«FULL OF DAZE, SHOCK AND AMAZE»: a reception history of the X-ray, or 'Röntgen Rays'

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Immediately following their presentation in the form of a visible image by German physics Professor Wilhelm Conrad Röntgen in 1895, 'X-rays' became the subject of widespread global public fascination. The rays' mysterious ability to penetrate solid objects and provide a lasting image of interior forms of an object — without even piercing its surface — revolutionized and liberated scientific consciousness. In an X-ray image, the *unseen* could be seen.

Instantly, the X-ray's revelations made conceptions of reality much more complicated and imaginative, because scientific knowledge was proven to no longer be limited to only phenomena observable by the human eye. Acceptance of the X-ray was predicated on the logic of empiricism. People believed what they could perceive first-hand with their senses, and 'light writing' (or 'photography' — which had a privileged ability to capture fleeting events with a relative fidelity to reality) was positioned as a trusted source of authentication. Because the X-ray, also called 'new photography', could capture the *unseen*, it was given credence for having a greater sensitivity than the sense perception of human beings.

This paper takes a closer look at the mass-cultural reception of this photographic practice to examine how the 'Röntgen Rays' both complicated and liberated scientific notions of reality.

Keywords. x-ray, Röntgen, new medicine, indexicality, photography, Spiritualism

Logo após a sua apresentação, sob a forma de uma imagem visível, pelo Professor alemão de física Wilhelm Conrad Röntgen, em 1895, os raios X tornaram-se o alvo de um fascínio público generalizado. A misteriosa capacidade dos raios em penetrar os objetos sólidos e fornecer uma imagem duradoura das suas formas interiores — sem sequer perfurar a sua superfície — revolucionou e libertou a consciência científica. Numa imagem de raio X, o *invisível* podia ser visto.

Imediatamente, as revelações fornecidas pelo raio X possibilitaram conceções da realidade muito mais complexas e imaginativas, pois o conhecimento científico já não se restringia apenas aos fenómenos observáveis pelo olho humano. A aceitação do raio X apoiou-se na lógica do empirismo. As pessoas acreditavam no que podiam perceber, desde logo, com os seus sentidos, e a "escrita da luz" (ou "fotografia" — que tinha uma capacidade privilegiada para captar eventos fugazes com uma relativa fidelidade à realidade) foi considerada uma fonte segura de autenticação. Por captar *o invisível,* o raio X, também denominado "nova fotografia", logrou ganhar credibilidade, ao possuir uma sensibilidade maior do que a mera perceção sensorial humana.

Este artigo analisa de perto a receção cultural em massa desta prática fotográfica, com vista a examinar de que modo os "Raios Röntgen" vieram complicar, mas também libertar as noções científicas da realidade.

Palavras-chave. raio X, Röntgen, nova medicina, indicialidade, fotografia, Espiritualismo

Immediately following their presentation in the form of a visible image by German physics Professor Wilhelm Conrad Röntgen in 1895, X-rays became the subject of widespread global public fascination. The rays' mysterious ability to penetrate solid objects and provide a lasting image of interior forms of an object—without even piercing its surface — revolutionized and liberated scientific consciousness. In an X-ray image, the *unseen* could be seen. Instantly, the X-ray's revelations made conceptions of reality much more complicated and imaginative, because scientific knowledge was proven to no longer be limited to only phenomena observable by the human eye:

> «They [the X-rays] promised to fulfill the age-old fantasy of seeing people's insides without first cutting open their bodies. In 1709, the Palatine princess had written, 'If poor human beings had a square window in their stomachs, through which the doctors could look, I think they would find the necessary means to cure people'» (Cheroux, et al., 2005: 115).

