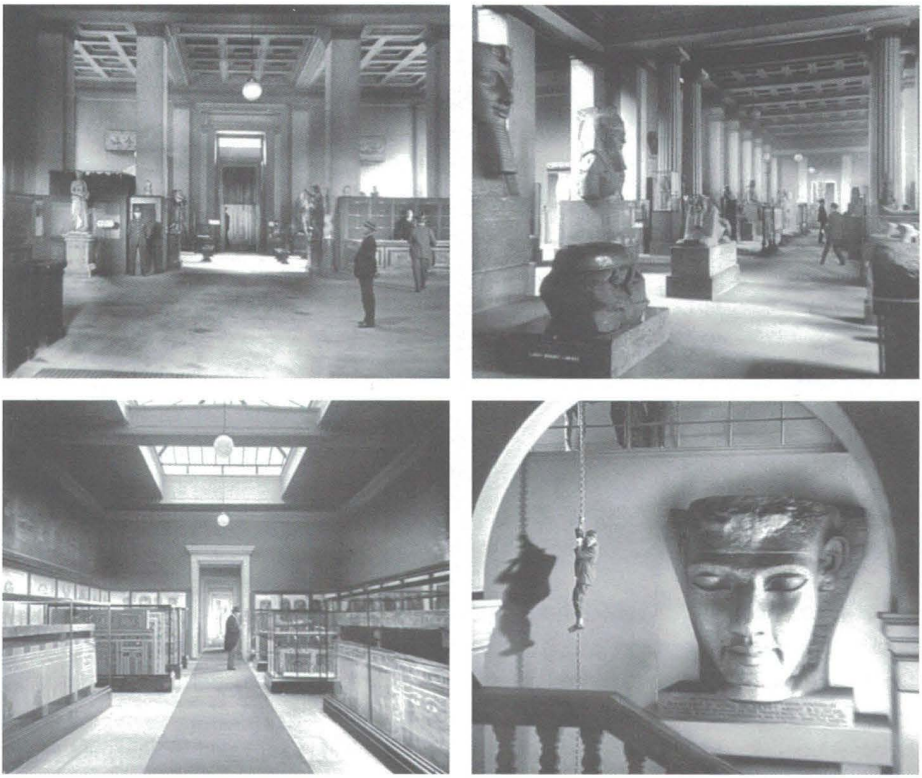
From Lilliput to Hitchcock

When travelling in Europe in August 1925, Carl Laemmle became aware of the Schüfftan process and secured Universal Pictures a two-year licence for commercialising the patents in North America, 'primarily to film *Gulliver's Travels*', as the *New York Times* reported.[34] Several other studios had previously considered adaptations of *Gulliver's Travels*, but none of these projects had been realised on account of the technological obstacles involved.[35] However, the scenes from *Gulliver's Travels* featured in Schüfftan's showreels apparently convinced Laemmle that the project had become feasible.[36] Starting in late 1925, Schüfftan and his collaborator Ernst Kunstmann spent about ten months in Hollywood where they refined the process while working on several low-profile Universal productions, as well as E. A. Dupont's first American film, *Love Me and the World Is Mine* (1926–7). Schüfftan's invention was met with considerable resistance in Hollywood and, compared to the media buzz in Europe, drew little public response in America. According to Schüfftan's observations, American directors and producers were more open to innovation than their German colleagues.[37] Cinematographers, on the other hand, were far less accommodating and, as mentioned above, accused Schüfftan of taking undue credit for a well-known technique. Universal eventually abandoned both the *Gulliver* project and its licence to the Schüfftan patents. In 1930, a second attempt was launched to promote the Schüfftan process in Hollywood. Now the technique's main selling point was its ability to resolve sound-related issues: large settings could be staged in intimate studio contexts where the sound was more easily controllable. As *Popular Science Monthly* reported,

> synthetic sets have become a vital problem. Thus it is expected that the Schufftan unit which arrived in the movie colony the other day will prove the nucleus from which will grow the general adoption of the system in this country.[38]

However, these hopes never materialised and the Schüfftan process failed to establish itself in America.

