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Chapter 3

Educating Nuclear Workers Through Images: The Work of Jacques Castan, Illustrator of Radiation Protection in the 1960s



Aurélien Portelli, Frédéric Lamare, Sébastien Travadel,
and Franck Guarnieri

Abstract In France, the first industrial-scale nuclear reactors were built by the French Atomic Energy Commission at Marcoule during the fifties. Most of the staff who were recruited at the time knew nothing about such risks, and their inexperience made it difficult to protect them. In response, the Radiation Protection Service (SPR) developed a worker education programme. Its implementation drew upon the artistic talents of Jacques Castan, a draftsman of the SPR. This study highlights its contribution to worker education and showcases how its illustrations have captured the imaginary of the radiation protection. The focus on a series of posters dedicated to dosimetry devices identifies three elements—anxiety, anthropomorphism, sublimation—which represent an ambiguous relationship to radioactive risk. Such ambiguity can be compared to Girard’s definition of the “sacred”.

Keywords Radiation protection · Education · Posters · Imaginary · Sacred

3.1 Introduction

The French Atomic Energy Commission (CEA) constructed, during the fifties, the country’s first generation of industrial-scale nuclear reactors at Marcoule. In terms of safety, the CEA then faced unprecedented challenges, as workers had to be protected from increasing quantities of radioactive materials. This task was the responsibility of the Radiation Protection Service [Service de Protection contre les Radiations (SPR)], which was also responsible for educating operators about the risks of radiation. The

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implementation of the latter programme benefited from the artistic talents of Jacques Castan, an SPR draftsman.

This study highlights its contribution to worker education and showcases how its illustrations have captured the imaginary of the radiation protection. In the first part, we discuss SPR doctrine, implemented by the education programme. In the second part, we present Castan's body of work. In the last part, we focus on a series of posters dedicated to dosimeters. Although the effectiveness of prevention posters has been discussed in the literature [4, 9, 17, 19], the lack of studies conducted in the 1960s on how Castan's posters were used makes it difficult to comment on their specific effect. However, the analysis identifies iconographic elements, making it possible to qualify the relationship that operators maintain with radioactive risk.

3.2 A Radioactive Risks Education Programme

While it did not invent radiation protection, the SPR rationalised and industrialised it.¹ Its success would prove to be crucial for the future of the nuclear industry. Close monitoring of radiation was not only a matter of health, but also a *sine qua non* in controlling the massive forces unleashed by science that engineers were required to control in order to produce energy.

3.2.1 Radiation Protection Doctrine

The challenge for the SPR was to discover the risks as operations unfolded and to implement prevention measures. These measures were based on the classification of workplaces according to their level of radioactive risk; the use of fixed on-site detectors; routine checks carried out by radiation protection officers; and the distribution of individual protection equipment and detectors to personnel. The department was also responsible for the decontamination of equipment and clothing. Finally, it monitored radioactivity levels in effluents released by the facilities.

Over the years, the SPR developed its own doctrine for radiation protection in industrial environments, the first of which was formalised in 1965 in the *General Radiation Protection Instructions* [12]. This manual was distributed to other CEA centres and used as a model to standardise radiation protection practices and help to establish a shared culture in the emerging nuclear industry.

¹ The CEA created the first SPR at the Fontenay-aux-Roses site in 1951 [18]. In 1956, the Fontenay SPR was divided into two departments: the Atomic Hygiene and Radiopathology Department, and the Radiation Control and Radioactive Engineering Department. The latter's director helped to draw up the CEA's theoretical foundations regarding radiation protection [5].

Prevention also took the form of a radiation protection educational programme, which began to be developed in 1959. The SPR considered education to encompass both workers in the nuclear industry and the general public. Moreover, given that workers were recruited from the general public, the latter's reservations, if not addressed, would have hindered the expansion of the sector. "The general public will therefore have to be the subject of a general information program. On the other hand, education must be specialised when it is aimed at workers or officials in charge of radiation protection" [15]. This belief, widespread within the SPR, was part of a process of the mass publication of articles.

3.2.2 Educating Workers and the General Public

The SPR was particularly concerned that new workers failed fully to appreciate the risks of radiation. Some were overly cautious, while others took unnecessary chances. Consequently, courses were organised to demonstrate to the former that fear was not a good way to protect themselves, and show the latter why it was important to follow instructions. These events were an opportunity to explain the risks associated with the handling of radioactive materials and demonstrate how to protect against them. Instructions were illustrated by slides and videos.

With respect to the general public, the SPR organised guided tours of Marcoule, participated in educational film projects and regional exhibitions. However, the service was confronted with the problem of how to represent risks that could not be detected by the human senses. Castan's creative skills would become a key asset in meeting these educational objectives.

