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THE PHOTOPLAY: A PSYCHOLOGICAL STUDY

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THE OUTER DEVELOPMENT OF THE MOVING PICTURES

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It is arbitrary to say where the development of the moving pictures began and it is impossible to foresee where it will lead. What invention marked the beginning? Was it the first device to introduce movement into the pictures on a screen? Or did the development begin with the first photographing of various phases of moving objects? Or did it start with the first presentation of successive pictures at such a speed that the impression of movement resulted? Or was the birthday of the new art when the experimenters for the first time succeeded in projecting such rapidly passing pictures on a wall? If we think of the moving pictures as a source of entertainment and esthetic enjoyment, we may see the germ in that camera obscura which allowed one glass slide to pass before another and thus showed the railway train on one slide moving over the bridge on the other glass plate. They were popular half a century ago. On the other hand if the essential feature of the moving pictures is the combination of various views into one connected impression, we must look back to the days of the phenakistoscope which had scientific interest only; it is more than eighty years since it was invented. In America, which in most recent times has become the classical land of the moving picture production, the history may be said to

begin with the days of the Chicago Exposition, 1893, when Edison exhibited his kinetoscope. The visitor dropped his nickel into a slot, the little motor started, and for half a minute he saw through the magnifying glass a girl dancing or some street boys fighting. Less than a quarter of a century later twenty thousand theaters for moving pictures are open daily in the United States and the millions get for their nickel long hours of enjoyment. In Edison's small box into which only one at a time could peep through the hole, nothing but a few trite scenes were exhibited. In those twenty thousand theaters which grew from it all human passions and emotions find their stage, and whatever history reports or science demonstrates or imagination invents comes to life on the screen of the picture palace.

Yet this development from Edison's half-minute show to the "Birth of a Nation" did not proceed on American soil. That slot box, after all, had little chance for popular success. The decisive step was taken when pictures of the Edison type were for the first time thrown on a screen and thus made visible to a large audience. That step was taken 1895 in London. The moving picture theater certainly began in England. But there was one source of the stream springing up in America, which long preceded Edison: the photographic efforts of the Englishman Muybridge, who made his experiments in California as early as 1872. His aim was to have photographs of various phases of a continuous movement, for instance of the different positions which a trotting horse is passing through. His purpose was the analysis of the movement into its component parts, not the synthesis of a moving picture from such parts. Yet it is

evident that this too was a necessary step which made the later triumphs possible.

If we combine the scientific and the artistic efforts of the new and the old world, we may tell the history of the moving pictures by the following dates and achievements. In the year 1825 a Doctor Roget described in the "Philosophical Transactions" an interesting optical illusion of movement, resulting, for instance, when a wheel is moving along behind a fence of upright bars. The discussion was carried much further when it was taken up a few years later by a master of the craft, by Faraday. In the *Journal of the Royal Institute of Great Britain* he writes in 1831 "on a peculiar class of optical deceptions." He describes there a large number of subtle experiments in which cogwheels of different forms and sizes were revolving with different degrees of rapidity and in different directions. The eye saw the cogs of the moving rear wheel through the passing cogs of the front wheel. The result is the appearance of movement effects which do not correspond to an objective motion. The impression of backward movement can arise from forward motions, quick movement from slow, complete rest from combinations of movements. For the first time the impression of movement was synthetically produced from different elements. For those who fancy that the "new psychology" with its experimental analysis of psychological experiences began only in the second half of the nineteenth century or perhaps even with the foundation of the psychological laboratories, it might be enlightening to study those discussions of the early thirties.

The next step leads us much further. In the fall of 1832 Stampfer in Germany and Plateau in France, independent of each other, at the same time designed a device by which pictures of objects in various phases of movement give the impression of continued motion. Both secured the effect by cutting fine slits in a black disk in the direction of the radius. When the disk is revolved around its center, these slits pass the eye of the observer. If he holds it before a mirror and on the rear side of the disk pictures are drawn corresponding to the various slits, the eye will see one picture after another in rapid succession at the same place. If these little pictures give us the various stages of a movement, for instance a wheel with its spokes in different positions, the whole series of impressions will be combined into the perception of a revolving wheel. Stampfer called them the stroboscopic disks, Plateau the phenakistoscope. The smaller the slits, the sharper the pictures. Uchatius in Vienna constructed an apparatus as early as 1853 to throw these pictures of the stroboscopic disks on the wall. Horner followed with the daedaleum, in which the disk was replaced by a hollow cylinder which had the pictures on the inside and holes to watch them from without while the cylinder was in rotation. From this was developed the popular toy which as the zoötrope or bioscope became familiar everywhere. It was a revolving black cylinder with vertical slits, on the inside of which paper strips with pictures of moving objects in successive phases were placed. The clowns sprang through the hoop and repeated this whole movement with every new revolution of the cylinder. In more complex instruments three sets of slits were arranged above one another. One set

corresponded exactly to the distances of the pictures and the result was that the moving object appeared to remain on the same spot. The second brought the slits nearer together; then the pictures necessarily produced an effect as if the man were really moving forward while he performed his tricks. In the third set the slits were further distant from one another than the pictures, and the result was that the picture moved backward.