In contrast to its fate in Hollywood, the Schüfftan process prospered in Britain. In January 1927, British National Pictures acquired the world rights (except for Germany and North



Schüfftan shots in *Blackmail* (1929)

America) as part of a major endeavour to modernise and expand the studio.[39] Replicating Schüfftan's German business strategy, a subsidiary company, the British Schüfftan Process Co. Ltd,[40] was formed, to which, as the *Kinematograph Weekly* reported, 'other production companies will be invited to subscribe ... [making the invention] available on license to all interested'.[41] Schüfftan and other Spiegeltechnik personnel travelled to London where they promoted the process, trained British staff and worked on British National's *Madame Pompadour* (1927). In the following decades, numerous British productions utilised the Schüfftan process, including several Hitchcock films such as *The Ring* (1927) and *The Man Who Knew Too Much* (1934). In *Blackmail* (1929), the climactic final sequence includes nine Schüfftan shots. As Hitchcock explained to François Truffaut and Peter Bogdanovich, the lighting conditions inside the British Museum precluded shooting on location. Using photographs that had been taken with exposure times of thirty minutes, the film-makers created backlit transparencies that were combined with the live action by means of Schüfftan mirrors.[42]

In each case, only a small fraction of what is visible in the frame was built to size. As Hitchcock recalled, 'there was barely any set that could be seen on the stage'.[43] Although two-dimensional photographs were used, the shots convey a sense of depth and the transitions between the photograph and the stage are difficult to spot, which renders these composites quite convincing.

With the coming of sound, the Schüfftan process became even more popular with European film-makers. Mirrors could charm away microphones positioned above actors' heads and, as Hans Nieter, staff member of British Schüfftan Process Co. Ltd, pointed out, 'the "Talkies" had increased the demand for the process tremendously, because it was possible to portray large scenes in a small compass and defeat the bugbear of echo in the microphone'.[44] The requirements of sound equipment also accelerated the ongoing shift in the dominant function of special effects, which were now primarily used to recreate physical reality.

Niches for Schüfftan's Mirrors

In the early 1930s, Hollywood and subsequently European studios began investing in high-tech composite systems. Although the Schüfftan process appeared painstaking and antiquated in comparison, it continued to play a considerable role in European film-making into the 1950s. Being cheap, low-tech and unobtrusive, it proved advantageous for production companies on tight budgets. By the mid-1940s, only studios that had Schüfftan experts on staff or were unable to invest in high-tech systems continued to employ Schüfftan shots. The technique remained in use where resources were scarce, most notably in television, low-budget film production and amateur film-making.

The studio that utilised the Schüfftan process most consistently after World War II was the publicly owned East German DEFA (Deutsche Film-Aktiengesellschaft). Established in 1946, DEFA acquired a reputation for productions with fantastic subject matter. Given the studio's limited resources, the realisation of spectacular scenes in fairy-tale films like *Die Geschichte vom kleinen Muck* (1953) and *Das singende, klingende Bäumchen* (1957) called for inexpensive yet sophisticated trick technological solutions. Head of the studio's special-effects department between 1947 and 1963 was Schüfftan's former associate Ernst Kunstmann. He perpetuated Ufa's trick tradition and repeatedly reverted to solutions that had served him well thirty years earlier. The petrifaction of the wicked miller in *Der Teufel vom Mühlenberg* (1955), for example, was evidently modelled after the dwarfs' petrifaction in *Siegfried*. In comparison with their colleagues in the West, Kunstmann and his successors Kurt Marks and Erich Günther took an anachronistic approach to special effects that was consistent with the somewhat outmoded style of DEFA's fairy-tale films.[45] DEFA surely valued the Schüfftan process for its affordability, but also employed it more than any other studio to fulfil the inventor's original objective, namely to visualise the unreal and impossible.[46]

The Schüfftan process continued to be used in the West as well, albeit more sporadically. Film-makers working with small budgets like Mario Bava in *Terrore nello spazio* (1965) and Roberto Rossellini in *La Prise de pouvoir par Louis XIV* (1966) and *Socrate* (1971) deployed Schüfftan shots for set extensions. Remarkable post-war depictions of fantastic subject matter include Ulysses' confrontation with the giant Cyclops in *Ulisse* (1954), which was created under Schüfftan's personal supervision.