Born in 1929, Castan began drawing as a child and joined an architectural firm, where he trained as a draftsman and designer. In 1957, he was hired as a draftsman for the SPR. His first project was a waste pit, but it was not long before the head of the SPR noted his skills with a pencil and suggested that he illustrate Marcoule's prevention campaigns.²

3.3 How to Draw an Invisible Risk?

Castan immersed himself in the site's activities and learned about physics. He frequently interacted with SPR staff in the field and observed operations in workshops and laboratories. His immersion in the language of engineers and technicians helped him to capture complex technical notions, which he tried to translate into a

² In 1968, Castan stopped drawing for the SPR and became a facilitator for Marcoule's training department, before taking over as its director in 1974. He retired in 1991 and died in 2014.

more readily understood form. His creations are a testament to the golden age of nuclear energy and plunge us into the striking universe of the *mystique of Marcoule* [7].

3.3.1 *Jacques Castan's Body of Work*

From 1959 onwards, Castan's posters were designed to illustrate radiation protection instructions. The original drawings were made using light pencil on Bristol board. Colours were added by positioning each shade on a transparent film superimposed on the black line. The first series used offset printing but, very quickly, screen printing was adopted given its ability to perfectly reproduce the solid surfaces drawn by Castan. His corpus includes 87 posters in A3 format. Initially prepared for the Marcoule centre, from the beginning of the 1960s they were distributed to other CEA centres. Castan used humour and a multitude of striking analogies. His translation of SPR doctrine contained a world populated by characters from disparate cultural universes. His illustrated leaflets on the principles and regulations of radiation protection, such as *The Use of Dosimeter Films and Pens* (1962), share the same graphical world as his posters and take a non-brutal approach to risk prevention.

In 1960, Castan designed the comic strip *Sophie and Bruno in the land of the atom*, which tells the story of two children who visit Marcoule. The images emphasise the power of atomic energy and show futuristic installations—a testament to France's technological influence [13]. This flattering presentation of the centre's activities was designed to serve the purposes of the CEA, whose mission was to support the expansion of the sector and ensure France's economic development and energy independence [3].

In 1962, Castan performs a mural in the stairwell of the SPR building. On the one hand, the work was intended to educate workers about the activities of the SPR [14]. On the other hand, it was seen by all visitors to Marcoule. The centre's activities were a source of concern for the surrounding population. The image responded to these concerns, showing that the risks were under control. This tranquil scene was intended to reassure the viewer and make nuclear power a socially desirable industry.

More modest than his mural, in 1966 Castan created a board game entitled *The noble game of the laws of radio protection*. The central part defines the rules of the game. The circle of boxes reproduces elements taken from the comic strip, posters and leaflets. The game can thus be seen as a synthesis of his earlier creations. Understood as a mediator between workers and their families, it aims to make radiation protection a soothing, familiar activity.

3.3.2 *The Radiation Protection Imaginary*

While artistic creation is always based on the symbolisation of an imaginary relationship to a real object [1], we argue that Castan grasps the imaginary meanings within which the doctrinal argumentation and commitment of SPR agents makes sense [20].

These illustrations are designed to go beyond safety messages and instil the beliefs that guided the activity of the SPR, by representing an ambiguous relationship to violence. Indeed, the danger of radiation or contamination can be both repellent or attractive; the threat must always be kept at bay but can never be eradicated. Such ambiguity can be compared to Girard's definition of the "sacred", namely "everything that controls man, all the more so because man believes he is more capable of controlling it" [8], 51. In this sense, we must not get too close to the sacred, because it unleashes violence, on the other hand, we must also not distance ourselves too far, because it is the foundation of institutions that protect against violence [21].

Radiation protection doctrine was founded on the idea of perfect control, which can be seen in the SPR attempts to legitimise its work. The objective of educating staff and the public was to eradicate the psychosis generated by nuclear power, in order to "show how man, who has succeeded in liberating new forces, can also protect himself effectively" [15]. However, these forces, which are omnipresent at Marcoule, began to manifest insidious effects and proved to be at the limit of what can be measured. The SPR began to see its work as a fight against a formidable enemy that was difficult to represent. Developing a radiation protection doctrine therefore went beyond a question of engineering or processing measurements. Rather, it required developing a collective understanding of a set of representations of its work with an imperceptible, terrifying object. The question was how to maintain a belief in the power of human beings and technical objects that acted as intermediaries in a violent relation with a natural phenomenon. Through the analysis of a series of posters, the following section illustrates these imaginary meanings and this ambiguous relationship to radioactive risk.