The scientific principle which controls the moving picture world of today was established with these early devices. Isolated pictures presented to the eye in rapid succession but separated by interruptions are perceived not as single impressions of different positions, but as a continuous movement. But the pictures of movements used so far were drawn by the pen of the artist. Life showed to him everywhere continuous movements; his imagination had to resolve them into various instantaneous positions. He drew the horse race for the zoötrope, but while the horses moved forward, nobody was able to say whether the various pictures of their legs really corresponded to the stages of the actual movements. Thus a true development of the stroboscopic effects appeared dependent upon the fixation of the successive stages. This was secured in the early seventies, but to make this progress possible the whole wonderful unfolding of the photographer's art was needed, from the early daguerreotype, which presupposed hours of exposure, to the instantaneous photograph which fixes the picture of the outer world in a small fraction of a second. We are not concerned here with this technical advance, with the perfection of the sensitive surface of the photographic plate.

In 1872 the photographer's camera had reached a stage at which it was possible to take snapshot pictures. But this alone would not have allowed the photographing of a real movement with one camera, as the plates could not have been exchanged quickly enough to catch the various phases of a short motion.

Here the work of Muybridge sets in. He had a black horse trot or gallop or walk before a white wall, passing twenty-four cameras. On the path of the horse were twenty-four threads which the horse broke one after another and each one released the spring which opened the shutter of an instrument. The movement of the horse was thus analyzed into twenty-four pictures of successive phases; and for the first time the human eye saw the actual positions of a horse's legs during the gallop or trot. It is not surprising that these pictures of Muybridge interested the French painters when he came to Paris, but fascinated still more the great student of animal movements, the physiologist Marey. He had contributed to science many an intricate apparatus for the registration of movement processes. "Marey's tambour" is still the most useful instrument in every physiological and psychological laboratory, whenever slight delicate movements are to be recorded. The movement of a bird's wings interested him especially, and at his suggestion Muybridge turned to the study of the flight of birds. Flying pigeons were photographed in different positions, each picture taken in a five-hundredth part of a second.

But Marey himself improved the method. He made use of an idea which the astronomer Jannsen had applied to the photographing of astronomical processes. Jannsen

photographed, for instance, the transit of the planet Venus across the sun in December, 1874, on a circular sensitized plate which revolved in the camera. The plate moved forward a few degrees every minute. There was room in this way to have eighteen pictures of different phases of the transit on the marginal part of the one plate. Marey constructed the apparatus for the revolving disk so that the intervals instead of a full minute became only one-twelfth of a second. On the one revolving disk twenty-five views of the bird in motion could be taken. This brings us to the time of the early eighties. Marey remained indefatigable in improving the means for quick successive snapshots with the same camera. Human beings were photographed by him in white clothes on a black background. When ten pictures were taken in a second the subtlest motions in their jumping or running could be disentangled. The leading aim was still decidedly a scientific understanding of the motions, and the combination of the pictures into a unified impression of movement was not the purpose. Least of all was mere amusement intended.

About that time Anschütz in Germany followed the Muybridge suggestions with much success and gave to this art of photographing the movement of animals and men a new turn. He not only photographed the successive stages, but printed them on a long strip which was laid around a horizontal wheel. This wheel is in a dark box and the eye can see the pictures on the paper strip only at the moment when the light of a Geissler's tube flashes up. The wheel itself has such electric contacts that the intervals between two flashes correspond to the time which is necessary to

move the wheel from one picture to the next. However quickly the wheel may be revolved the lights follow one another with the same rapidity with which the pictures replace one another. During the movement when one picture moves away and another approaches the center of vision all is dark. Hence the eye does not see the changes but gets an impression as if the picture remained at the same spot, only moving. The bird flaps its wings and the horse trots. It was really a perfect kinetoscopic instrument. Yet its limitations were evident. No movements could be presented but simple rhythmical ones, inasmuch as after one revolution of the wheel the old pictures returned. The marching men appeared very lifelike; yet they could not do anything but march on and on, the circumference of the wheel not allowing more room than was needed for about forty stages of the moving legs from the beginning to the end of the step.