One of the technique's rare forays into magical effects in American film-making was Darby's (Albert Sharpe) visit to the Leprechaun cave in *Darby O'Gill and the Little People* (1959).[47] Indeed, the rendering of extreme size differences is one of the most striking applications of Schüfftan shots. Even in the late 1950s, the Schüfftan process was therefore considered an attractive option to cost-efficiently realise *Gulliver's Travels*. In 1958, writer-director Jack Sher

Darby entering the Leprechaun cave in *Darby O'Gill and the Little People* (1959)

expressed an interest in engaging the technique for his Gulliver project at Universal. On 23 May 1958 he wrote to Schüfftan:

> our script involves split-screen work, miniatures, the use of mock-ups and other standard tricks that are extremely costly. If your process can eliminate the necessity for six months of special printing after the picture is photographed, I know that we will be extremely interested.[48]

Unfortunately for Schüfftan, however, Universal backed out of the project and Sher signed with producer Charles H. Schneer, whose long-term partner Ray Harryhausen was entrusted with the special effects for *The 3 Worlds of Gulliver* (1960).[49]

Although the Schüfftan process only played a minor role in post-war special effects, it continues to inspire film-makers and technicians. It was influential in the development of front-projection systems, including Introvision.[50] In the digital age, film-makers like cinematographer Henri Alekan in *Der Himmel über Berlin* (1987) put the Schüfftan process back on the map. Special-effects supervisors Robert and Dennis Skotak, who enlised the Schüfftan process in *Aliens* (1986),[51] value traditional in-camera effects for their immediacy and excellent image quality: 'Even in the digital age, these techniques still work perfectly, and you can get your shot done in one take without any additional processes.'[52] The Skotaks as well as other film-makers like Niklaus Schilling in *Der Atem* (1989) have successfully experimented with hybrids of Schüfftan shots and digital technologies.[53]

Like no other phenomenon in the European context, the Schüfftan process highlights a crucial transition in the history of special effects: the shift from one-of-a-kind, eye-catching tricks to standardised, economical and imperceptible special effects. Simultaneously, it embodies a key

feature of European silent cinema, namely the attempt to reconcile ideals of artisan film-making with the realities of the motion-picture business. While Schüfftan's idealistic project of promoting fantastic film art could not ultimately succeed in a modern entertainment industry, the versatility and cost efficiency of the Schüfftan process as well as its capacity to produce high-quality composites have ensured its continued survival. To this day, the Schüfftan process epitomises the legendary ingenuity and creativity of German film technicians of the 1920s. As an icon for the inseparability of craftsmanship and film art, Schüfftan's magic mirrors persevere in the digital age.

This article is dedicated to Helmut G. Asper and Rolf Giesen, who prepared the ground for my work on Eugen Schüfftan and provided invaluable assistance during my research. Many thanks to David Degras, Yancey Clayton and Leigh Ann Smith-Gary for their generous help with completing it.

Notes

1. Talbot for instance writes:

> In common with other producers of trick films, Paul found that the time involved in their production was out of all proportion to the financial results. It was no uncommon circumstance for a subject approximating 100 feet in length to absorb a week or more of continuous work.

See Frederick A. Talbot, *Moving Pictures: How They Are Made and Worked* (London: William Heinemann, 1912), pp. 205–6.