Physicians immediately hailed the X-ray as a medical miracle marking the triumph of the new Modern machine age. The so-called "new medicine" was employed to cure cancer, alcoholism, blindness, tuberculosis, deafness and various skin diseases, and X-rays were regularly employed on women to remove unsightly body hair, to darken hair, or to test for pregnancy (Knight, 1986: 18, 31; Davis, 1896: 263-270; Drayton, 1901: 8; Magie, 1896: 251-261; Pusey, 1901: 121; Rinehart, 1902: 115-119; Saltus, 1995: 29). The X-ray became a fertile fantasyland of science, and doctors were thrilled that the day had come when «a flick of a switch, might heal a wide range of mortal ills» (Knight, 1986: 26).

Acceptance of the X-ray was predicated on the logic of post-Enlightenment

empiricism. The mass public believed what they could perceive firsthand with their senses, and "light writing" (or, "photography" — which had a privileged ability to capture fleeting events with a relative fidelity to reality) — was positioned as a trusted source of authentication . The X-ray benefited from its arrival into this ocular-centric, mass-accessible modern culture with a healthy appetite for visual representations of scientific advances (Crary, 1990). In the late-nineteenth century, art, and science — and photography was the faithful product and tool of both — were part of an inseparable « single interlocking field of knowledge and practice» (Crary, 1990: 9).

Yet despite the fervor surrounding the discovery of X-rays and the proliferation of them in mass culture, much was still unknown about them. The harmful effects of overexposure would not be reported widely or taken seriously for about a decade (*Paris Fears Experiments*, 1907: C.3). Upon announcing the discovery of the rays, Professor Röntgen himself confessed that he did not even understand their nature (Schedel, 1995: 343). He named them "X" — for the "unknown" variable in mathematical equations – because he was not sure if they were a frequency of light, a vibration in a vague substructure of electro-magnetic matter called the "ether", or if they were something else entirely unimagined (Marien, 2002: 216).

Nonetheless, X-rays eagerly were accepted as accurate images of a newly expanded reality by scientists. Eager to spread their excitement for this miraculous new discovery to the public while they worked out the "bugs," scientists released news of the discovery (which the humble Röntgen never patented) to the world (Glasser, 1934: 36-37). Like the daguerreotype decades earlier, X-rays were eagerly embraced by the public. Röntgen, a reclusive man, reluctantly became an international celebrity (Foulger, 1995: 333).

Commercial photographers jumped at the opportunity to make money by taking X-ray images — which were called "the new photography" (Marien, 2002:

218). Curious customers lined up around the block to have X-ray images made of their hands at department stores and public demonstrations. Advertisements claimed that the "Röntgen Rays" could be used by detectives to catch cheating spouses, and to allow men —with the aid of X-ray eyeglasses — to peer through clothing of unsuspecting women and see their naked bodies (Schedel, 1995: 344; Glasser, 1934 : 45). The rays became a cultural phenomenon, and inspired songs, poems, plays and novels, including H. G. Wells's *The Invisible Man* of 1897 (See *Images 1-6*).

The X-ray profoundly transformed human knowledge by making:

> «visible all that escaped [the eye], all that lay beyond the capabilities of neutral vision: all that was either too close or too far away, all that lay hidden in the deep recesses of the body, all that was transparent, all that was invisible — even the human soul» (Lemagny & Rouille, 1987: 71).

Thus, the "Röntgen Rays" also were regarded as a means for arguing that unseen phenomena such as ghosts and other spirit phenomena did indeed exist (Cheroux, et al., 2005: 119). These connections were reinforced by the Spiritualist associations of Sir William Crookes, the inventor of the cathode ray tube (which emits X-radiation). Crookes had been a renowned Spiritualist since the 1870s, during which time he also photographed *séances* to prove their legitimacy while working as the editor of *The Quarterly Journal of Science* (Henderson, 1989: 119; Henderson, 1983: 23; Cheroux, et al., 2005: 172-174)[1]. Crookes' dabbling in both scientific and occult practices was not uncommon in the late 19th Century — an age in which science and spirituality were indistinguishable (Henderson, 1987: 6).