3.4 **The Representation of Personal Radiation Measurement Equipment**

We chose to study the SPR's posters because they were seen as the "most effective direct means of action in the field of information" [10]. For the service, they raised the awareness of workers regarding the specific nature of radioactive risks: "Experience shows that safety has benefited greatly" [16].

The poster is mostly viewed the first time; the second, it is already just a vague reminder, and "even then, if its presence does act on the subconscious, it will have faded into the background" [15]. To compensate for the posters' short-term impact,

Fig. 3.1 *Don't forget your guardian angels* (1959).
VRH 2014-04-009. CEA/J.
CASTAN



the SPR ensured that they were constantly renewed and defined criteria to increase their effectiveness. Specifically, to ensure that the message would be remembered, the text had to be short and linked to a single topic.

Here, we focus on a series of posters on the topic of dosimeter films and pens (Figs. 3.1, 3.2, 3.3, 3.4, 3.5 and 3.6).³ Films are passive dosimeters. Once developed, the degree of blackening indicates the irradiation dose received by the agent. Pens are a pocket, electronic dosimeter. They provide workers with an immediate reading of the amount of radiation received. At the individual level, these detectors are fundamental because they determine the pace of work and operational constraints designed to limit the contamination or irradiation of agents.

The posters contain one or more conjugated verbs (except for Fig. 3.5). The affirmative form predominates, and texts are addressed directly to the recipient (use of the second person plural). The text and background are different colours to facilitate reading. Castan uses punctuation, underlines important words or modifies the case of a term. He prefers to only use a few colours and contrasts in order to attract the eye. Posters always contain at least one character, who is either a human drawn in whole or in part, or an anthropomorphic dosimeter. The background is usually either plain or composed of geometric shapes, sometimes supplemented by decorative elements or objects with no connection to a nuclear power plant.

³ The series includes eight posters. In this publication, we present six, reproduced with the permission of the CEA. The two posters not reproduced are entitled *Remember, the danger is invisible* (1962) and *Is your film wet, torn, heated, etc. Tell the SPRAR* (1967).

Fig. 3.2 *Your pen is your friend. Check it out!* (1961).
VRH 2014-04-021. CEA/J.
CASTAN



Fig. 3.3 *If you lose a film or pen notify the SPR* (1961).
VRH 2014-04-013. CEA/J.
CASTAN



Fig. 3.4 *Hand over your films* (1961). VRH 2014-04-101. CEA/J. CASTAN



Fig. 3.5 *Your sixth sense!* (1962). VRH 2014-04-35. CEA/J. CASTAN



Fig. 3.6 *Don't let me fall, my heart is weak!* (1964). VRH 2014-04-69. CEA/J. CASTAN



Castan avoids harsh imagery and adopts a humorous approach. He combines amusing and unusual images, drawing his inspiration from religion, fairy tales, medieval stories, esotericism, science fiction, pop culture or the history of France. More specifically, we can identify three main iconographic elements within the series: anxiety, anthropomorphism and sublimation.

3.4.1 Anxiety

According to the centre's director: "[radioactive] risk is everywhere in this hunt where the presence of perfidiously camouflaged game can only be perceived by the hunter through his electronic 'hunting dog'" [6]. But how could the service monitor the health of workers if they did not use or hand in their dosimeter films? This concern appears in the service's reports that note, in December 1958, that 10% of films were not handed in.⁴ In the following months, this rate decreases. In June 1960, only 0.45% of films were lost and 0.29% were not returned.⁵ In subsequent years, reports confirm that good practices became established.

⁴ Rapport d'activité, 2 janvier 1959, VRH 2009-043-175.

⁵ Rapport d'activité, 1^{er} juillet 1960, VRH 2009-043-193.

The SPR attributed much of this success to the effectiveness of its education programme and poster campaigns. Consequently, here we examine how Castan represented the anxiety induced by the loss of a dosimeter. In Fig. 3.3, the detectors, shown as childish silhouettes, are desperate. Like Hansel and Gretel, they have been left to their fate in a hostile environment, embodied in the rigidity of the composition and its background colours. The title symbolises a staircase to the afterlife, which the dosimeters, equipped with blue wings, are about to enter.

This interpretation raises the question of the role of death in Castan's work. Although he never explicitly mentions it, he suggests it, for example by the repeated use of black backgrounds (Figs. 3.1 and 3.6). The representation of death sometimes depends on a subtle detail, as in Fig. 3.4. The name on the dosimeter indicates "Vercingetorix", a French national hero. Workers are thus invited to return their films, as the Gallic leader handed over his weapons to the Roman conqueror. However, this historical reference is disturbing, as the character's surrender did not save him from death. The image is all the more disturbing as the film leads the agent to lose his cover and "expose" himself. Although the poster asks the recipient to comply with the SPR's requirements, it also seems to implicitly question the effectiveness of dosimeters and dosimetry, whose accuracy continued to be improved during the 1960s.