2. Quoted in Mark Cotta Vaz and Craig Barron, *The Invisible Art: The Legends of Movie Matte Painting* (San Francisco, CA: Chronicle Books, 2002), p. 41.
3. Carl Louis Gregory, 'Trick Photography', *Camera* vol. 33 no. 1 (July 1926), p. 58.
4. –y, 'Die Wunder des Spiegels', *Film-Kurier*, 6 November 1926.
5. Gertrud Isolani, 'Gespräch mit Eugen Shuftan', *Basler Nachrichten*, 19 October 1965, p. 9.
6. Alternatively, a two-way mirror and masks can be used.
7. Erich Kettelhut, *Der Schatten des Architekten*, Werner Sudendorf (ed.) (Munich: Belleville, 2009), p. 93.
8. See Carl Louis Gregory, 'Trick Photography Methods Summarized', *American Cinematographer*, June 1926, p. 21.
9. For the use of the Schüfftan process in this film, see 'Tricks und Vorspiegelungen: Das neue Schüfftan-Verfahren – Wie ein Trickfilm entsteht', *Scherls Magazin* vol. 1 (1927), pp. 2–7, 5.
10. Helmut G. Asper (ed.), *Nachrichten aus Hollywood, New York und anderswo: Der Briefwechsel Eugen und Marlise Schüfftans mit Siegfried und Lili Kracauer* (Trier: Wissenschaftlicher Verlag, 2003), p. 4.
11. Eugen Schüfftan, 'Mein Verfahren', *Kinotechnische Rundschau des Film-Kurier*, 18 November 1926.
12. Hans Poelzig was president of the Royal Art and Vocational School in Beslau, Schüfftan's alma mater, between 1902 and 1916. Apart from his art deco design for the Großes Schauspielhaus, Poelzig is best known for his sets in *Der Golem, wie er in die Welt kam* (1920) and the IG Farben building in Frankfurt am Main (1928–30).
13. According to Asper and Giesen, Schüfftan was in charge of the colour design of the prominent cascading 'limestone cave' dome. See Asper, *Nachrichten aus Hollywood, New York und anderswo*, p. 4;

Rolf Giesen, 'Eugen Schüfftan', in Hans-Michael Bock (ed.), *CINEGRAPH: Lexikon zum deutschesprachigen Film*, vol 7 (Munich: edition text-kritik, 1984–present), p. B1.

14. Max Ophüls, *Spiel im Dasein: Eine Rückblende* (Stuttgart: Goverts, 1959).
15. Sidney W. Clarke, 'The Annals of Conjuring', *Magic Wand* vol. 14 (1926), p. 91.
16. See Katharina Loew, 'Tangible Specters: 3-D Cinema in the 1910s', *Film Criticism* vol. 3 no. 2 (Spring/Fall), pp. 87–116.
17. See Guido Seeber, *Der praktische Kameramann*, vol. 2, *Der Trickfilm in seinen grundsätzlichen Möglichkeiten* (1927) (Frankfurt am Main: Deutsches Filmmuseum, 1979), p. 132; George E. Turner, 'The Evolution of Special Effects', in Linwood G. Dunn (ed.), *The ASC Treasure of Visual Effects* (Hollywood, CA: American Society of Cinematographers, 1983), pp. 15–82, 45.
18. Before the 1910s, emulsions and lamps were not capable of rendering dim and extremely bright illumination levels simultaneously.