This essay discusses how the X-ray both complicated and liberated scientific notions of reality by taking a look at the history of the reception of this photographic practice. While this genre of photography allowed for the rationalization of external and internal phenomena and the advance of science, previously unseen views of the interior of the human body became both cultural spectacle and the subject of a regulatory medical gaze.

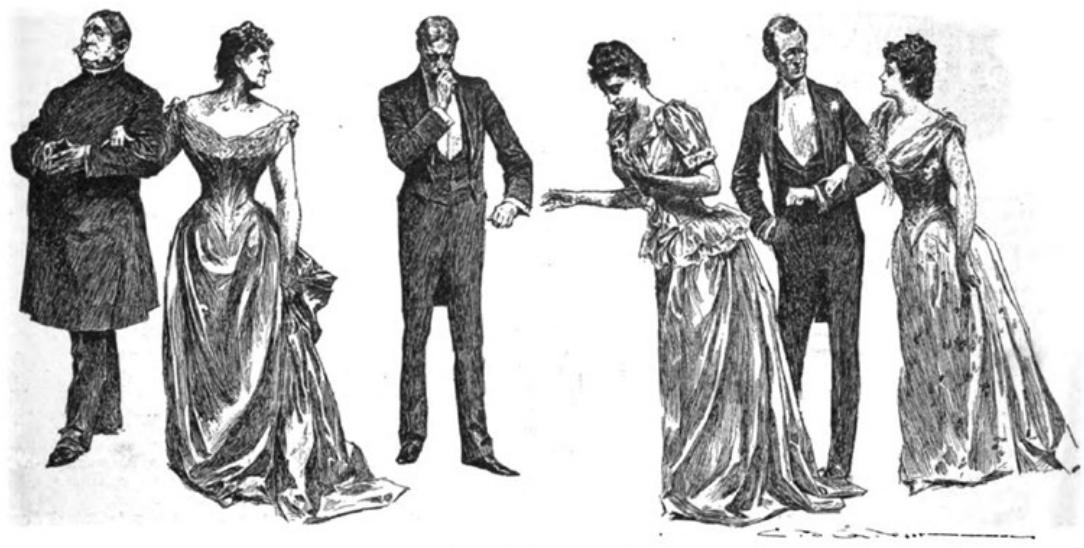
Examining the X-ray

On November 8, 1895, University of Würzburg physics Professor Wilhelm Röntgen had lost track of time while working in his laboratory. The sun had set, taking all of the lab's natural lighting with it, and leaving the engrossed professor in complete darkness (Foulger, 1995: 332). It was in these moments (before turning on the battery-operated electric lighting) that Röntgen noticed the greenish glow of a barium-platinocyanide-coated sheet of cardboard lying about six feet away from an active cathode ray tube. He approached the glowing cardboard, and held his hand between the board and the radiation. Röntgen shuddered as he saw the shadow of his own bones articulated on the board, and was confronted by an eerie premonition of his own death. He observed that the rays appeared to have passed right through his body, blackening on the photographic plate unless they were absorbed to differing degrees by calcium in his bones[2]. In this moment, the first X-ray image was born.

That night, Röntgen tested this strange phenomenon by making more X-rays of his hand, and creating a few new images of some weights enclosed in a wooden box (Glasser, 1934: 16). Known for being a thorough, detailed scientist, Professor Röntgen did not want to divulge any of the details about his discovery until he had thoroughly investigated it. So, he worked obsessively and ceaselessly for eight weeks — sleeping in his laboratory (even though his apartment was right next to the lab) in order to avoid distraction and to be able to conveniently resume his experiments in the event of a sudden burst of inspiration (Glasser, 1934: 4; Foulger, 1995: 331.). He gathered data for a report, which he illustrated with an X-ray image of his wife Bertha's left hand (See *Image 1*), and he presented it to the Würzburg Physical and Medical Society on December 28, 1895. Röntgen's discovery then was published in science journals. The first newspaper reports on X-rays were published on January 5, 1896. That year, more than 60 articles about the X-ray were printed in American and British periodicals aimed at a very intrigued general public (See *Images 1-7*).