3.4.2 *Anthropomorphism*

Anthropomorphism creates an analogical relationship between the human and their dosimeter. In Fig. 3.1, the difference between the two angelic silhouettes is reminiscent of Stan Laurel and Oliver Hardy. The reference to the comic duo introduces a lighter note and reinforces the idea that the two figures are inseparable.

Dosimeters are also presented as a dependable colleague. A friendly relationship can be established between these human and non-human partners (Fig. 3.2), or even a romantic alliance (Fig. 3.6). Castan draws upon the story of Rapunzel, trapped in a tower, which is climbed by the prince. But unlike the princess in the Grimm brothers' fairy tale, she remains unmoved by the advances of her suitor, although he promises to save her. Nevertheless, the promise of love remains, indicated by Rapunzel's red dress, which is the same colour as the precious gift offered by the dosimeter.

Anthropomorphism is thus a means of emphasising the usefulness of dosimeters, non-human collaborators and guardian angels of workers. However, the angel illustrates all the ambiguity of the symbolism of Castan. The angel, symbol of invisible powers, in some cases represents the dosimeter with protective powers, and in others the radiation that must be protected, as in *Remember, the danger is invisible*, a poster drawn in 1962.

3.4.3 Sublimation

Given the relationship to the unrepresentable, the agent must place his faith in technical objects that act as intermediaries between him and an inaccessible world. Castan therefore sublimates dosimeters. In Fig. 3.1, the pen and film are celestial creatures that protect workers' lives. Figure 3.2 represents the pen as a psychic with a crystal ball. Here, the object (pen) communicates with intangible forces—radiation. Its eyes are closed, suggesting that it is in a trance. Its finger underlines its submissiveness and points to a celestial elsewhere, a higher reality that only it knows. The characters do not seem to belong to the same world. The pen is shown on a yellow background, while the agent is shown on a green background, dividing the space occupied by each character. A green owl is shown on the yellow background. This symbolises both the clairvoyance of the object and the wisdom of the worker who came to consult his friend. The animal acts as an intermediary between the two worlds, while the yellow teapot on the green background suggests the convivial relationship between human and non-human actors.

The ability of dosimeters to save lives is also presented. The spacing of Gainsbourg's⁶ hands, in Fig. 3.5, evokes religious iconography. The pen, by absorbing radiation, is sanctified, suggested by its glowing halo. The smoking singer seems to be thanking the device that provides security—reinforced by the brightness of the blue background—to those who remember to use it.

In a more warlike register, the dosimeter pen becomes, in *Remember, the danger is invisible*, the only “weapon” available to the operator to protect himself. Unable to see the winged imps who come to taunt him, he has to place his faith in his equipment. In general, the posters therefore associate the dosimeters with border objects, thus materialising the mystery that connects the visible to the invisible.

3.5 Conclusion

The iconography used in Castan's posters reflects an approach to risk prevention that is consistent with the sensitivities of the time. At the turn of the 1950s, poster artists abandoned brutal images in favour of other approaches, such as showing ways to save your own life or humour [2].

The approach has raised questions about the underlying rationale. The entertaining dimension of Castan's posters exposes the SPR's perception of their colleagues: “*SPR officers thought that workers could not be trusted to take safety issues seriously*” [11], 196. Do Castan's posters therefore seek to infantilise CEA workers? We argue that they do not. On the one hand, the education programme aimed to empower staff, on the other hand, posters captured the radiation protection imaginary and reflected an ambiguous relationship with radioactive risk. The presence of this ambiguity supposes that the viewer was able to perceive the multiple levels

⁶ Serge Gainsbourg (1928–1991) was a French singer, pianist, composer, poet, painter and actor.

of meaning in the image—why else represent it? This observation suggests that the thesis of infantilisation should be refuted.

This ambiguity does not reflect a form of dissent from Castan. Rather, it seems to reflect a degree of collusion between the poster's designer and the worker who viewed it. For example, Fig. 3.5 implicitly states that the SPR knows that staff smoke in the working area. However, while this disregard for regulations appears to be tolerated, the service is uncompromising with respect to the use of the dosimeter.

Given the lack of data regarding the effectiveness of posters, a content analysis can shed light on the procedures used to educate agents. These images, beyond their evocative power and ability to represent an imperceptible risk, reflect, to a greater or lesser extent, the day-to-day working environment. As such, the posters work iconographically because they speak for the pioneers of a booming industry.

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