If the picture of a motion was to go beyond these simplest rhythmical movements, if persons in action were really to be shown, it would be necessary to have a much larger number of pictures in instantaneous illumination. The wheel principle would have to be given up and a long strip with pictures would be needed. That presupposed a correspondingly long set of exposures and this demand could not be realized as long as the pictures were taken on glass plates. But in that period experiments were undertaken on many sides to substitute a more flexible transparent material for the glass. Translucent papers, gelatine, celluloid, and other substances were tried. It is well known that the invention which was decisive was the film

which Eastman in Rochester produced. With it came the great mechanical improvement, the use of the two rollers. One roller holds the long strip of film which is slowly wound over the second, the device familiar to every amateur photographer today. With film photography was gained the possibility not only of securing a much larger number of pictures than Marey or Anschütz made with their circular arrangements, but of having these pictures pass before the eye illumined by quickly succeeding flashlights for any length of time. Moreover, instead of the quick illumination the passing pictures might be constantly lighted. In that case slits must pass by in the opposite direction so that each picture is seen for a moment only, as if it were at rest. This idea is perfectly realized in Edison's machine.

In Edison's kinetoscope a strip of celluloid film forty-five feet in length with a series of pictures each three-quarters of an inch long moved continuously over a series of rolls. The pictures passed a magnifying lens, but between the lens and the picture was a revolving shutter which moved with a speed carefully adjusted to the film. The opening in the shutter was opposite the lens at the moment when the film had moved on three-quarters of an inch. Hence the eye saw not the passing of the pictures but one picture after another at the same spot. Pretty little scenes could now be acted in half a minute's time, as more than six hundred pictures could be used. The first instrument was built in 1890, and soon after the Chicago World's Fair it was used for entertainment all over the world. The wheel of Anschütz had been widespread too; yet it was considered only as a half-scientific apparatus. With Edison's kinetoscope the moving

pictures had become a means for popular amusement and entertainment, and the appetite of commercialism was whetted. At once efforts to improve on the Edison machine were starting everywhere, and the adjustment to the needs of the wide public was in the foreground.

Crowning success came almost at the same time to Lumière and Son in Paris and to Paul in London. They recognized clearly that the new scheme could not become really profitable on a large scale as long as only one person at a time could see the pictures. Both the well-known French manufacturers of photographic supplies and the English engineer considered the next step necessary to be the projection of the films upon a large screen. Yet this involved another fundamental change. In the kinetoscope the films passed by continuously. The time of the exposure through the opening in the revolving shutter had to be extremely short in order to give distinct pictures. The slightest lengthening would make the movement of the film itself visible and produce a blurring effect. This time was sufficient for the seeing of the picture; it could not be sufficient for the greatly enlarged view on the wall. Too little light passed through to give a distinct image. Hence it became essential to transform the continuous movement of the film into an intermittent one. The strip of film must be drawn before the lens by jerking movements so that the real motion of the strip would occur in the periods in which the shutter was closed, while it was at rest for the fraction of time in which the light of the projection apparatus passed through.

Both Lumière and Paul overcame this difficulty and secured an intermittent pushing forward of the pictures for three-quarters of an inch, that is for the length of the single photograph. In the spring of 1895 Paul's theatrograph or animatograph was completed, and in the following year he began his engagement at the Alhambra Theater, where the novelty was planned as a vaudeville show for a few days but stayed for many a year, since it proved at once an unprecedented success. The American field was conquered by the Lumière camera. The Eden Musée was the first place where this French kinematograph was installed. The enjoyment which today one hundred and twenty-five thousand moving picture theaters all over the globe bring to thirty million people daily is dependent upon Lumière's and Paul's invention. The improvements in the technique of taking the pictures and of projecting them on the screen are legion, but the fundamental features have not been changed. Yes; on the whole the development of the last two decades has been a conservative one. The fact that every producer tries to distribute his films to every country forces a far-reaching standardization on the entire moving picture world. The little pictures on the film are still today exactly the same size as those which Edison used for his kinetoscope and the long strips of film are still gauged by four round perforations at the side of each to catch the sprockets which guide the film.

As soon as the moving picture show had become a feature of the vaudeville theater, the longing of the crowd for ever new entertainments and sensations had to be satisfied if the success was to last. The mere enjoyment of