Image 1. Wilhelm Röntgen, *Frau Röntgen's Hand*, 1895.

This image, which accompanied Wilhelm Röntgen's initial scientific paper on the X-ray, is the first known surviving X-ray image of a human being. The exposure time was 15 minutes. Bertha Röntgen, Wilhelm's wife, often posed for her husband's X-ray images. The extended exposure to X-rays was said to have contributed to her death in 1923 from carcinoma of the intestine (Glasser, 1934: 6; Keller, 2004: 3). This X-ray image was widely reproduced in the press. It was regarded as «an icon of new discovery, [which] fascinated people around the world» (Foulger, 1995: 333).



THAT DELICIOUS MOMENT

WHEN YOU FIND YOU ARE TO TAKE INTO DINNER THE GIRL WHO YESTERDAY REFUSED YOU.

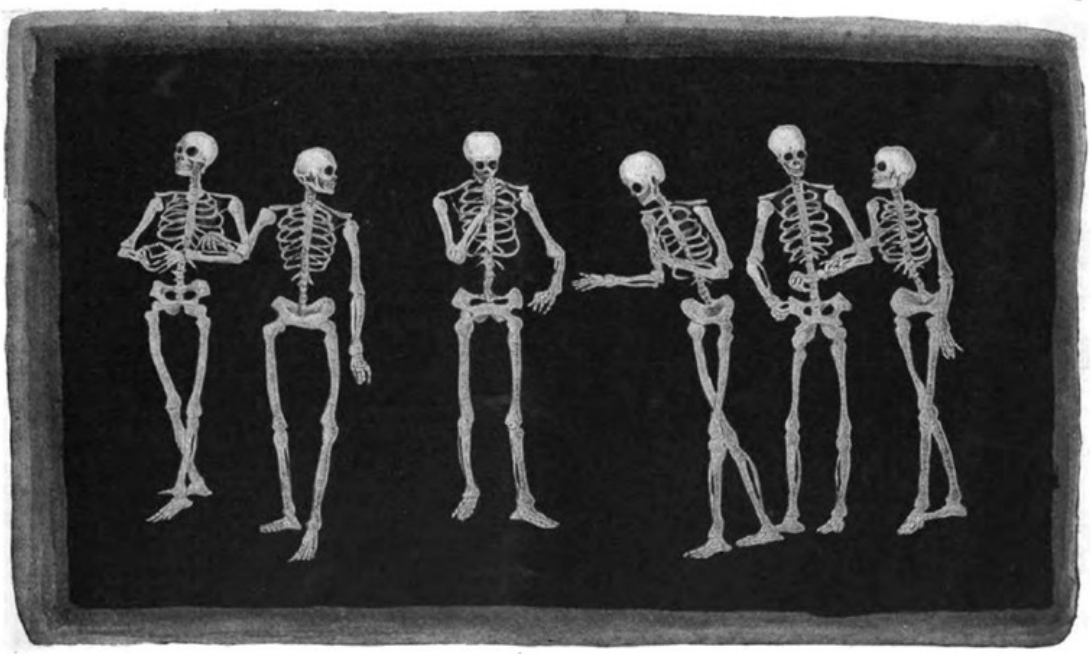


Image 2. Anonymous, *That Delicious Moment When You Find You Are to Take into Dinner the Girl Who Yesterday Refused You* (*Life* 27(694), 1896: 313). Public domain.

"X-Actly So!"

The Roentgen Rays, the Roentgen Rays,
What is this craze?
The town's ablaze
With the new phase
Of X-ray's ways.

I'm full of daze,
Shock and amaze,
For nowadays
I hear they'll gaze
Thro' cloak and gown – and even stays,
These naughty, naughty Roentgen Rays.

