PREFACE

As chance would have it...

The history of sciences teaches us that many advances have come about thanks to a fortuitous coincidence of favorable circumstances (for example, the story-or legend-of Newton's apple).

In other cases, progress in knowledge is the result of predictions founded on theories. Nevertheless, as could well be expected, many intermediary situations arise.

It seemed to me worthwhile therefore, to analyze a particular case from this standpoint, a case quite limited in its duration and scope. In order to simplify any literature search, I have chosen an example of my personal work: my doctoral thesis realized over three years, between 1936 and 1939.

On finishing my university studies, in 1936, 1 obtained a post as assistant, which gave me the opportunity to work towards my thesis. But there remained for me two crucial things to do: find a supervisor and choose a subject of research. Given that I was not familiar with potential supervisors and knew little about the scientific work going on at that time, undoubtedly my decisions owed much to chance. Yet these first steps influence the entirety of one's scientific life. (Fortunately, things have improved much since that time).

My “boss” who looked after my dissertation work was Charles Mauguin, a crystallographer, who kept an eye on my work rather distantly, but he did pass on a very good idea on me: to study, in addition to Bragg diffractions, diffuse scattering. One of his students, Jean Laval, was working on this question (subsequently, Laval studied especially the thermal scattering).

As the scattering is very weak, Mauguin asked me to make a camera with monochromatic primary radiation and with minimum parasitic radiation. I finished constructing it in the first year. But what could this chamber (now called the Guinier Camera) be used for? I investigated samples of many different materials that came my way in order to find the best performances of my camera. In the ordinary cameras utilized at that time, there was a strong parasitic scattering in the small-angle region, which prevents any correct measurement. My camera had not this defect. That is why I studied especially small-angle scattering. I observed that small-angle scattering does not exist when the sample is homogeneous. It is strong when it contains fine grains (10 to 100 nm).

I produced next the means of determining the grain size from the scattering curve. It was the beginning of X-rays small-angle scattering which, some years later, was followed by neutron small-angle scattering. Part of the interest of small-angle techniques was due to the fact that one had not yet the electron microscope.

In my view the discovery of the Small-Angle Techniques was not made by chance, but my approach had very little to do with “voluntarism”.

In 1938, while I was still working on SAS, an event occured which bore no relation to my preoccupations: I met two metallurgist friends (J. Calvet and P. Jacquet) who spoke to me about their research topic: the age-hardening. I know nothing about this phenomenom. Some light alloys, as Al-5%Cu

become harder, more mechanically resisting, when subjected to certain heat-treatment. One hypothesis, still unproved, entailed the presence of a phase of grains so fine that they were not visible on the bests micrographs.

Immediately, I thought that this could perhaps be studied by X-ray small-angle technique. My friends gave me one of their samples and, straight away, I put it in my camera. The same evening, I obtained a scattering pattern which, to my knowledge, had not been described before. Furthermore, it was easily explained: that was the effect of tiny copper platelets lying along the (100) planes of the matrix.

However, the story does not end there. Three weeks after publication of my first note, an article, signed G. D. Preston, appeared in the english Institute of Metals Journal. It reported the same observations as my own, for the same alloy, with the same interpretation that I had given. Naturally we were completely unknown to each other. It was only later on (after the war) that the metallurgists started to designate these materials by the name “G P Zones”.

The observation of zones in hardened alloys was for my part due to chance; but G. D. Preston had for a long time been studying the atomic structure of alloys by X-ray diffraction: for him, it was not unexpected that one day he would “come across” the zones.

Scientific discoveries appear at certain moments to have been ready to hatch, for some scientist or other, in one place or another, perhaps sooner perhaps a bit later. From this stem local variations and unevenness. However, taken as a whole, the front of knowledge progresses quite steadily.

We shall say that it has to be admitted that chance can indeed contribute to an advance in science or technology. Of course, it is more glorious for man if he makes progress thanks to his intelligence alone. But let us recognize that many of the objects around us are partly the fruits of chance events? We should not scorn them, but above all, we should not let slip opportunities to make the most of them. And it is this that can be the most difficult part.

W. L. Bragg humourously used to give a piece of advice to the young scientists entering his lab: “Never hesitate do an experiment that the theoreticians have declared stupid.”

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