19. J. Stuart Blackton and Albert E. Smith revealed the secrets behind *Princess Nicotine* in 'Some Tricks of the Moving Picture Maker', *Scientific American*, 26 June 1909, p. 476. Books and journals worldwide subsequently took up the story in remarkable detail. See for instance Talbot, *Moving Pictures*, pp. 242–53.
20. Dawn referred to a mirror shot in an unidentifiable production. Other details provided are questionable as well. See 'Inventory List', *Norman O. Dawn Collection of Special Effects Cinematography*, Henry Ransom Center at the University of Texas at Austin.
21. Gregory, 'Trick Photography Methods Summarized', pp. 21–2.
22. For the patent litigations, see Giesen, 'Eugen Schüfftan', p. E2.
23. See 'Bericht über Zwischenrevision der Geschäftsbücher und der Bilanz per 28. Februar 1927', *Files of the Deutsche Spiegeltechnik GmbH & Co. K.-G. Berlin* (R109/12455), Bundesarchiv Berlin.
24. Confusingly enough, Spiegeltechnik GmbH & Co. was a joint venture between Ufa and a separate company, the open corporation Spiegeltechnik AG. See 'Angebot der Universum-Film AG an die Deutsche Spiegeltechnik GmbH &Co, Berlin W9, Köthenerstrasee 1/4 vom 15. September 1926', *Files of the Deutsche Spiegeltechnik GmbH & Co. K.-G. Berlin* (R109/12070), Bundesarchiv Berlin; 'Auflösungsvertrag vom 28. Februar 1928', ibid.
25. See 'Bericht über Zwischenrevision'; 'Bericht über Revision der Geschäftsbücher und der Bilanz für das am 30. September 1927 abgelaufene Geschäftsjahr', *Files of the Deutsche Spiegeltechnik GmbH & Co. K.-G. Berlin* (R109/12456), Bundesarchiv Berlin; Giesen, 'Eugen Schüfftan', pp. F1–F2; Alexander Jason, *Handbuch der Filmwirtschaft: Filmstatistiken und Verzeichnisse der Filmschaffenden, Filmfirmen, der Filme und der Tonfilmkinos*, vol. 2, Film-Europa (Berlin: Verlag für Presse, Wirtschaft und Politik, 1931), p. 17.
26. Having initially aimed at a flat fee of 200 Reichsmark (£10 or $50 in 1926) per metre, the price actually averaged around 125 Reichsmark ($31.25 or £6.25 in 1926) per metre in 1926. See 'Bericht über Zwischenrevision'.
27. The total German feature-film production in 1925 amounted to 253 titles, including Ufa's twenty-nine titles. See Kinemateksverbund, Arbeitsgruppe Deutsche Filmografie, 'Deutsche Spielfilme 1925: Jahresproduktion und Filmbestand Bundesarchiv', Bundesarchiv-Filmarchiv, October 2007. Even before Spiegeltechnik GmbH & Co. was established, doubts were raised regarding the specific terms of the contract. A memorandum in the Ufa files at the Bundesarchiv Berlin deemed the annual guaranteed purchase quantity of 1,000 metres of Schüfftan footage grossly exaggerated.