Image 3. Wilhema, "X-Actly So!". Transcription of poem originally published in *Electrical Review (1896, 17 April)*. Public domain.

"THE NEW PHOTOGRAPHY"

O, Röntgen, then the news is true,
And not a trick of idle rumour,
That bids us each beware of you,
And of your grim and graveyard humour.

We do not want, like Dr. Swift,
To take our flesh off and to pose in
Our bones, or show each little rift
And joint for you to poke your nose in.

We only crave to contemplate
Each other's usual full-dress photo;
Your worse than "altogether" state
Of portraiture we bar in toto!

The fondest swain would scarcely prize
A picture of his lady's framework;
To gaze on this with yearning eyes
Would probably be voted tame work!

No, keep them for your epitaph,
these tombstone-souvenirs unpleasant;
Or go away and photograph
Mahatmas, spooks, and Mrs. B-s-nt!

Image 4. Anonymous, "The New Photography". Transcription of poem originally published in *Punch: Or the London Charivari,* 100 (1898, 25 January), 45. Public domain.

Death Perception

When Bertha Röntgen first saw at her husband's X-ray images of her hand, she gazed in horror, commenting «that she had seen the shadow of her own death» (Keller, 2005). Wilhelm Röntgen confessed to having a similar reaction to the first image of his own skeletal X-rayed hand. Such pictures fully realize Roland Barthes's suggestion in *Camera Lucida* that every photograph is a reminder of the inevitability of death (Barthes, 1980: 96). The image of Bertha Röntgen's hand — made in the past — is a premonition of the unavoidable suggestion of her death in the future (which ironically would be the result of overexposure to X-rays). The image becomes not just a reminder of her inability to retrieve the moment (rather, the accumulation of 15 minutes) during which the image originated, but the image also perhaps more powerfully functions as an eerie premonition of the unavoidable fact that her life *will end*. To Bertha Röntgen, that ending was a mystery. That makes the image of her hand is all the more chilling. As viewers, we are placed in the awkward position of knowing that our visual enjoyment had a human price. We are seeing radiation slowly kill Bertha Röntgen.

The X-ray image's connection to death evoked a sense of awe and horror. At first, some viewers were squeamish about seeing their own bones. Their reluctance was quickly replaced by awe, and the X-ray gained a hearty public following. Curious fans of the X-ray lined up to get images made of their hands at department stores such as Bloomingdale's in New York City, or to attend X-ray demonstrations. The "X-Ray slot machine" allowed anyone on the street to buy an X-ray of their own hand for a nickel — with the same ease with which we might buy a soda from a vending machine. One X-ray image which reached icon status in America was an X-ray of two lovers with their hands clasped, accompanied by a caption reading, "'till death do us part". X-rays and death were inseparable. Nonetheless, the public's ready fascination with the notion of the inevitability of death hints at a curious ambivalence toward death — and perhaps, the finality of what might follow it:

Image 5. Muggins, *New Röntgen Photography: 'Look Pleasant, Please'* (*Life*, 27 (687), 1896: 155). Public domain. The X-ray immediately was assumed to be a natural extension of commercial photography practice.

> «We generally credit scientific advancement with the dissolution of superstition. The greater the determinism of the world around us and the more quantifiable nature, the less likely we are to accept the existence of the supernatural. Röntgen's discovery appears to have had the opposite effect. […] X-rays confirmed the existence of forces and energies that a human cannot see and challenged our conceptions of both identity and reality» (Grove, 1997: 171-172).

The X-ray was found — in at least one instance — to have the magical power to defy death. After a professor at the City College of New York drowned a mouse (to get it be still) and X-rayed the animal for 10 minutes, he watched with shock and

amazement as the mouse miraculously came back to life (Knight, 1986: 14, 25). The professor publicly announced the rays' death-transcendent powers. Although a re-testing of his theory on more dead mice and snakes netted nothing more than a bunch of unnecessarily dead animals, the X-ray sparked hopes that humankind was on the verge of understanding what comes after our life on earth — and that humankind may soon be able to live forever, thanks to the invention of this modern medical machine.

The X-ray machine, which revealed the existence of energies (X-rays) beyond the detection of human sensory perception, provided many scientists and believers as an example of the possibility that many other multiple, unseen energies exist. Consequently, the X-ray was associated in the public's eye with the occult, as well as with science. Like the clairvoyant or the medium, the X-ray could register energies not visible to other humans. These emanations were widely assumed to also be able to detect spirit manifestations from the body.

> «This discovery [of the X-ray] corroborates…Paul's doctrine of the spiritual body as now existing in man. It proves, as far as any experiment can prove, that a truer body, a body of which the phenomenal body is but the clothing, may now reside within us and which awaits the moment of its unclothing, which we call death, to set it free» (Glasser, 1934: 206).

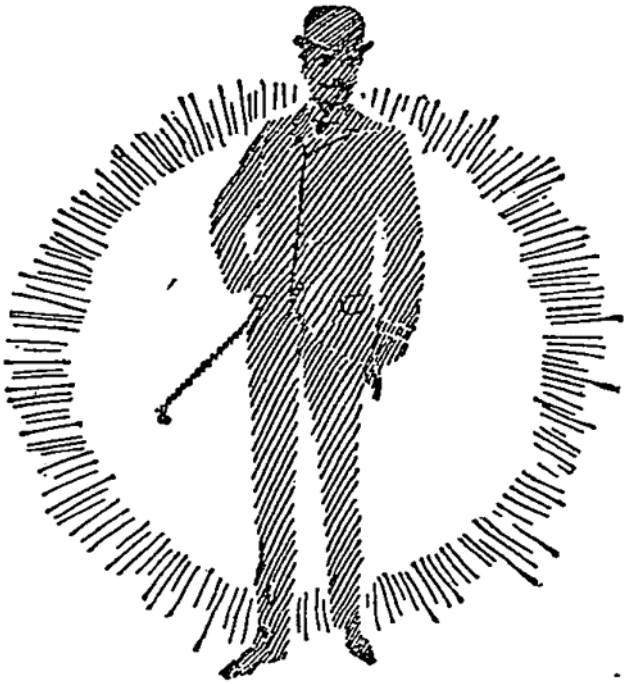
The Spiritualist movement — with respected scientist and inventor of the cathode ray tube, Sir William Crookes, as its cheerleader — declared that the X-ray embodied science and the spiritual by providing proof of the existence of unseen manifestations, such as ghosts and other spirits (Campbell, 1980: 18). In fact, at the time X-rays were discovered, there was little distinction between the realms of science and belief. Röntgen's invention of the X-ray image machine helped to kindle an expanded consideration of all things miraculous, scientific, spiritual, imaginative, and fantastic:

> «The newly discovered rays were soon associated with many mysterious hopes and fads which have continued to occupy human fancy through many centuries, such as the discovery of the magic stone, […] Spiritualism, soul photography, soothsaying, fortune telling, telepathy, etc.» (Campbell, 1980: 18).

The X-ray merely fit into a category of photographic practices so expansive and complex that it also included astrological photography, psychological documentation, ethnography, medical imaging, and spirit photography — to name just a few. The expanding role of the photographic image in an expanded conception of the domains of science reveals the degree to which technology was employed (albeit sometimes awkwardly) to affirm the workings of the imagination, belief, and human will. But the late19thCentury interest in the occult, according to Rose-Carol Long, was «part of a search for alternatives to restrictive social and political attitudes and outworn conventions» (Long, 1987: 38). Specifically, Maria Carlson has argued that the immense popularity of Spiritualism and other occult movements:

> «[…] was an expression of society's discontent with the materialism that dominated the second half of the 19th Century. Materialism, with its scientific positivism, its analytical, fragmenting nature, its denial of supersensory phenomena and spiritual experience, and its emphasis on scientific method, threatened to unseat man from his central position in the universe and his spiritual kinship with God. The occult movements hoped to balance the materialism of the age by reminding man of his spiritual, intuitive side. Spiritualism sought to resolve the metaphysical dilemma by using science against itself to "prove" the existence of the spiritual world» (Carlson, 1993: 34-36).