See 'Notiz vom 4. August 1926', *Files of the Deutsche Spiegeltechnik GmbH & Co. K.-G. Berlin* (R109/I 2070), Bundesarchiv Berlin.

28. See 'Bericht über Zwischenrevision'.
29. Walter Reimann, 'Filmarchitektur – heute und morgen', *Filmtechnik*, 20 February 1926. Similarly, cinematographer Karl Freund expressed his hopes that the Schüfftan process would eliminate monumentalism in German set design. See A. Koslowski, 'Die Männer der Kurbel IV: Karl Freund', *Film-Kurier*, 30 May 1925.
30. Seeber, *Der Trickfilm in seinen grundsätzlichen Möglichkeiten*, pp. 141–2.
31. 'Das Ende der Dekoration', *Kinematograph* vol. 950 (3 May 1925).
32. See 'Bericht über Zwischenrevision'.
33. See 'Auflösungsvertrag vom 28. Februar 1928'. See 'Bericht über Zwischenrevision'.
34. See Frederic Wynne-Jones, 'When the Camera's Eye Lies for Entertainment', *New York Times*, 2 May 1926, p. X5. Laemmle announced that *Gulliver's Travels* was to become one of three Universal 'Super-Jewels' for 1926 via cable from Europe in September 1925. See Grace Kingsley, 'Flashes', *Los Angeles Times*, 17 September 1925, p. A11. Swift's work celebrated its bicentenary in 1926.
35. Edwin Schallert, 'Fantasy Again in Foreground', *Los Angeles Times*, 15 February 1925, p. D19.
36. See Moulton, 'Magical Effects Brought to Screen by Unique Process', *Los Angeles Times*, 18 April 1926, pp. C25–6.
37. Schüfftan, 'Mein Verfahren'.
38. Michael Mock, 'New Ideas Sweep Movie Studios', *Popular Science Monthly*, May 1930, p. 144.
39. 'British National Strengthened', *Kinematograph Weekly*, 13 January 1927, p. 56.
40. Hans Nieter, 'The Schüfftan Process of Model Photography', *Photographic Journal*, January 1930, p. 16.
41. 'Schüfftan Process Acquired', *Kinematograph Weekly*, 13 January 1927, p. 56.
42. François Truffaut, *Hitchcock* (New York: Simon & Schuster, 1967), p. 64; Peter Bogdanovich, *Who the Devil Made It* (New York: Alfred A. Knopf, 1997), p. 495. According to Hitchcock, the transparencies were about twelve by fourteen inches in size. Considering that BIP held the world rights (outside Germany and North America) of the Schüfftan process, Hitchcock's claim that he had to employ it behind the backs of the studio heads is certainly incorrect. See also Tom Ryall, 'Blackmail', in Rob White and Edward Buscombe (eds), *British Film Institute Film Classics*, vol. 1 (London: BFI, 2003), p. 99.
43. Hitchcock in Bogdanovich, *Who the Devil Made It*, p. 495.
44. Nieter, 'The Schüfftan Process of Model Photography', p. 18.
45. This conservative stance had not only financial but also technical reasons. The colour print materials used in the East German film industry (ORWO) prohibited chroma key compositing and special-effects artists had to make do with rear-projection and traditional techniques.
46. At DEFA, the Schüfftan process was routinely utilised into the 1980s. In addition to those mentioned above, the Schüfftan process was employed in the following fantastic GDR productions: *Das Feuerzeug* (1958); *Vom König Midas* (1962); *Spuk im Hochhaus* (TV, 1982); *Die Geschichte vom goldenen Taler* (TV, 1985).
47. The unusual resurfacing of the Schüfftan process at a major Hollywood studio possibly traces back to special-effects artists Peter Ellenshaw and Albert Whitlock, both of whom had worked on several British films that had utilised Schüfftan shots.

48. 'Letter from Jack Sher to Eugene Schüfftan', Eugen Schüfftan file in the Paul Kohner archive, Deutsche Kinemathek, Berlin.
49. See Giesen, *Special Effects Artists: A Worldwide Biographical Dictionary of the Pre-digital Era with a Filmography* (Jefferson, NC: McFarland, 2008), p. 144.
50. Les P. Robley and John W. Eppolito, *Front Projection Composite Photography System Combing Staged Action with Two Projected Images*, United States Patent 5,061,061, filed 14 June 1988, and issued 29 October 1991. Front-projection as a method of composite photography was pioneered by Walter Thorner, who had previously patented an improvement of the Schüfftan process. See Walther Thorner, *Verfahren und Vorrichtung zur Herstellung kinematographischer Kombinationsaufnahmen*, Deutsches Reichspatent 598,712, filed 19 May 1932, and issued 18 June 1934. The trailblazers of the modern Scotchlite system were Will Jenkins, who references Schüfftan in his patent application, and Schüfftan's former assistant Henri Alekan. See Will F. Jenkins, *Apparatus for Production of Light Effects in Composite Photography*, United States Patent 2,727,427, filed 3 March 1952, and issued 20 December 1955; Henri Alekan, *Procédé et dispositif de prise de vues combinées*, République Française Brevet d'invention 1,098,128, filed 7 January 1954, and issued 2 March 1955. Schüfftan himself patented a number of front-projection improvements. See for instance Eugen Schüfftan, *Photocomposition System*, United States Patent 2,857,806, filed 26 July 1954, and issued 28 October 1958.
51. Sheldon Teitelbaum, 'Special Effects: Aliens', *Cinefantastique* vol. 16, October 1986, p. 122.
52. Quoted in Richard Rickitt, *Special Effects: The History and Technique* (New York: Billboard Books, 2007), p. 91.
53. 'Der Atem der Geschichte: Niklaus Schilling im Gespräch mit Mareike Sprengel', http://www.visualfilm.de/texte.htm.

SPECIAL EFFECTS

NEW HISTORIES/THEORIES/CONTEXTS

Edited by DAN NORTH, BOB REHAK, MICHAEL S. DUFFY

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