But these efforts to reconnect with spirituality often were undertaken as entertainment. For many, dabbling in the occult (and having X-rays made of their hands) was just plain fun. Men and women could sit together in dark *séance* rooms and hold hands without censure. (Critics quickly reprimanded Spiritualism for encouraging such sexual depravity.) Spiritualism also produced a steady stream of theatrical miracles — including floating chairs, spirit voices, apparitions, and disembodied hands. Some participants found the *séance* to be a consoling opportunity to contact their deceased loved ones, and they found some comfort in the "proof" that there was an existence after death. But for others, the *séance* — and an interest in mysticism — marked an entirely new direction in a scientific research that stood on the threshold of a breakthrough to discovering a new set of natural laws that could prove the existence of life after death.



Our suits will stand the sharpest X Ray photographing. The ins and outs of our clothing are made to stand wear and weather test. Our guarantee binds us that they wear satisfactorily one year !

Special line of English striped trouserings to order $5.00, formerly $7.00. Special line of gray oxfords and pin head check worsteds, suit to order $16.00.

SAMPLES, FASHION REVIEW, FREE ON APPLICATION.

ARNHEIM,

Broadway & 9th Street.

WE HAVE NO OTHER STORE.

Image 6. Advertisement, Arnheim, *X-ray-Proof Suit*. Retrieved from *The New York Times* (1898, 20 April), 5.

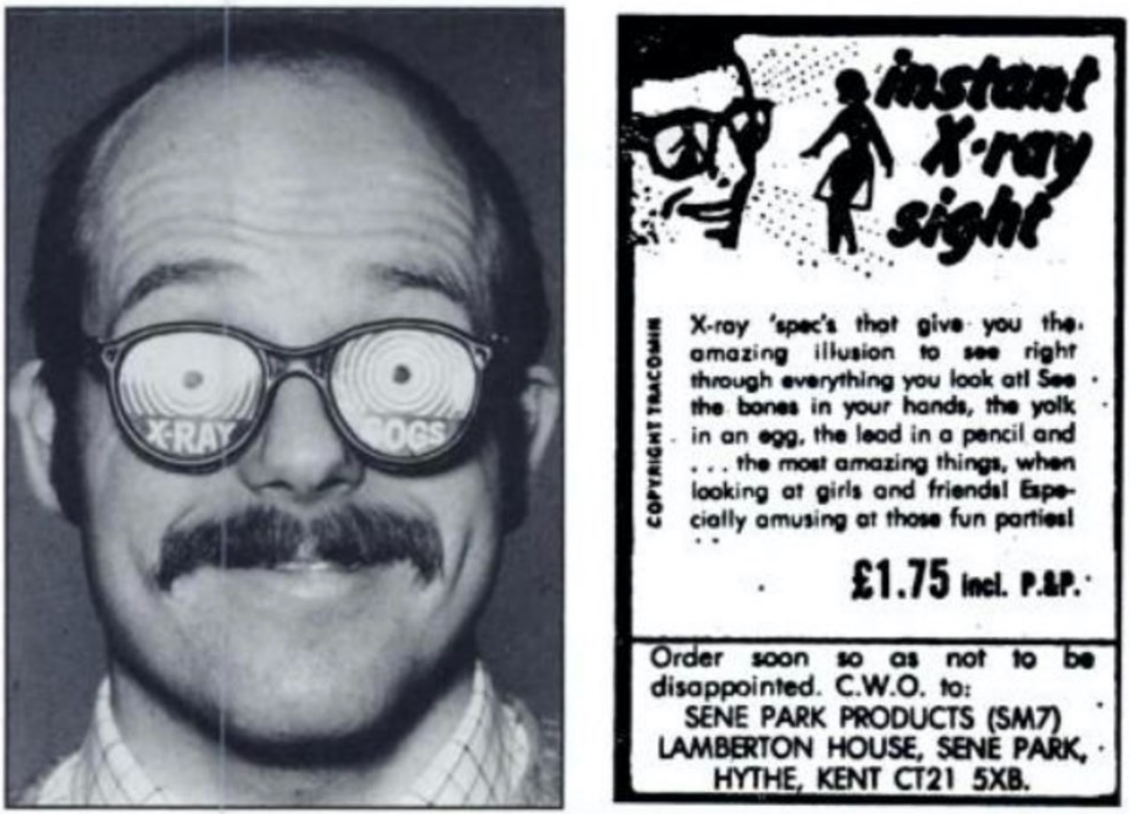


Image 7. – Advertisement, *Instant X-Ray Sight,* 1980. Fascination with the X-ray's power to see through clothing continued (at least, as a joke) up to the late 20th Century.

Conclusions

The invention of the X-ray machine in 1895 by Wilhelm Röntgen profoundly transformed the field of scientific knowledge by revealing phenomena which had escaped the reach of unaided human senses. In an X-ray image, the *unseen* could be seen. Reality thereafter was regarded as composed both of phenomena perceptible by human beings, and phenomena that existed and lie beyond our detection — such as ghosts, invisible light spectra, and spirit manifestations. The power of the modern medical machine had succeeded in penetrating the surface and structure of solid objects to provide a lasting image of their interior form — without the need to even touch the object's surface. The interior domain of the body thus became the new subject of a medicalized gaze and authority, while also transforming into a source of spectacle and wonderment.

The eager reception of the X-ray reveals a groundswell of hope that a total understanding of all of life's mysteries (including, the conquest over death's inevitability) would soon follow, or even — result — from the invention of the celebrated X-ray machine. Its revelations made scientific conceptions of reality much more complex and accommodating of representations involving a departure from the known visual appearance of subjects — including the body. Photography's conquest of an unseen reality created a new direction in the quest for knowledge that built upon the innovations of the stop-motion studies of *fin-de-siècle* photographers Eadweard Muybridge and Étienne-Jules Marey to suggest that the image can exceed and expand upon the limits of unaided human vision. To a 19th Century audience that stood on the threshold of a new millennium, the X-ray was a breakthrough which promised to expose a new, exciting set of natural laws which revolutionized and liberated scientific and popular consciousness.

Notes

1 Incidentally, Crookes especially worked to defend several mediums who later were exposed as frauds. It has been speculated that Crookes never retracted his publicly declared support for the mediums because he might have feared that such a move would discredit his scientific achievements. It is important to recall that science and spirituality were not seen as separate camps at the time of the X-ray's discovery. The two were, in fact, intertwined.

2 Because solid X-rayed masses impede or obstruct light, producing a white or light-colored appearance in the finished image, the X-ray image is similar to William Henry Fox Talbot's photogenic drawings. A main difference is, of course, that Röntgen's invisible light could pass thought solid objects that were not dense enough to block the radiation. In both X-rays and photogenic drawings, the presence of a solid mass produces an absence of imprinting upon a sensitized plate. This produces a reversal of tonalities in a photogenic drawing, but an X-ray's relationship to reality is much more complicated. (For instance, the blackish-blue color of an X-ray does not correspond to the actual color of our blood, muscle, and connective tissues. Those parts of our body appear to be dark blue in an X-ray image, unless dye was injected to make these soft tissues appear light. On the other hand, our bones are white. And they *do* appear white in the final image).

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